Dépendance au sentier et changement agraire : une analyse institutionnelle de l'économie hévéicole au sud de la Thaïlande

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Dépendance au sentier et changement agraire : une analyse institutionnelle de l'économie hévéicole au sud de la Thaïlande

Soutenue le 17 Décembre 2015 devant le jury composé de

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Dépendance de sentier et changement agraire:
une analyse institutionnelle de l'économie hévéicole au sud de la Thaïlande

Résumé :

La filière hévéa contribue de manière significative à la subsistance et au développement socio-économique de la Thaïlande avec plus de 1.17 millions de familles de planteurs produisant du caoutchouc naturel. Cette contribution de l'hévéaculture à la croissance économique et à la subsistance en milieu rural a souvent été étudiée. Pourtant, l'évolution des exploitations hévéicoles sur une longue période et ses déterminants sont peu documentés alors qu'ils affectent l'avenir de la filière.

Cette thèse a pour objectif de présenter et donner du sens aux dynamiques de changement agraire au sud de la Thaïlande où l'hévéa est une culture dominante. Elle vise à fournir des éléments aux décideurs politiques pour réfléchir aux orientations futures de l'économie hévéicole thaïlandaise. Mobilisant les concepts de trajectoire d'exploitation et de dépendance au sentier, elle utilise un cadre conceptuel basé sur l'économie institutionnelle pour analyser le changement agraire. L'hypothèse principale est que la coévolution de l'accès au foncier et des contrats de travail sont les déterminants clés du changement agraire à l'œuvre dans l'économie hévéicole.

J'ai appliqué une analyse statistique multivariée et une classification systématique pour caractériser les trajectoires de 220 exploitations hévéicoles au sud de la Thailand. J'ai également analysé l'évolution des contrats de métayage pour la saignée des hévéas à travers des entretiens individuels, des enquêtes et une revue de la littérature. Un cadre d'analyse basé sur la dépendance au sentier a ensuite été appliqué pour identifier et caractériser la manière dont les institutions et leur reproduction ont influencé les trajectoires observées et les contrats de métayage pour la saignée des hévéas.

J'ai identifié six principales trajectoires de transformation des exploitations entre 1990 et 2010. Deux trajectoires montrent un déclin de la surface des exploitations et/ou du recours à de la main d'œuvre rémunérée dans les exploitations de taille moyenne (10.5%) et dans les petites exploitations (25%). Trois trajectoires montrent un accroissement de la surface et/ou du recours à de la main d'œuvre rémunérée. Elles concernent des entreprises familiales agricoles de taille moyenne (14.5%), de grandes entreprises familiales agricoles (4.1%) et des exploitations qui évoluent vers des entreprises patronales (7.7%). Ces deux grands groupes de trajectoires opposées témoignent d'une polarisation croissante des exploitations hévéicoles. 38.2% des exploitations suivent une trajectoire de stabilité caractérisée par l'absence de changement dans la taille des exploitations et dans la structure du travail. Cependant, ce sont de petites exploitations qui risquent de suivre une trajectoire de déclin.

La disponibilité en travail et les contrats de métayage pour la saignée ont évolué au cours du temps mais le métayage est le principal, quasiment l'unique, contrat de travail pour la récolte du latex depuis que l'hévéaculture a commencé en Thaïlande. Les conventions contractuelles de travail pour la saignée sont dans une situation de verrouillage institutionnel sous la forme actuelle des contrats de métayage pratiquée du fait de mécanismes d'auto-renforcement, de fonctionnement et de légitimation. J'ai identifié un ensemble de règles qui peuvent expliquer la prédominance des contrats de métayage pour la saignée en permettant de mobiliser la force de travail disponible et en assurant une grande résilience face aux variations et incertitudes des conditions sociales et économiques.

La dépendance au sentier permet d'interpréter la polarisation des exploitations et le verrouillage institutionnel des contrats de métayage comme le résultat d'un processus d'auto renforcement conduisant à une reproduction institutionnelle. La thèse montre que la période de contrôle de la production du caoutchouc naturel entre 1934 et 1946 est un point critique à l'origine d'une expansion importante des nouvelles plantations et d'un cadre institutionnel qui a favorisé la polarisation qui s'est reproduite seule jusqu'à présent par le mécanisme d'auto renforcement. La polarisation du foncier a un effet positif sur la stabilisation des contrats de métayage pour la saignée. De plus, du fait de la polarisation, les exploitations en expansion emploient davantage de main d'œuvre rémunérée pour la saignée induisant une demande croissante alors qu'une offre croissante de saigneurs qualifiés est apportée par les petites exploitations sur le déclin. Les contrats de métayage pour la saignée actuellement mis en œuvre assurent la disponibilité de main d'œuvre rémunérée et renforce simultanément la concentration foncière.

Basés sur les résultats de l'analyse du changement agraire, trois scénarios de politique sont proposés pour mettre en évidence l'avenir possible de la filière hévéa. Ces scenarios sont: i) poursuivre la politique actuelle, ii) inverser le processus de polarisation et iii) faire face aux contraintes globales. Le scénario politique visant à inverser le processus de polarisation est mis en relief comme une option pour les décideurs compte tenu de ses conséquences sur la croissance économique, le bien-être social et la durabilité du développement agricole de la filière hévéa.

Mots clés: trajectoire d'exploitation, métayage pour la saignée, polarisation, dépendance au sentier, scénario politique, filière hévéa, Thaïlande

Path dependence of agrarian change:
an institutional economic analysis of the rubber economy in Southern Thailand

Abstract:

The rubber sector significantly contributes to livelihood and socio-economic development in Thailand with over 1.17 million households depending on rubber production. Rubber sector's contribution to economic growth and rural livelihood in Thailand has been frequently studied. Yet the evolution of rubber farms over time and its drivers are less documented, though they will affect the future of the rubber sector.

This Ph.D. work aims at exposing, and giving sense to the dynamics of agrarian change in Southern Thailand where rubber is a major crop. It intends to provide elements for decision makers to reflect on the future directions of the Thai rubber economy. Using both concepts of farm trajectory and path dependence, it intends to use a conceptual framework based on institutional economics for analyzing agrarian change. The main hypothesis is that co-evolutions of access to land and labor relationships are the key drivers of agrarian change taking place in rubber economy.

I applied a sequence of multivariate analysis and systematic clustering to characterize the trajectories of 220 rubber farms in Southern Thailand. I also analyzed the evolution of share-tapping arrangements though personal interviews, survey and literature review. A path dependence analytical framework was then applied to identify and characterize how institutional settings and institutional reproduction shaped the observed trajectories and share-tapping arrangements.

I identify six significant farm transformation trajectories between 1990 and 2010. Two trajectories show a decline in landholding and/or hired labor related to medium farms (10.5%) and small farms (25%). Three trajectories show growing landholding size and/or use of hired labor. They concern growing medium family farm enterprise (14.5%), large family farm enterprise (4.1%) and farms moving towards patronal enterprise (7.7%). These opposing trajectories witness a continuing polarization of rubber farms. 38.2% of farms follow a trajectory of stability with no change in farm size and labor structure. However, these are small farms and present a risk to follow the trajectories of farm decline.

Labor availability and share-tapping arrangements evolved over time but share-tapping remains the main, almost unique, labor contract for harvesting since the beginning of rubber cultivation in Thailand. Labor contracting arrangements are in an institutional lock-in situation under the current form of share-tapping through three self-reinforcing economic, functional and legitimating mechanisms. I identified a set of rules that could explain the prevalence of the share-

tapping arrangement in pursuing the exploitation of available labor force and ensuring high resilience to variations and uncertainty in social and economic conditions.

Path dependence explains farm polarization and the institutional lock-in of share-tapping as the results of self-reinforcement mechanisms leading to institutional reproduction. The thesis shows that the period of rubber control during 1934-1946 was a critical juncture resulting in large expansion of new plantings and an institutional setting favoring polarization that has reproduced itself through self-reinforcing mechanisms until now. Land polarization had a positive effect on the stability of share-tapping contracts. In addition, due to polarization, farms with growing landholding employ more hired labor, inducing an increasing demand while an increasing supply of skilled tappers is provided by declining small farms. The current share-tapping arrangements ensure the availability of paid labor and simultaneously reinforce land concentration.

Based on the results of this analysis of agrarian change, three alternative policy scenarios are proposed to highlight the possible future of the rubber economy. These scenarios are: continuation of present policies, reverting polarization and coping with global constraints. The policy scenario of reverting polarization is suggested as an option considering its consequences on economic growth, social welfare and sustainable agricultural development in the rubber sector.

Key words: farm trajectory, share-tapping, polarization, path dependence, policy scenario, rubber economy, Thailand

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List of Abbreviations

ADS	Air dry sheet
ALRO	Agricultural land reform office
ANRPC	The Association of natural rubber producing countries
CLU	Cluster number
Con-latex	Concentrated latex
DAE	Department of agriculture extension, Thailand
DRC	Dry rubber content
FAO	Food and agriculture organization of the united nation
GDP	Gross domestic products
IBRD	International bank for reconstruction and development
INRO	International natural rubber organization
IRA	International rubber agreement
IRRA	International rubber regulation agreement
IRRDB	International rubber research and development board
IRSG	International rubber study group
NESD	Nation economic and social development, Thailand
NR	Natural rubber
NSO	National statistical office, Thailand
OAE	Office of agricultural economics, Thailand
ORRAF	Office of the rubber replanting aid fund, Thailand
PC	Principal component
PCA	Principal component analysis
PE	Pattern of evolution
RES	Rubber estate organization, Thailand
RRC	Rubber research center, Thailand
RRIM	Rubber research institute of Malaysia
RRIT	Rubber research institute of Thailand
RSS	Ribbed smoked sheet rubber
SHFE	Shanghai future exchange
SICOM	Singapore commodity exchange
SR	Synthetic rubber
STR	Standard Thai rubber
TOCOM	Tokyo commodity exchange
TR	Trajectory
UNDP	United nation development program
USS	Unsmoked sheet rubber
WTO	World trade organization

Glossary of Terms and Definitions

Agrarian change	Agrarian change is institutional change and evolutionary process of institutions embedded to order habits of thought, behaviors and actions of actors that govern and shape the agrarian structure and system
De-agrarianization	Process of agrarian change moving agrarian society away into something else, in which mostly became urbanizations and/or industrialization
Family farm	Family owned and operated farms by family labor
Family farm enterprise	Family owned farm enterprise which conducts and manages to the farm business
Farm polarization	A process of farm orientation and its change in which is divided into two polar axial movements or opposing directions contrasting groups or sets of institutions, resources, management and objectives, etc.
Macro institutions	Institutions at constitutional level in which embedded social, economic and political behaviors and activities at macro level
Meso institutions	Institutions embedded social, economic and political behaviors and activities at meso level
Micro institutions	Institutions embedded behaviors and actions of individual and collective actions or the operational level
Non-farm	Family labors were employed to work by employers in outside of farm sectors that would pay a salary or wage, or by self-employments that they gain income from their jobs
Off-farm	Family labors are hired by other farms in returns for wage
On-farm	Family labors engaged to work family-owned farms
Path dependence	The sequence events set in motion of pattern of change and influence subsequent events emphasizing critical juncture and contingent events to create institutions, institutional reproductions and reactive sequences governing actor behaviors and institutional patterns
Patron farms	Farm owners worked non-farm activities and operated farm by only the hired labors
Self-reinforcement	Mechanism process of institutional reproduction
Share-tapping	Labor contracts in rubber production which paid by output sharing as a form of wage
Trajectory	The farm changes moving into a particular direction in response to sequence events and the actions of a given forces, etc.

Chapter 1

Introduction and Methods

1.1 Introduction

Natural rubber (Hevea. Brasiliensis) is one of the most important agricultural products and is a major economic crop in Thailand. The rubber economy involves more than 6 million people or about 10% of the Thailand population. Rubber production has a high value ratio in gross domestic agricultural production and accounts for about 40% of the total export value of agricultural products (RRIT, 2008). This production has greatly increased farm income, improved the standard of living of rubber farmers, and achieved the growth of the rubber industry.

Since the early 1990s, Thailand has been the world's largest rubber producer and exporter. Rubber areas now total 3.1 million hectares with production of about 3.6 million tons (OAE, 2012). About 95% of the production comes from smallholdings (holding size below 8.0 hectares) (RRIT, 2012). The farmers produce mainly three forms of rubber products which are unsmoked sheets, fresh latex, and cup lump. Farmers sell their products to middlemen or cooperatives, and then those products are transformed into rubber smoked sheets, concentrated latex, or block rubber by the intermediate industry. Domestic consumption is approximately 15% and export about 85% of total rubber products which provide about 40% of world market share. Southern Thailand, and to a lesser extent other regions in Thailand, is the traditional area for rubber cultivation. Rubber is cultivated across the fourteen southern provinces and accounts for about 66.7% of the total land in southern Thailand. Rubber plantations covering about 1.95 million hectares constitute more than 63% of total rubber areas in Thailand and produce about 73% of national rubber production (OAE, 2012). Produced by about 1.0 million farm households, rubber is an important economic crop in terms of main income, livelihood, and a source of competitive advantage for social and economic development in this region.

In the early 1900s, rubber was first introduced in Trang province. Most farmers used simple technology with traditional cultivation practices such as seedling trees with very scarce capital, family labor, and poor farm management (Stifel, 1973). The yield of rubber plantations was lower than 400 kg per hectare. In the 1960s rubber development projects entitled "rubber re-plantation schemes" were established. The re-plantation schemes were part of the policies of the Ministry of Agriculture and Co-operatives. Two agencies were responsible, the Rubber Research Institution of Thailand (RRIT) and the Office of Rubber Replanting Aid Fund (ORRAF). New technologies from RRIT were diffused to farmers by ORRAF. ORRAF also provided grants in accordance with the rubber-replanting Act. Moreover, Rubber Estate Organization (RES) also provided and set up trials on technologies such as planting materials, agriculture tools, and other materials necessary for rubber cultivation including pilot plants of rubber processing. Under the rubber re-planting schemes, high yielding plantations (new clones, mono-specific plantation, and performing tapping

systems) were widely adopted by the farms. The technology brought by the re-plantation schemes played an important role in the growth of the rubber economy.

In particular, the replanting scheme was a critically important factor to increase the areas planted with high yielding clones, whereby 1.472 million hectares were replanted between 1960 and 2007 (ORRAF, 2010). In 1991, about 40% of total rubber areas were planted with a high yielding clone and increased to 98% in 2003. As a result, the average yield of rubber plantations in the southern region is now 1,644 kg per hectare (RRIT, 2012). Figure 1-1 presents an estimation of the rubber yield evolution in the southern region since 1960. It shows that the rubber yield had increased from less than 400 kg per hectare during the 1960s to 1980s to a maximum of about 1,800 kg per hectare in 2003, indicating one of the best levels of yield in the world by smallholdings. This achievement was enforced through technology and government intervention. However, since 2003, the study observed that yield had sharply declined to diminish pattern as in Figure 1-1.

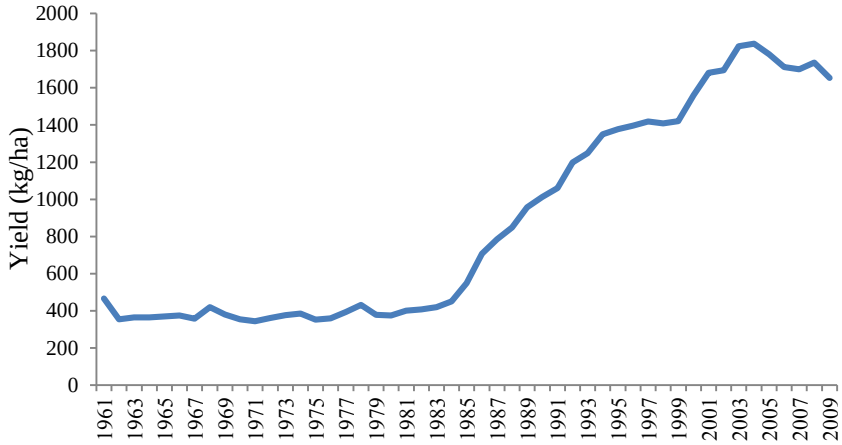

Figure 1-1 Evolution of rubber yield in Southern Thailand
Sources: FAOSTAT, 2010; RRIT, 2010

Moreover, about 55% of total rubber farms in 1998 did not collaborate in the re-plantation scheme (NSO, 1998). They had increased to 60% in 2008 (Somboonsuke et al., 2008). These farmers also tried to adopt the new technology brought by the scheme (notably using clones) even if they adapted it in respect to their farm constrains in particular land size, labor availability, and socioeconomic conditions. Similarly, farmers involved in the schemes adapted recommended technology after the end of the scheme (sixty-six months after plantation). For example, the previous research showed that more than 58% of rubber farms in Songkhla province used a high intensity tapping system, mostly ignored fertilizer use, increasingly planted rubber on wet land, and so forth (Somboonsuke et al., 2008). RRIT (2008) also argued that rubber trees had generally low girth and heterogeneous growth in the immature period of more than 7 years. Deficient farm management during the mature period and intensive tapping systems may lead to a short productive life. These resulted in pressure on resource exploitation, tend to decline yield, and declined economic performance. The limited/selective adoption of official recommendations by the farmers when there was no (or no more) development project was not only observed by small farms in Thailand. The

Association of Natural Rubber Producing Countries argued that the plantation technologies appropriate for the estate sectors might not necessarily be appropriate for smallholding farms.

The farmers were still reluctant to take risks to adopt new or improved technologies, especially those that were complex and expensive technologies (ANRPC, 2001). Since the introduction of rubber, southern Thailand has undergone land change. Before the 1980s, the growth of the rubber economy was due to expansion of new planting in new land. This was largely explained by a large surplus of land. After that date, the expansion of new cultivation areas became limited, and so the growth of the rubber economy was due to the adoption of new technology in particular with high yield. That was the end of land frontier leading to scarce and unavailable land use and rising land constraints (Siamwalla, 1996; RRIT, 2006).

Since that time, the average size of rubber farm households continued to decline from 2.7 hectares in 1998, 2.5 hectares in 2003, and only 1.87 ha in 2007 (RRIT, 1998, 2007). Accordingly, the study also observed the changes in distribution of rubber landholdings between 1998 and 2003 in southern Thailand. The share of the small size holdings (0.3 to 6.24 hectares) decreased from about 64% to about 60% and the average size decreased from 1.8 to 1.7 hectare. Similarly, the share of big size holdings (more than 22.25 hectares) decreased from about 10 to 9% and the average size from 42.2 to 31.0 hectares. On the other side, the share of the medium size holdings (6.24 to 22.25 hectares) increased from about 26% to 31%, but the average size decreased from 6.7 to 6.3 hectares (NSO, 1998, 2003). The data indicated that distribution of landholding is changing. The preliminary survey in 2010 found that most rubber farms operated small farm size of about 1.6 hectare and widely formed land fragmentation, presenting multiple small plots and forming scatterings of landholdings, which complicated the management of the farm. Moreover, because of the reduction of farm size, farm income might decrease and force farmers to adopt new strategies at the plot and/or at the farm level to ensure family livelihood.

Other evidence from the field was that the availability of land was limited for rubber and so increased pressure on land use in the southern region. Because facing low availability of land, new plantings were expanded to either marginal areas or unsuitable land for rubber trees that could not benefit from ORRAF subsidies. In the past, farmers had avoided to plant rubber on lands that they considered less suitable for rubber production (Besson, 2002). But, from 2003 to 2010, most of the new plantings had encroached from paddy fields, flooded land, and old fruit tree areas, which were unsuitable with limited topography conditions (Somboonsuke et al., 2008). The main constraints were observed in unsuitable areas consisting of inappropriate soil, low soil fertility, unconditioned climate, and improper topography for rubber trees. Plantations planted in these conditions needed special farm management and highly adapted RRIT technology. The study knew that these plantations had lower yield and higher production cost compared with recommended areas (RRIT, 2009). Moreover, the price boom during the past decade (2010s) has increased pressure on limited available lands. The rate of re-plantation areas had declined by about 30% since 2006, although it could provide the support to maintain the rate of replanting. On the other side, new planting of owned-investment was increasing substantially (ORRAF, 2009).

From the above discussion, it is clear that land has always been an important production factor in the rubber economy. At the beginning, land was a surplus resource allowing the extension of new plantings and so it significantly contributed to high growth of the rubber economy.

Since the 1980s, land has become a scarce resource and unavailable for the rubber economy. This can be observed through the change of structures of holdings and the increasing use of marginal land. If this evolution continues, land changes in southern Thailand may threaten the future of the rubber economy. Therefore, this study will analyze the recent changes and their determinants.

Labor is another important factor for rubber cultivation. During the productive period, rubber harvesting (tapping) is labor intensive needing a large number of skilled labor without technology replacement. Since the beginning of development of the rubber economy, labor availability has been changing. These changes are complex, involving the interaction of several factors and they are much influenced by the policy of every major economic sector, social development, and farm and non-farm labor policies. For the last three decades, the demographic structure in Thailand has changed from high to low mortality and fertility leading to a continued decline of population growth rate and overall supply labor including an aging population (UNFPA, 2011). In parallel, Thailand's rapid economic expansion increased the demand of labor for industry both skilled and unskilled and so induced migration of a large number of farm laborers to urban areas. Siamwalla (1996) predicted an absolute decline of the labor force in agriculture sometime in the 1990s. In the southern region, farm labor gradually declined from 3.2 million in 1993 to 2.1 million in 2007. The farm labor per farm household also declined from 3.52 people in 1998 to 2.58 people in 2007. There were some changes in farm holder structure with the share of young holder (<35 years) declining from 18.7% in 1993 to 16.7% in 2003 when the share of elders increased (> 65 years) from 12.6% in 1993 to 16.4% in 2003 (NSO, 2003, 2008). The decline of farm labor forces was especially dramatic for very young labor 15-24 years due to industrialization, education, and attitudes (Poapongsakorn et al., 1998). At present, the family workforce in the rubber farms is below 2 people per household. This workforce is characterized by older age (> 47.5 years), minimum education, lack of training, and lack of tapping skills (RRIT, 2007; Somboonsuke et al., 2008).

In southern Thailand, two types of tapping labor exist, these are family labor and hired labor, in this study called "share-tapper". Labor contracts are always laid down on share-tapping. A share-tapping contract is a contract arrangement between a landowner and a tapper (hired labor) where tapping labor is a tenant and has contracted out the right to tap rubber trees for a wage in the form of output sharing. Each contract agreement specifies the output sharing, cost sharing, and level of responsible jobs contracted out by informal agreements in respect with a certain context of circumstances. These three attributes can differ from one contract to another. Sharing output and cost are determined and negotiated between owner and hired labor, which means that they are a tradeoff between benefit and cost sharing of farm maintenance. In 2008, output sharing varied from 70:30 to 50:50 i.e. 70:30

means that the owner got 70% of total output and 30% was shared with the hired laborers. The ratios 55:45 and 50:50 are the most common agreements.

Several researchers claimed that share-tapping had evolved through increasing output sharing for hired labor in respect with increasing labor constraints, and social and economic change (Keawhnoo, 1995; Somboonsuke & Junjareang, 1995; Thungwa et al., 1998; Taanthai, 2002). But this argument still has to be scientifically demonstrated. The contractual arrangements and negotiations are affected by several factors such as labor attributes, socioeconomic conditions, institutions, location, biophysics characteristics of the plantation, community attributes, supply of tapping labor, rubber price, and marketing (Somboonsuke et al., 2008). From the field survey in 2010, each contract agreement seemed to be accepted in conditions and attributions by the rubber owner and hired laborers, and this deal became the rules for tapping employment in the community. By share-tapping contracts, the average labor cost was over 65% of total production cost when it was only about 49% with family labor calculated by daily wage of Songkhla in 2007 for estimation of labor opportunities cost (Somboonsuke et al., 2008). There was the highest labor cost to compare with labor cost in other crops.

Hired laborers were commonly employed by farm businesses. Eventually smallholdings faced several constraints such as low available of family labor, low working capacity, long distance of their owned plots, and rubber being a secondary occupation leading many of them to employ share-tapping labor. Presently, there are no official statistics about numbers of hired laborers and the distribution of tapping laborers. Kosaiysavee (1999) indicated that about 48% of plantations in the southern region employed tapping labor in 1999. By the estimation of a preliminary survey, the employment of share-tapping labor was likely to be more than 65% of total farms. This labor came from various sources such as kinship, local laborers from the village and neighboring provinces, other regions, and immigrants from Burma and Laos. Rubber owners prefer kinship and local labor in the villages rather than the other options. However, the labor force was characterized by high mobility between tapping and industrial jobs regarded rubber price fluctuation and wages. In particular, the trend of increasing rubber price since 2003 has encouraged labor to come back to tapping (NESD, 2008).

For most households of share-tappers, tapping is their main source of income. They are pressured from various constraints such as small size, landlessness, fluctuation of income, hard working conditions, insecurity of employment, etc., (World Bank, 1994; Thungwa et al., 1998). Consequently, tapping jobs are not attractive or motivating jobs in particular at the period of low or high-fluctuated price. The workforce will move to alternative jobs in industrial sector and then some difficulties arise for famers to recruit tappers especially when rubber prices fall.

Other critical issues were lack of skills and quality of hired labor. Skill is an important determinant of the present and future productivity of the rubber plantations. Generally, a tapper should be apprenticed for one to four years to perform at an average skill level.

Therefore, general laborers cannot be a tapper if one has no tapping skill and experience of tapping (ANRPC, 2001). However, it is not realized in facts. And this study mentioned that the rubber farmers and tappers were getting older or have more tapping years, but they are considered unskilled labor. The reason for that is that if farmers need to train or improve tapping skills, they learn from neighbors and by working their farms. Chancharoen and Somboonsuke (1997) argued that 47.1 % of labor had no skill in rubber tapping. This problem might be increasing as seen in the results of the survey by Somboonsuke et al. (2008) which stated that about 70% of tappers in Songkhla province were unskilled and few followed training in tapping before becoming a tapper.

RRIT (2008) also mentioned this shortage of qualified tapping labor for rubber production. In southern Thailand, even if up to now, it had not been reported that rubber plantations were not tapped, which would indicate a real labor shortage, labor constraints became an increasing pressure and could reduce competitiveness at farm and national level in the future of the rubber economy. The same events had been observed in Malaysia leading to a decline of rubber production in the 1980s (IRRDB, 2001). Because of their possible consequences on the future of rubber sector in Thailand, both quantity and quality labor constraints need to be addressed by alternative policies or reform policies. Therefore, this study focuses on tapping labor and share-tapping issues that will threaten the future the rubber economy.

Moreover, rubber prices highly fluctuate, despite the high nominal price level achieved during the 2000s. FAO (2006b) stated that rubber prices depended mainly on the cyclical movement of the world economy and influenced by various short-term factors such as weather, currency movement, future market activities, market interventions and irregular demand, and then there were fluctuations along this gentle phase of the rubber cycle. Indeed, the global economic slowdown during 1980-2000 had obviously affected rubber demand greatly, resulting in a decline in rubber prices. The falling rubber price caused a price intervention periodically, attempting to bring prices to a more remunerative level, especially for smallholders. Together with falling farm size and labor constraints, farms tended to increase vulnerability of livelihoods. However, profitability was increased during the period of price boom (2003-2011). Rubber price is an important factor to determine resource allocations (land and labor) in farms and the government policies. Therefore, this study will analyze how the farms respond to the market, price, and their influences to shape government policy.

The above discussion showed that rubber played an important role in the growth of the Thailand economy and contributed highly to increase the standard of living of farmers, notably in the southern region. The model of development of the rubber economy in Thailand is usually considered as a success. For the past three decades, some changes have happened in land and farm labor in particular in southern Thailand. These evolutions may threaten the development of the rubber economy in Thailand. Therefore, this raises the broad question of what/how the rubber economy will be in the future. This development issue refers to study concerns; this study will provide a better understanding of agrarian change. By this

understanding, the study expects to be able to give some information about what the future of the rubber economy could be and advise or suggest an appropriate policy in order to modify the general current and future state of the rubber economy if policy makers need to come up with alternative policies.

As it will be shown in this work, market analysis is not sufficient to explain the current situation of the rubber economy in southern Thailand. In this approach, this study believes that the sequence of events in social and economic development are governed and shaped by historical events and prevailing institutions that have influenced deterministic patterns or set institutional arrangements for the motion of future events. The historical sequences of events establish critical juncture for institutional settings and a given institutional arrangement reproduced to structure a pathway of social and economic development in the present and the future. Institutions, which are established and set by prevailing institutions, are embedded in habits of thought, behavior, and individual and collective actions. Therefore, social and economic development should be explained in terms of the structural transformation and an evolutionary process of institutions recognizing institutional change and the evolution of institutions.

This study defines and describes agrarian change by the views of institutionalism. The definition of agrarian change adopted in this study "is institutional change and evolution of institutions embedded to order habits of thought, behavior, and individual and collective actions that govern and shape an agrarian structure and systems" (Hamilton, 1932; Hodgson, 2004a). Agrarian structure and systems in this research denote a complex relationship within the agriculture sector. These include the structure of land, labor, technology, production systems, and social and economic elements, which determine economic systems of individual farms and an agrarian economy. Institutional change plays a central role to constitute and to impose upon agrarian change from one institutional setting to another.

Accepting the role of institutions with the mechanism of reconstitutive causation, institutional change is considered as the structural transformation of social and economic elements that can cause changes in habits and behavior within individuals through endogenously generated change. It enables new habits of thought, behaviors, and individual and collective actions in an agrarian society. These are a continuum and occur over time as evolutionary processes of institutions. When the movement of institutional settings to another one occurs as a result of adaptation of habits to the changing environment, new institutions, social selection, technology, power, and external shocks, institutional changes have the capacities to mold and increase new habits of thought, behavior, expectations, and actions (Hodgson, 2004b) as Veblen's states "The situation of today shapes the institutions of tomorrow through a selective, coercive process, by acting upon men's habitual view of things" (Veblen, 1899). After new institutions become common habits of thought and behavior or concordant habits, regularity of human actions will lay down on an agrarian society that will lead to agrarian change.

Main study questions:

1. How did the rubber sector evolve historically?
2. What are the key determinants of this evolution in southern Thailand?
3. What are the policy implications on the future of the rubber sector?

1.2 Objectives of the study

The main objective of this study is to address the problems of the rubber economy by developing a conceptual framework of institutional economics for analyzing agrarian change. This framework will be applied to the rubber economy in southern Thailand.

Specific objectives consist of:

1) to analyze farm transformation in the rubber economy
2) to examine the evolution of land, labor use, contracts, and their determinants in the rubber economy in southern Thailand
3) to develop prospective policy analysis in order to suggest policy options and implications for policy decisions in Thailand

1.3 Hypotheses of the study

Main hypothesis:

Simultaneous co-evolutions of access to land and labor relationships are key drivers of agrarian change taking place in the rubber economy

Specific hypothesis:

1) Apparently, there is no significant change in labor availability because institutional arrangements in share-tapping have never been challenged
2) There is polarization of landownership; farm size of the smallholdings is decreasing when some owners are increasing land accumulation leading to land concentration
3) Land polarization reinforces the stability of tapping contracts

1.4 Study outcomes

The study seeks to provide good understanding of transformations in rubber based farms and to have knowledge of macro-institutions, micro-institutions, and their links influencing farm transformation. It will highlight implications for alternative policies to government intervention, rubber organization, and re-plantation schemes to increase economic welfare. It also will provide the setting of appropriate and technological services beyond supporting agricultural and economic growth.

1.5 Literature reviews

This section pays attention to a critical review of the literature about theoretical frameworks of agrarian change and institutional economics. The attention focuses on the main ideas about how they were developed, theoretical approaches, and their limitations including comparisons between schools of thought. In this study, the research approaches institutional economics, in particular the so-called "old institutional economics" for analyzing agrarian change. The study begins with a classification of main influential thoughts of agrarian studies that are fundamental in the understanding of agrarian change. Next, institutional economics are fundamentally reviewed to answer the following questions: what are institutional economic approach exits, institutional changes and path dependent theory in order to answer why institutional economics appropriately explain agrarian change in the rubber economy. Finally, methodological institutionalism is discussed.

1.5.1 Agrarian change

Agrarian change is analyzed by various theoretical approaches such as economic growth, agricultural development, political economy, and sociology. All of them have applied theoretical and methodological frameworks as aspects of courses and objectives in specific ways. However, agrarian change seems to be highly fashioned through political and economic issues and rural development, in particular the contribution of transitions to capitalism or socialism. By the researcher's observations, agrarian studies attempt to understand constrains, problems, and prospects of social and economic change in agricultural sectors. The formation and transition to capitalism or socialism are essentially recognized together with economic growth and government policies. There are reflections on social and economic development in developed, developing and poor countries. In this section, the study attempts to present a board theme of agrarian change and agrarian movement, to classify and sketch the context of agrarian studies and to debate leading scholars of agrarian change, allowing the explanation of contemporary agrarian change.

A broad theme of agrarian change and agrarian movement has seemed to be a transition to capitalism and neo-liberalism. Agrarian transformations within and across countries have been significantly and dynamically altered during the past few decades, gearing the change in the world economy and global politics. The agrarian world has witnessed continuity and change in terms of general patterns of accumulation, appropriation, and dispossession for capitalist development as well as socialist construction (Borras, 2009).

Since the sixteenth century, the held thought of capitalist development has been the pioneering of successful agricultural change and was remarkable as a main direction of this change. In the past four decades, the era of neoliberal globalization has influenced and witnessed important changes in the nature, scope, pace, and direction of agrarian transformations within and between countries. The transnational agrarian society was a new movement of the existing agrarian scenario. This change considers intensive capitalism and high dynamics with international trade (Bernstein & Byres, 2001; Borras, 2009). Borras et al.

(2008) argued that transnational agrarian change raises the recent wave to restructure agrarian society by the impact of neo-liberalism and global political-economy that has predominantly altered the dynamic of agrarian production and exchange relations within and between countries. Consequently, national peasant and farmers' groups are directly linked to transnational movements that have gained and confronted considerable power and political influences.

Agrarian movements are affected by, or have struggled with the global-local complex process in response to localization, privatization, and internationalization which has led to global agrarian restructuring (Borras et al., 2008). The results were complicated to evaluate but it led to de-agrarianization as in the transformation of Turkish agriculture. Aydin (2010) argued that the de-agrarianization in Turkey was actively propelled by the increased liberalization of agriculture, absolute control of transnational corporations, and state policies. Globalization has meant the restructuring of agrarian arrangements to free market economy. Agriculture is controlled and owned by large multinational corporations. They are capable of pushing small farmers out of agriculture. The destruction of agricultural production will only exacerbate Turkey's problem (Aydin, 2010).

In this study, the researcher's concern is with agrarian change as a phase of world agrarian movement, and wishes to deeply understand the specific process of evolution and structural transformation. The transitions from a traditional economy or backward economy to capitalism or from socialism to capitalism have occurred around the world as a main wave of the agrarian movement. Such change may move to a phase of intensive capitalism or transnational agrarian production and exchange in the coming decades. Technology has certainly driven this change as well as gearing world economy. Even though it has failed to deliver the goal of agrarian change by rising farm living standards and economic welfare in many places.

This transition coincides with the most recent wave of global political economics and agrarian reconstructing, allowing even great power to transition in terms of production and exchange to favor a large private capital, which will lead us to face even more de-agrarianization (Borras et al., 2008; Aydin, 2010). As Berstein and Byres (2001) notes, the agricultural transition to capitalism is a crucial argument of agrarian change. There is a complex interplay between land availability, technical progress, organization, social and political power, and their specific mechanism of appropriation. This statement provides a broad determinant to contribute to agrarian change. In this study, the researcher postulates that land, and labor are important factors to determine agrarian change in the rubber economy in southern Thailand.

In this research, the classification of agrarian studies proposed by Ellis (2000) and Borras (2009) were employed. Ellis (2000) emphasized the theoretical framework of agrarian studies, while Borras (2009) focused on general themes of political economy and social science studies. These schools of thought have influenced classification of agrarian studies regarding approaches of scholar papers and core background theory. Thus, agrarian studies

can be classified through critical reviews of agrarian change into four themes: agricultural development, political economics, population and technological theories (Ester Boserup), and socioeconomic approach (Interdisciplinary).

Agrarian studies approach to agricultural development

The influential thoughts of agricultural development focus on the role of agriculture in economic development. The structural transformation results from movement toward specialization and market participation. The specializations become a central focus and attributes of rising productivity and per capita income in the agricultural sector through a specific crop and transforming to specialist producers. The result is augmented productivity of land, labor, and capital including productive technology (Tomich et al., 1995). Agricultural transformations arose from two basic issues, the contribution of agriculture in economic growth and the conditions or factors that lead to the modernization of the agricultural sector (Timmer, 1988). The structural transformation can be explained by four processes: a declining share of agriculture in GDP and employment, a rural-to-urban migration that stimulates urbanization, the rise of a modern industrial and service economy and a demographic transition from high birth and death rates common in rural areas to lower ones associated with better health standards in urban areas. The outcome is an economy in which capital and labor productivity in agriculture are comparable to other sectors by well functioning labor and capital markets (Barrett el al., 2010).

Ellis (2000) claimed that this school of thought predominantly envisages individuals and households moving from farm to non-farm occupations, thus enabling an increase in output per person and income. The non-farm growth is hypothesized to occur as a consequence of rising farm productivity (Ellis, 2000). The study agreed that this theme focuses on changing output share and labor reallocation that characterizes structural transformation by a relative decline in the agricultural sector.

This theme has been much contributed to through a neoclassical economic approach, crucially, the agricultural transformation by Timmer (1988) that seems to evolve through the four processes of structural transformation. The process starts when agricultural productivity per laborer rises. The increased productivity was possible through institutional change, new technology, structure of markets and incentives and significant investments in rural infrastructure. This productivity creates a surplus, which in the second phase can be tapped directly, through taxation and factor flows, or indirectly through government intervention into the rural-urban terms of trade. This surplus can be utilized to develop the non-agricultural sector, and this phase has been the focus of most dual economy models of development. In the second stage of the process, agriculture contributes to economic growth establishing market linkage with industry. Technology and incentives to create better agricultural development provide the improvement of factor market leading to mobilize and flow out of rural resources. The rural factor and product market become better integrated with those in the rest of the economy. The progressive integration of the agricultural sector into the macro economy is a third phase of agricultural transformation. This phase has seen a declining share

of food in the typical urban budget. In this phase, agricultural sectors push to increase productivity, high outflow of resources, and lagging rural labor productivity. Finally, the fourth phase is reached when the agricultural sector represents a few shares in the industrialized economy. The fourth phase of transformation is characterized by a small share of food commodities in consumer budgets, unemployment in the industrial sector creating pressure to keep labor in agriculture, and income distribution as a political as well as environmental issue. The declining importance of the agricultural sector is uniform and pervasive whether in a socialist or capitalist economy (Timmer, 1988).

Thus, this thought emphasized the rising productivity and share of the agriculture sector in the economy as a phase of transformation. It means that they assess structural transformation by the change of productivity in resource use and capita per income at period time, considering agriculture's contribution to economic growth. This thought contributed to popular empirical studies by economists and agricultural economists around the world such as Hayami and Ruttan (1985), Hayami and Kikuchi (2000) and so on. For instance, Hayami and Ruttan's work in 1985 showed evidence for the sources of changes in agriculture productivity and implied patterns of change by relationships between resource endowments, cultural endowments, institutions, and technology. They also argued that Asian countries require strongly rising land productivity to cope with small farm size and rapid growth in population while labor productivity rises through movement of labor to other sectors and increased wages. Tomich et al. (1995) argued that the structural transformation accompanies three principal contributions: markets draw into productive use land, labor, and entrepreneurship that might otherwise go untapped, competitive pricing creates incentives to allocate resources to areas where the efficient resources allocation, and the financial market results in an increase in the capital available to assist individual laborers leading to augment their productivity.

Following Timmer's agricultural transformation, this concept was used to explain the transformation of rubber plantations in Southeast Asia as proposed by Barlow (1997). The development of rubber plantations can be classified into five stages. The first stage is a backward economy having a subsistence agriculture based on family farms. These original plantations form a growing tradition with plentiful and underutilized land, low productivity labor, and very scarce capital. International trade and growing industry engaged agricultural transformation to a commercializing orientation in a second stage. This stage had coincided with colonialism and the arrival of estate plantations. The estate plantations grew with tree crop technology, capital from international markets, utilization of plentiful land, and low cost of labor from local and migration sources through the rising enhanced infrastructure and service. The earning capacity of new cash crop started transforming the backward domestic economy by promoting its cultivation geared to world markets. The simple technologies were further adopted by smallholdings leading to competition between individual smallholdings and estates. This condition led to increased price of production and declining profitability. In this stage, plantation agriculture was leading and a major share in economy.

The agricultural transformation then enters a third stage, when industry is gaining economic momentum and manufacturing growth by promoting import substitution policies. The agricultural sector is a major share in the economy but its surplus is overtaken by industries. Government and public agencies started to supply research services and researchers and to generate new technology for raising land and labor prices. The new technology, high yielding clones and modern farm practice, originally developed for, and used by estates, was later adopted by smallholdings. The government gradually encouraged more integrated and competitive markets through enhanced rural infrastructure, health and education services. The downstream manufacturing of plantation crops was encouraged by import substitution policies, and benefited from accessible low cost raw materials.

The fourth stage of agricultural transformation is an early advanced economy. The manufacturing becomes much larger than the agricultural sector and moves to an export orientation including downstream plantation crop processing into final goods. Tree crop technology is continually generated and adopted as in the previous stage with concomitant widening of available techniques to assist adjustment to different circumstances. The new technology moves firmly into less land and labor intensive, capital-intensive innovation and farm management by induction of manufacture. Farmers gradually adopted technology associated with cost of resources and may be shifted to less labor-intensive trees or annual crops at the end of cycles. The growth of manufacture has advantage outcomes for plantations by strengthening demand linkage with downstream manufacture. It also encourages the development of rural infrastructure and service.

After, economic growth reaches the fifth stage as an advance economy where manufacturing becomes a major share in economy rather than agriculture including having significant plantation crop processing into final goods. Tree crop technologies concentrate mainly on the generation and adoption of technologies for quality improving techniques of intermediate and finished goods to meet international demand. Estates and highly educated smallholders find producing profitable tree crop by using relative management, capital intensive, and less labor techniques. The traditional plantation crop production is uneconomic and replaced by new profitable crop; but the existing trees are still exploited until they earn sufficient return over direct costs. Rural markets are more integrated with international markets. The government is continually providing infrastructure and services (Barlow, 1997).

The researcher claimed that this analysis can significantly explained the path of rubber development in Malaysia and may also be the case in Indonesia but it should be reassessed for the path of rubber development in Thailand regarding key determinants, deterministic patterns, process of transformation, consequences and time period. It was a broad portrait and not precise to practical eventuality with the evolution of the rubber economy in Thailand. Indeed, the researcher disagreed with Barlow's explanation that seems to have prior influences by estate plantation's power, the role of manufacture and trade, focusing a share of the agriculture sector into the whole economy.

However, Barlow's work further provided complex determinants and a broad mechanism of change, which positive and negative influenced at each stage that drives the transformation process. Indeed, Barlow suggested that the key elements in plantation adjustment consist of market conditions, technologies, relative resource prices, institutional arrangements, and government interventions (Barlow, 1997). Similarly, Besson (2002) argued that government interventions and technologies are key factors that drive rubber development in Thailand. Accordingly, this study argued that neoclassic economics is mainly influenced by approaches and methodologies. The results showed empirical studies of transformation patterns and their determinants that comprise of a least land, labor, capital, and technology. However, the explanation of how the process or mechanism of agricultural transformation works and how they evolved have been never essentially been investigated. These questions inspire me to need to deeply understand, and witness such a transformation.

Agrarian studies approach to the political economy

The influential thought is the groups of ideas and theories of the political economy. This theme conducted by a conceptual framework of agrarian political economy, deals with agrarian transformation, peasant differentiation, peasant economy, agrarian class and class politics, class agency, family farms, and moral economy of the peasant. The notions of Karl Marx, Vladimir Lenin and Alexander Chayanov are mostly debated on these approaches such as agrarian transition to capitalism and socialist construction, agrarian class, and the way those have influenced rural development in theory and practice, past and present (Bernstein & Byres, 2001).

As proposed by Bernstein and Byres (2001), political economics for explaining agrarian changes can be divided into four stages: 1) pre-capitalist, 2) transition to capitalism, 3) capitalism to socialism or socialism to capitalism, and 4) colonialism.

The first stage is a pre-capitalist agrarian formation that was debated by influential Marxists on the relevance of European feudalism and the reason for the original farm transition to capitalism. By the crucial argument in this stage, based on Europe, the landlord has been a power to mobilize servile labor for manorial production in Eastern Europe that has depended on agricultural production and class differentiation in Western Europe. The type of peasants and peasant classes were the outcomes of the complex interplay between land availability, technical progress, organization of farming, social and political power, and their specific mechanism of appropriation. The agricultural transition to capitalism is a crucial argument of agrarian change. The mode of production moved to the capitalist mode of production.

The paths of agrarian transition evolved in different conditions through the change of wage labor in farming, the replacement of sharecropping by wage labor, the impact of colonialism, the change of global markets and manufacturing technology, the emergence of industrial agriculture and industrialization in rural areas, and the development of social and economic factors.

In the agrarian history of Soviet Russia and China, the agrarian Marxists in context of Soviet economic policy and its politics after 1917 was the formation of the agrarian model in socialist construction. The transition from capitalism to socialism and later, socialism to capitalism was a specific form of agrarian change. The peasant class and the sociology of peasant political action have been different in the context of feudalism and the transition to capitalism in Europe such as the forms of the social organization of agriculture and their interrelations, performance of socialist agriculture, and the contributions to economic development and industrialization. The collectivization of agriculture did not contribute or less net transfer of surplus from agriculture to industry or industrialization. In contrast, the transitions from socialism to capitalism brought change in relative prices favorable to agriculture and increased supplies of farm inputs. The official reform, institutional capacities, and macroeconomic conditions have affected the plausible transition to capitalist agriculture.

Finally, the formations of imperialism had contributed to agrarian change and had impacts on agrarian structure and dynamics during colonialism and after. By the enforcement of commoditization, settler colonialism, the emergence of new technology by settler colonialism, mode of production, and patterns of commoditization by integrated policies on land tenure, labor migration, tax regimes, and capital. They contributed to the agrarian political economy of India, Malaysia, Africa, and South America, relative to the development or stagnation of agrarian society.

In summary, the agrarian political economy approaches the transition from subsistence to capitalism in terms of three central themes. The first focuses on the social relations, the form of agricultural production and their effects for the means of productive forces and path of technical change. The second concerns the form of agriculture in social divisions of labor, land, factors and commodity marketing, and commodity chains within the national and international economy. The third considers the impact of those economic spaces on agrarian class, political structure and processes, and those of state policy (Bernstein & Byres, 2001). In an agrarian political economy, Ellis (2000) argued that this principle is concerned with increasing disparities of income and wealth in rural economies and viability of farms in the long run. The literatures emphasize inequality, power relations, social class, and the differentiation in rural areas. The critical writing addresses agricultural development concerning economic and political power, the emergence of social class, the imperative of industrialization, the role of wage labor, and the political basis of progressive social policies. This thought accepted that various factors might permit peasants to persist in a competitive capitalist economy.

The researcher argued that agrarian political economy approaches essentially focus on a transition from a subsistent economy to capitalism or socialism. There is concern with the explanation of modes of production, resources use, politics, power, social relations, and their effects for the means of productive forces and path of technical change. It deals with the form of agriculture in social divisions of labor, land, factors and commodity marketing, and commodity chain within the national and international economy. Moreover, it further considers the impact of those economic spaces on agrarian class, political structure, and

processes, and those of state policy. The counter approaches between Marxism and Neoclassic economics have influenced their schools of thought, therefore land, labor and capital through distribution of income typically elaborate object and commitment to comparative analysis that extends across countries. This influential thought of political economy dominantly contributed to agrarian change and peasant studies in the last three decades through the observation of a transition agrarian society to capitalism or socialism (Bernstein & Byres, 2001).

Agrarian studies approach to the Ester Boserup

Agrarian studies is a set of ideas on agrarian change inspired by Ester Boserups' work. *The Conditions of Agricultural Growth* (1965) showed new perspectives on agricultural change. This contradicted Malthus's assumption that agricultural systems tended to produce at the maximal level allowed by available technology. Instead, land was often shown to be used intermittently with heavy reliance on fire to clear fields and following to restore fertility in the widespread practice of slash and burn farming (Boserup, 1965). Stone (2001) summarized that Boserup held that extensive agriculture with low overall production concentration is commonly practiced when the rural population density is low enough to allow it, because it tends to be favorable in total workload and efficiency. Increasing population density requires production concentration rises and fallow times to shorten. These changes often induce agricultural innovation but increase marginal labor costs to the farmer. Farmers expanded efforts at fertilizing, field preparation, weed control, and irrigation in grass or bush land. This means that the higher population density, the more hours the farmer must work for the same amount of produce. Boserup (1965) initially stressed agricultural intensification and the mode of intensification such as capital-based, farming technology, and infrastructure-based. Changing agricultural methods to raise production concentration at the cost of more work at lower efficiency is the meaning of agricultural intensification. For example, the labor required to produce food generally decreases, whereas the total direct and indirect energy cost increases to exceed high level. The landscape is rebuilt to enhance or remove constraints on production.

As Stone (2001) noted, in general Boserup's model of agricultural change has been found in agricultural change: farmers with abundant land do tend to rely heavily on methods that are land expensive and labor cheap; farmers under more crowded conditions do tend to adopt labor expensive or capita expensive methods, and the decline in marginal utility on inputs does offer a causal mechanism for the change (Stone, 2001 reference to Netting, 1993; Wiggins, 1995). Moreover, intensive farming technology tends to occur as the population density rises. Rural population growth shortens fallow periods, increases investment in land, switches land preparation from hoe to animal traction, introduces manure in order to maintain soil fertility, reduces the average cost per inhabitant of rural infrastructure, promotes specialization in production, shifts land tenure from general to specific rights, and diminishes the per capita availability of common property resources (Boserup, 1965).

The researcher agreed that Stone wrote "the Boserup model has been widely influential, but its broad-brush success comes at the cost of neglecting many important aspects of agricultural change, and researchers from various fields have faulted it" (Stone, 2001). This is because the change in agriculture will be shaped by many major factors beyond Boserup's model and less explanation with cross-cultural agricultural variability. In this study, Boserup's model depicted the relationship between production concentration and efficiency of agricultural method through the change of factors.

Agrarian studies approach to interdisciplinary research

In the fourth theme, the influential thought is relatively newer paradigms emphasizing socioeconomics and related interdisciplinary topics such as politics, ecology, gender studies, and sustainable rural livelihoods approaches (Bernstein & Byres, 2001). These contributions deal with essays on various concepts such as sustainable rural livelihood approaches by Scoones (2009), food regimes analytical framework by McMicheal (2009), gender perspective by Razavi (2009), and academic-activity research by Edelman (2009). For instance, Scoones (2009) argued that rural livelihood perspectives must address the questions about knowledge, politics, scale, and dynamics challenging intellectual and practical levels. The analysis of livelihood requires the recognition of cross scale-dynamic change and the change of knowledge, power, values, and politics as central to livelihood (Scoones, 2009). This theme has increasingly influenced various fields of interest that expanded the scope of agrarian studies with interdisciplinary topics.

Overview of agrarian transformation in Thailand

In Thailand, agricultural development and structural transformation in the agricultural sector have been well documented in the delta central region in Thailand. Ingram (1971) stated that Thailand changed from a self-sufficient economy to an economy that specialized in limited production, in particular rice since the 1850s. Since the Bowring treaty between Thailand and Great Britain in 1855, Thailand agreed a reformed economic policy to gear with free trade and an open economy. The agricultural sector in Thailand transformed from a self-sufficient economy to a market economy by the board picture of agrarian political economy. During that period, rice was a principal crop for home consumption and that surpluses went for export. The Thai population tended to specialize more in selling rice and using the money for various purchases. The income was earned through expansion of cultivation areas and the export market (Ingram, 1971). However, the change toward a money economy was seen mostly in the central region, and unevenly in other regions. Feeny (1982) also stated that two important determinants of the agrarian transformation in Thailand were driven by land and labor property since King Rama V abolished slavery in 1905. There was encouragement to increase cultivation areas and export rice. After that date the agricultural sector underwent a transformation into a market economy by integrating into the world economy.

In the researcher's point of view, reformed policies and implementations of the national economic and social development plans were key factors to drive a great agrarian transformation after 1960. Timmer's agricultural transformation model was performed to explain agricultural transformation as follows.

During the 1960s to 1970s, the agricultural sectors transformed to the second stage, representing a large share in Thai economy. Agricultural production has been Thailand's main foreign income. It also facilitated the growth of industrialization by supplying low cost agricultural production and labor. In this time, the expansion of cultivation areas and the acquisition of technology (green revolution) were important factors imposing the transition; in the rubber sector that was the transition from traditional jungle rubber in the southern region to clonal mono-specific rubber plantations using high-yielding clones.

The share of farm labor had also decreased by a few percent annually during this time due to rural labor movement into the expanding industrial sector (Tre'buil, 1995). At the end of the 1980s, the agricultural sector had integrated with the macro economy. There had been a simultaneously decline in the share of the agricultural sector and a rise in the share of the industrial sector (Kaosa-ard, 1998; Paitoonpong et al., 2004). It showed that Thailand transformed from an agricultural dominated economy into an industrial based economy. It means that the agricultural sector had gone into the third stage of transformation. Trebuil (1995) stated that young labor moved significantly from the agricultural sector to new factories. Thus, there are incentives to transplant by technology and labor-intensive practices such as new varieties and harvest contractors, resulting in the reduction of production costs within the more efficient production units. Until the mid 1980s, the expansion of cultivated land was a major source of agricultural growth facing with the end of land frontiers. Increasing shortage of water and labor, and an inefficient use of pesticides have recently impeded further enhancement of productivity. Productivity growth can be accounted for by yield improvement, capital investment, and shifts to high value crops (Siamwalla, 1996).

To conclude, economic development and agrarian political economy have influenced and contributed widely in terms of theories, methodologies, and empirical studies across the agrarian world. There is a mainstream of agrarian studies in particular the approach of neoclassic economics that play an important role for explanation and exploratory agrarian change in terms of economic growth and productivity. For instance, Chinprateep (2004) showed that a dynamic general equilibrium model was used to examine the role of agriculture in the development of the Thai economy. The model implied that the transition out of agriculture raises the productivity of labor in the agriculture sector without help from public goods during three decades. The total factor productivity of agriculture started from a positive value going to a steady state in the long run (Chinprateep, 2004). Moreover, Jumpasut (1981) employed a supply-response model with a two stage variant using time series data in the period 1947-1979. The main findings of estimated equations is the long term lagged price of natural rubber seems not to influence rubber production as much as the current price and the price of the substitute crops. The results do not support the hypothesis that rubber production depends on the level of income in the previous periods. The analysis of input-output tables

indicates the rubber industries are an economically important sector, especially natural rubber is a source of foreign exchange earnings.

Then again, Soontaranurak (2011) used an economic model of the supply response of rubber farmers (output model and acreage-yield model) using time series data from 1961-2008. The study results indicate that an output supply response model appears inappropriate to explain the supply of rubber production in Thailand. The acreage response model showed the long-run relationship between the rubber areas, production and fertilizer price. This study concluded that farmers in Thailand respond to price incentives. The study found that these are the empirical research results conducted by an economic model of supply response that emphasizes key determinants driving rubber development. These results might imply instability of the model for the explanation of the rubber economy in Thailand as stated by Soontaranurak (2011). The discussion of economic models in these researches indicates that it is difficult to deal with the role of the government policy and dynamics of market forces, even in facts, there are the key determinants to explain the development of rubber.

As well as other empirical researches drawn on the agriculture sector in Thailand, mostly dealing with total factor productivity (Thaiprasert, 2006), and econometric model (Tantitemit, 2001; Vanichjakvong, 2002; Chinprateep, 2004). The researcher argued that these study results have limited ability to explain how process of change in input, output and improvement of productivity occurred, that might imply lack of explanations in process/mechanism of agricultural development and how it evolved. The results were a weak explanation and exploratory in the roles of government policies, institutions and dynamics of market forces in certain context of social and economic development.

In researcher's point of view, this study defined agrarian change as institutional change and the evolutionary process of institutions. It means that agrarian change is institutional change with an emphasis on rules, institutions and their evolutions. The analysis therefore focuses on structural transformation and the evolutionary process. This is claimed as the first perspective or new approach for the study on agrarian change. Institutional change and the evolution of institutions that structure and embed human activities were essential roots of agrarian change. This proposition can be deeply understood through institutional change and path dependence. Therefore, the study has an interest and applies to institutional economics. This is because the institutional economic approach emphasizes the importance of institutions as the unit of analysis, and is concerned with the process of structural transformation, the evolution of institutions, emergence of new institutions and institutional change, which is appropriate to get a deep understanding of agrarian change and their determinants in the rubber economy.

Thus, the study began to propound agrarian change by an institutional economic approach. With this approach, the definition of agrarian change used in this research is different from common themes and discusses to engage influential agrarian studies and the current situation of agrarian change. Our definition (see page 7) adequately provides a fundamental proposition to develop a theoretical framework of institutional economics,

account to the extensive role of institutions, and properly to apply with agrarian change. This definition is a broader one of an institution, encompassing organizations as well as social structures. There is attention to the origin of institutions that emphasizes habits and interaction between institutions, habits of thought, and human actions, and illustrates how institutions work in individual and collective actions. And the study then subscribes and expands on the statement that "Habits of thought, behavior, individual, and collective actions are governed and shaped by institutions that structure and determine social and economic development" (Hodgson, 1998b, 2004b). It is also very flexible to develop a conceptual framework of institutional economics as research objectives.

1.5.2 Institutional Economic Approach

Since the published crucial essay "Why is economics not an evolutionary science?" in 1898, Thorstein Veblen was attacked for criticism of orthodox economics and a concept of institutions and evolutionary economic approaches for heterodox economics. In 1918, Walton Hamilton used the phrase "institutional economics" for the first time at a meeting of the American Economic Association. Contemporary institutionalism can be traced through the work of Thorstein Veblen, John R. Commons, Wesley Mitchell, John Maurice Clark, and Clarence Ayres, etc. Most of them are called "American institutional economics" or "old institutional economics". Thorstien Veblen provided much of the intellectual foundation for institutionalism through his work such as the theory of the leisure class (1992), the theory of Business Enterprise (1904) and other essays. Veblen's works set the theoretical foundations of old institutional economics around the relationship between institutions, and social and economic development including an evolutionary approach and hedonistic psychology, even though it did not complete the theoretical system. Veblen's works provided the main idea and basic element of a theoretical framework for the post-Veblenian economists. In particular, Veblen argued that economics should be an "evolutionary science". Veblen emphasized the central analysis of institutions, institutional change, and the evolutionary process of institutions including the actions of state. These notions provided an important idea and have influences into this research approach.

The current debate within the old institutional economic thought is divided into two major theoretical significances. The first is associated with Veblen's system undertaken by Clarence Ayres and Geoffrey M Hodgson. This thought is built around the concept of a foundational dichotomy between the business or pecuniary and the industrial aspects of the economy. It is also expressed in a more general way as a dichotomy between institutional and technological; of doing and thinking. The approach focuses on investigating the effects of new technology on institutional schemes, and the way in which established social conventions and vested interest resist such change. Veblen attempted to develop a theory of economic and institutional evolution along essentially Darwinian lines (Hodgson, 1998a). Professor Geoffrey M Hodgson and evolutionary economists have restructured this theory set up by the initial work of Thorstein Veblen. The evolutionary economics of the Darwinian line might be much of the intellectual inspiration for institutionalism (Hodgson, 1998b).

Although Veblenian still developed to complete a theoretical system, Veblen's work generated elements of theoretical frameworks about habits, institutions, their relationship, and how institutions work on social and economic development. There are three main aspects of Veblen's themes. The first is based on an attempt to provide a specific view of humans as embodying various instincts that enable them to become active beings. The positive instincts include workmanship, idle curiosity and parenting, and the negative ones are the pecuniary, emulative and predatory traits; although they cross and fuse with each other in a complex interactive pattern. Veblen showed how human beings are under the influence of instincts that provide them with a direction and plan; the instincts are conditioned and activated through various habits of life and thought and also that are transmitted through various macro social institutions. The second aspect of Veblen's work is associated with institutions and various invidious and non-invidious elements impinging on the social economy.

Veblen (114) demonstrated views of institutions comprising social habits of thought, behavior and organizations. The "Veblen dichotomy" has been an area of active research in institutional economics. A related theme to develop is that of the 'social individual" constraint, and institutionalized patterns. Veblen originated the notion of individuals existing within a fabric of different groupings or roles associated with species, race, gender, and class. Lastly, Veblen had developed an economics of change, evolution, and instability. The evolutionary economics replaced a comparative static framework in favor of one oriented to a long-term process. Veblen provided the foundations of an evolutionary view of institutions including the application of the notions of selection, adaptation, and variation with society and individuals (O'Hara, 2002).

Following Veblenian, the researcher claimed that old institutionalism offers a perspective on the nature of human agency based on the concept of habits, the interaction between institutions and habits and the mechanism of reconstitutive causation from institutions to individuals. Habits govern repeat behavior by rules that are seen as necessary for human action. This was a dominant concept of human behavior. The concept of habit connects crucially with the analysis of institutions. This means that institutions with the mechanism of reconstitutive causation establish rules to mold and embed habits of thought on human agency. This idea has important implications for understanding economic systems in favor of the evolutionary transformation of institutions and economic change both at the microeconomic and macroeconomic levels. Moreover, the researcher believed that historical processes and a particular critical event can create new institutions, if it favored with human agents; it is set into human disposition leading to reproduce or transform. Institutions are continuously reproduced and transformed through social and economic evolution. It means that institutions are governed and shaped by human activities of production, exchange, distribution, consumption, and resource allocations that take place by human disposition. Then, the Veblenian approach was used as a central part for analysis and discussion in this research. Habits, institutions, and reconstitutive downward causations will be clarified and discussed in the next section.

The second major theoretical significance of old institutional economics has roots in the work of John R. Commons and writings by Warren Samuels and Allen Schmid. Commons' works grew out of early concerns with integrating the law and the functioning of the state into economics, collective organizations and the bargaining between collective organizations, and a drafting legislation and the operation of the court and administrative commissions. It includes law, property rights, organizations, and their evolution, and impacts on legal and economic power, economic transactions, and the distribution of income. Institutions are seen largely as the outcome of a formal and informal process of conflict resolution, the criterion of success being whether the institution has generated a "reasonable value" or "workable mutuality" out of conflict (Rutherford, 1996). Commons (1950) emphasized the development of institutions as caused by change in both the political and judicial process. Interest groups and political parties and organizations may determine the kind of institutional structure that are created in society. The market mechanism is not the sole or totally dominating institutional framework, but it is seen to be surrounded, complemented, and challenged by a host of other institutions.

In some aspects, this approach is complementary to the Veblen-Ayres approaches and runs through all old institutionalism writing as the collapsing a pillars of Veblenian institutionalism (Rutherford, 1996, 2001; Hodgson, 2003). Commons' work is highly significant and important to provide a systematic theory and concerned about making institutional economics a viable tool for policy. Rutherford (1983, 1995) stated that in Commons' the principal tasks were to analyze in more detail the way in which the structure of rules constrains economic behavior, and to deal with the mechanism involved in the selection of rules over time that is concerned with the behavior of private, collective, court, and government.

In accordance with Commons' works, the notions of collective actions and the roles of politics related with my research is useful to conduct research. The study assumed that policies and the state played important roles to drive the structural transformation in the rubber economy. Commons argued that institutional economics are the uncertainty of meaning of an institution that seems to mean a framework of laws or natural rights within which individuals act, the behavior of the inmates themselves, anything additional to or critical of classical economics. Moreover, Commons showed that institutions are collective action in control, liberation, and expansion of individual actions. Collective action ranges all the way from unorganized customs to the many organized going concerns such as the family, the corporation, the trade association, the trade union, the reserve system, and the state. The principle common to all of them is greater or less control, liberation, and expansion of individual action by collective action. Institutions are collective actions in control, liberation, and expansion of individual action (Commons, 1934). According to collective actions, Commons recognized that institutions embody collective action. Collective action controls individual action through physical, moral, or economic sanctions including constraints of individual action. Collective action may also involve the liberation or expansion of individual action. Institutions may liberate individuals from coercion, duress, or discrimination at the hands of others.

In Commons' terminology, the rules, regulations, common practices, customs, and laws that regulate the actions of individuals and concerns are the "working rules of collective action". The concept of working rules is extremely pertinent and applies within the broad social framework of custom and law, and to constitutions that determine what individuals do. By Commons approach, institutions evolve under pressure from the requirement of workability. Workability involves a degree of efficiency and a distribution of benefits and burdens that allows the system to survive, but inefficiencies and injustices may remain. Workability is an entirely pragmatic requirement; there must be a set of rights and rules, and some degree of adherence to common customs or norms.

Working rules come from two main sources. First, there are the rules that arise from the power of monarchs or other absolute rulers by conquest or subordination, or from the acts of legislative bodies. Second, there are rules that arise from customs and common practices and the decisions of common law courts in resolving disputes. How working rules constrain and effect economic behavior and economic outcomes is constrained in Commons' treatment of transactions. Commons concentrates on how working rules determine the terms upon which economic transactions take place.

More than orthodox economics, Commons' work is concerned with the transfer of rights of ownership and control between individuals and group standing in various relationships to each other. Transaction can be classified into three major types: the rationing transaction, the managerial transaction, and the bargaining transaction based on legal and functional criteria. Transactions involve the use of economic power and limits on their use. Working rules can constrain the use of power by requiring that some alternatives be avoided, or by limiting the use of power to reasonable levels. The change in law or other working rules may shift certain transactions from the rational to the bargaining type, or may restrict the range of rationing or managerial authority and provide more room for bargaining. The abolition of slavery involved the substitution of bargaining for rationing authority while the establishment of a socialist state would work in the opposite direction. The type of transaction used and the terms upon which they take place depend on a process of negotiation carried out within a context of working rules that determine legal and economic power and the limits on the use of such power. The working rules evolve and change over time. Institutional change is a process of the selection of one set of practices or rules over the other involving a process of pragmatic decision making. In Commons, the political and judicial institutions govern the process of changing other rules or institutions. Commons thought of political and judicial institutions stress under pressure from the requirement of workability. Political and judicial institutions must be workable and result in workable solutions to problems and conflicts over other institutional rules that lead to institutional change (Rutherford, 1983, 1996).

However, Commons' notion did not entirely reject neoclassic economics and his thoughts on the analysis of institutions supplements neoclassic economics (Rutherford, 1983). Commons' work was much more different by shifts in academic opinion away from instinct-habit psychology (Veblen's approach), Darwinian modes of thinking, ignorance of the

unintended outcomes of human interaction and his work emphasized legal issues rather than institutions (Hodgson, 2003). However, the study agreed that laws and regulations, working rules of collective actions, have influenced growth and constrains on outcomes of economic development, in particular the impact of the re-plantation act in Thailand. The change in laws or other working rules may change the power involved, constrained on the operation of individual actions, and shift the transactions that lead to institutional change. Indeed, the Commons' notion will apply regarding influence of the impact of power, laws, and political institutions taking place in the rubber economy.

The purpose of the following section is to explain why this study approaches institutional economics. Following institutionalism, Hodgson (1998b) argued that neoclassic economics were inadequate both in conceptual and methodological frameworks to explain the open economic system because of its erroneous ideas about equilibrium, the utility maximizing economic man, the idea of the given individual as science of choices, the rejection of politics and policies, and neglects institutions. Indeed, it emphasizes to use mathematics for analysis of rationality and equilibrium to be found in model analysis. Moreover, the scope of mainstream economics largely consists of examining the allocation of givens to attain the maximum real income. Resources are axiomatically finite and their substance generally does not entertain the economic theorist: they too are given, thus, the starting point of analysis is the abstract human individual to equip wants and capacities toward want-satisfaction. The central problem of neoclassicism is that it has adopted the analysis of the operation of the market and of the price mechanism, but it fails to provide an adequate explanation of how markets work (Samuels, 1995, 2000). Other serious mistakes of mainstream economists are concerned about policy by rejecting means of policies because the alleged policy unwittingly bolsters the theory. Then, theory and mode of doing economics focuses on a paradigm of given, abstract, model analysis, and a research protocol requiring the production of unique determinates optimal equilibrium solutions driven by mathematics (Hodgson, 1998b).

On the other hand, institutional economists emphasize the importance of institutions, habits, rules, and their evolution in social and economic development. They see economics as an evolutionary process of economic life and attempt to understand the processes of structural transformation, emergence of institutions, and institutional change (Hodgson, 2000, 2004b). Institutionalists reject individualistic assumptions of hedonism and exogenous preference in favor of a more organic conception of individual agency; they also reject an executive emphasis on equilibrium in favor of the idea of cumulative causation. And they adopt institutions as the main units of analysis rather than individuals. They also involve an extension and deeper understanding of the principle of relative rationality and scarcity Thus it is appropriate to explain dynamic and real world economy, macroeconomics, and economic growth, while mainstream economics deals only with special cases, close economic systems, and static economy. In addition, an institutional economic approach gives practical relevant theories that not only focus on institutions, the evolutionary process, innovation and change but also are open to related elements by a broad set of social, cultural, political**,** power relationship and technological change (Hodgson, 1998b, 2004b). Within this approach, the

study could conduct research with extensive use of ideas and data from other disciplines leading to explain the economic system and evolutionary process of economic growth.

In summary, institutional economics is a more general theory than mainstream economics. Furthermore, the current situation in the rubber economy involves complex and multiple constraints, and the closed models of mathematics or econometrics are inappropriate and inadequate representations of real economics with formalism in mainstream economics. Then the theoretical framework of institutional economics takes advantage of understanding the rubber economy in southern Thailand.

According to an institutional economic approach, Hamilton (1919) was the first advance of institutionalism that explained institutional economics alone could unify economic science by showing how part of the economic system related to the whole. Hamilton's description and propositions would expand that economy should be defined as an open and evolutionary economic system through the evolutionary process of institutions. The notion of individual agents is affected by institutions and cultural situations. Institutional economics are strongly intended to give relevant practical theories focusing on institutions, the process of institutional conservation, innovation, and change of institutions leading to extensive use of ideas and data from other disciplines (Hodgson, 2000). Samuels (1995) argued that institutional economics is much more important prospect of providing a useful framework for economic analysis in future. In particular, the institutionalisms focus on collective rather than individual actions, a preference for an "evolutionary" rather than mechanism approach to economy, and an emphasis on empirical observation over deductive reasoning. The characteristics of institutional economics are summarized as following:

1. Institutional economists tend to emphasize the evolutionary process through which an institution evolves and rejects the neoclassic theory of automatic adjustments mechanisms through changes in the price system.
2. Institutionalists reject the neoclassic view of a free and efficient market. They emphasize that the existence of institutions suggests collective actions on the part of individuals in the society. They also argue that the market system is itself a result of different institutions existing at a particular point in time.
3. An important point made by Institutionalism is that the state of technology is not given. Technology is a process of continuous change and this causes important institutional change. It determines the ultimate availability of physical resources.
4. Institutionalists propagate the view that resources are allocated through the various institutional structures and in particular the various power relations in the society. In fact, in many developing countries large amounts of resources are vested in the hands of the local elite and those in political office. Often there is a deliberate collusion between the local business elite and those who control state power in the process of allocation of national resources.
5. The institutionalist theory of value is not concerned with the relative price through which the values ensconced in institutions, social structure and behavior are worked out.

6. Culture and power determine the way in which an individual behaves. Individuals are bound by the society's norm and values and they behave in a collective rather than an individual way.

7. The institutionalists are more pluralistic or democratic in their orientations. The neoclassic view often accepts the given institutional structure and within this, it also takes as given power and social structure. Nevertheless, it is not concerned about inequality and other social evils that may be the result of existing institutional structures.

8. The institutional economists view the economy in a holistic way and explain economic activities in a multi-disciplinary way.

Hodgson (1998b) shed light that the core idea of institutionalism concerns institutions, habits, rules, and their evolution. Institutional economics approaches a general idea concerning human agency, institutions, and the evolutionary nature of economic process as general theories. This general idea will apply to specific ideas and theories for analyzing specific economic institutions or economic systems. The analysis consists of multiple levels and types of analysis that can be linked together with the concept of habits and institutions. It also helps to link specific research and the general theories. Institutional economics attempts to provide a broad framework in terms of a set of meta-theoretic and methodological guidelines. It also extensively uses historical and comparative empirical material, and analyzes by open interdisciplinary methods. Thus, the study could develop a specific idea of specific phenomena under a theoretical framework of institutional economics as Hodgson explained that institutionalism proposes to build specific theories under general theory of institutional economics (Hodgson, 1998b).

This means that a conceptual framework of institutional economics will be developed in order to explain institutional change and the evolution of institutions, which adequately apply to economic systems in the rubber economy, purposing to analyze agrarian change. In contrast, it is impossible to conduct this by a neoclassic economic approach because it sets a universal theoretical framework concerning rational choice and maximizing behavior, attains toward equilibrium, and moves directly to theories of price, market problems, economic welfare, and different economic studies. This means that the study could be more able to address research questions and be more useful in dealing with the structural transformation process, institutional change, and the evolutionary process of institutions including social and economic development that have much more complexity, and are less open to formal modeling.

1.5.3 Habits, Institutions, and Reconstitutive Downward Causations

This section is devoted to a precise understanding of institutions and core ideas of institutional economics. The study will discuss ideas based on the works of Thorstein Veblen, Walton Hamilton, and Geoffrey M Hodgson. Firstly, the study relied on Thorstein Veblen's work, enriched by Geoffrey M Hodgson. This proposition is a crucial element in the conceptual framework of my research. In the line of Veblen's work, Hodgson (2000, 2004b) argues that an alternative conception of human agency has developed to replace the

conception of the utility maximizing individual by mainstream economics. This thought was influenced by the writing of instinct psychologists and pragmatist philosophers including the influence of Darwinian biology. For instance, Veblen (1919) argued that "a coherent structure of propensities and habits which seeks realization and expression in an unfolding activity" and remarked that "man mentally digests the content of habits under whose guidance he acts, and appreciates the trend of these habits and propensities". Veblen saw human agency and social structure because of evolution at both biological and social levels. Behavior is the result of both inherited instinct and the cultural and material environment of the individuals leading to formation of habits, which act as the grounding of purposes and beliefs.

Veblen (1919) believed that human action at the micro level was conditioned by instincts, habits, and conscious plans. Instincts provide a source of human action, social habits guide and condition these actions, and human objectives and plans are means by which individuals can change or channel their habits into specific actions. While individual plans seek an end or objective, following instinctual attributes or conscious reasoning under the influence of habit and culture, socioeconomic evolution attains no such teleological end-in-view. With this statement, institutionalism believed that habits are the basis of human action and belief. Many habits are unconscious. Habits can be defined as a largely non-deliberative and self-actuating propensity to engage in a previously adopted pattern of behavior. It is a form of self-sustaining and non-reflective behavior in repetitive situations. The meaning of habits regarded by Veblen is that habit was of an acquired proclivity or capacity, which may, or may not, be actually expressed in current behavior (Hodgson, 1997, 2004c, 2007a). Habits are established by repeated behavior. When habits are acquired in humans, they are not used all the time. There is propensity to behave in a particular way in a particular class of situations (Hodgson, 2010). Repeat behavior is important in establishing a habit. A habit is a propensity that is molded by environmental circumstances and transmitted culturally rather than biologically. They are submerged repertoires of potential thought or behavior and triggered by an appropriate stimulus or context. They act as filters of experience and the foundations of intuition and interpretation (Hodgson, 1997, 2007b, 2010).

The formation of habit required behaviors in particular repeated behavior to establish habits of thought or action, which sometimes are triggered by innate dispositions, and often result from the propensity to imitate others in social conditions with guiding constraints (Hodgson, 2007a). Habits are vital to all thought and behavior meaning that all deliberations including rational optimization, rely on habits and rules. They help agents to deal with uncertainty, complexity and change but it requires relatively limited mental storage capacity. In that, habits are triggered by circumstance or stimuli that have a condition or rule-like structure. Then, rules have to become ingrained in habits in order to be deployed by agents (Hodgson, 2010). Rational deliberations always depend on prior habits and rules that can be to identify reason and beliefs of human action depending on habit of thought. The installing habit is the foundation of deliberation and choice that at the beginning of an explanation are consistent with the facts of human evolution (Hodgson, 2004b).

Remarkably, habits are placed on an inherited instinct but habits must be distinguished from instinct. Instincts are inherited behavioral dispositions that take the form to reflex, urges, or emotions without the need for imitation and neural learning. There were essentially simple and directed to some concrete objective end. Instincts are selected by nature and biology over thousands of years and do not reflect transitory circumstances. In contrast, habits can be suppressed or diverted. They were the means by which the pursuit of these ends could be adapted in particular circumstances. By comparison, habits are a relatively flexible means of adapting to complexity, disturbance, and unpredictable change. They are acquired through imitation and allow much learning in society (Hodgson, 1997, 2007a, 2010).

Accordingly, Hodgson (2004a, 2010) noted the relationship between human cognition and action via the Darwinian perspective that instinct is prior to habit, habit is prior to belief, and belief is prior to reason. This order has evolved in human society over millions of years. That too is the order in which they appear in the ontogenetic development of each human individual. The capacity for belief and reason develops on a foundation of acquired instinctive and habitual dispositions. With this relationship, they are arranged in a hierarchy of functional dependence, where the current operation of reason depends upon belief, belief depends upon habit, and habit depends upon instinct. Lower elements in the hierarchy do entirely determine the higher functions, but they impel them into being, where they are formed in their respective natural and social context. The lower elements are necessary but not sufficient for the higher. In this model, habits seem as the foundation of beliefs and preference. The beliefs or preferences deliberate to the actions of individuals. These relationships involving a casual mechanism can develop to enrich understanding of the interaction between individuals and institutions (Hodgson, 2005, 2006, 2010).

Even with clarification of the relation between instinct, habits, belief, and action, a problem arises. This is how to explain interplay of habits and institutions. Veblen (1919) wrote the argument, as “the wants and desires, the end and aim, the ways and the means, the amplitude and drift of the individual’s conduct are functions of an institutional variable that is of a highly complex and wholly unstable character”. Another argument is “the institutional fabrics are an outcome of the conduct of the individual members of the group” while at the same time “these institutions act to direct and define the aims and end of conduct”. Likewise, Hodgson, 2003 argued that Commons (1965) also recognized this, “institutions shaping each individual” and it clear that “the individual with whom we are dealing is the institutionalized Mind” (Commons, 1965). Thus, individual taste and preference are molded by institutional circumstance (Veblen, 1919; Commons, 1965; Hodgson, 1998b). This means that institutions are the kinds of structure that matter most in the social realm: they make up the stuff of social life. The role of institutions involves the recognition that much of human interaction and activity is structured in terms of overt or implicit rules. Institutions enable ordered thought, exceptions, and action by imposing form and consistency on human activities as constrains and enable behavior. Individual habits both reinforce, and are reinforced by institutions.

As Hodgson noted (2004a), institutions work because the rules are embedded in shared habits of thought and behavior. Habits are submerged repertories of potential thought or behavior. The acquisition of habit is the psychological mechanism that forms the basis of much rule-following behavior. For a habit to acquire the status of a rule, it has to acquire some inherent normative content, to be potentially modifiable, and to be prevalent among a group. The prevailing rule structure provides incentives and constraints for individual actions. It also helps to create habits and preference that are consistent with its reproduction. While habits are the constitutive materials of institutions, providing them with enhance durability, power, and normative authority. In turn, by reproducing shared habits of thought, institutions create strong mechanisms of conformism and normative agreement (Hodgson, 2006, 2007a).

Moreover, Hodgson (2004b) mentioned that the human capacity to form habits has evolved as a result of highly variable environmental and other conditions. Nevertheless, the relatively degree of sophisticated development of social structures has been to form different sophisticated and adaptable habits, even if it is similar environmental variations. In fact, individuals had to deal with a relative complex social structure as well as the natural environment. They evolved the capacity to create and sustain relatively complex social structures, but at the same time, they had to evolve the capacity of communication and interpretation so that each individual could cope with his or her social circumstance. Channeling behavior in this way, accordant habits are developed reinforced among the population. Habituation and sociality are linked together (Hodgson, 2010). Of course, the above criticisms of Hodgson accepted the foundational role of habits in sustaining rule-following behavior. They are acquired in a social context and not genetically transmitted. Reasons and beliefs are often the rationalization of deep-seated feelings and emotions that spring from habits laid down by repeated behavior (Hodgson, 2010). The interplay of behavior, habit, emotion, and rationalization helps to explain the normative power of custom in human society. Because habit is seen as the foundation of preference or beliefs, the interaction between individuals and institutions can be developed to enrich understanding including the casual mechanism. Emergent institutions help to pattern individual behavior. Individuals develop and reinforce habits consistent with that behavior which is revised upon beliefs and preferences.

The revised beliefs or preferences lead to further actions, which may affect institutions by the mechanism of reconstitutive interaction in two ways, from individuals to institutions called, “reconstitutive upward causation” and a crucially from institutions upon individuals call “reconstitutive downward causation” (Hodgson, 2004b, 2010).

In the line of Hodgson approach, the concept of relationships between institutions and individuals was influenced by Veblens’ work as Hodgson (2004c). A strong notion of Veblen is here described with “reconstitutive downward causation” by considering the power of institutions over individuals. Institutions shape habit of thought and enforce them on individuals as, “As soon as it has won acceptance as an authoritative standard or norm of life it will react upon the character of the members of the society which has accepted it as a norm. It will to some extent shape their habits of thought and will exercise a selective surveillance

over the development of men's aptitudes and inclinations. The effect institutions wrought partly by a coercive, educational adaptation of the habits of all individuals, partly by a selective elimination of the unified individuals and lines of descent" (Veblen, 1919). Veblen (1919) also wrote: "The situation of today shapes the institutions of tomorrow through a selective, coercive process, by acting upon men's habitual view of things". The conclusion here is to recognize the significance of reconstitutive downward causation on habit, intention, or preferences. Reconstitutive downward causation works by creating and molding habits. Habit is the crucial and hidden link in the causal chain. By affecting habits, institutions can indirectly influence our purpose and preferences. It is not directly dependent on individual decisions, but on habitual dispositions. By acting, institutions exert a downward causation without reducing an individual agency to their effects. In turn, upward causation from individuals to institutions is still possible. Hodgson (2004b, 2006, and 2010) shed light about reconstitutive downward causation that the causal power associated with social structures may not simply impede or constrain behavior, but may also affect and alter foundational properties, powers, and propensities of individuals. When, an upper hierarchical level affected components at a lower level in this manner. This is a special and stronger case of "downward causation" that may be termed as "reconstitutive downward causation". Those particular social structures bringing a reconstitutive downward causation upon individuals are termed institutions. This concept upholds that social structure can also affect the fundamental properties of the individuals. With this concept, we can understand how institutions affect individual dispositions and behavior and how social power is exercised.

Furthermore, questions need to be answered; why institutions are durable, and how institutions structure social interactions. Veblen (1919) argued that the institution was regarded as the unit of relative stability and continuity through time, ensuring that much of the pattern and variety is passed on from one period to the next. Veblen (1919) wrote: "Institutions are products of the past, are adapted to past circumstances, and are therefore never in full accord with the requirements of the present. At the same time, men's present habits of thought tend to persist indefinitely, except as circumstances enforcing a change. These institutions, which have so been handed down, these habits of thought, points of view, mental attitudes and aptitudes, or what not, are therefore themselves a conservative factor. This is the factor of social inertia, psychological inertia, and conservation". The relative stability and durability of habits and institutions made them key objects of evolutionary selection in a socio-economic sphere.

Hodgson (2004a, 2007b) stated that habits help to make up individual preferences and dispositions. When new habits are acquired or existing habits change, then their preferences also change. Generally, institutions enable ordered thought, expectation, and action by imposing form and consistency on human activities. They depend upon the thought and activities of individuals but are not reducible to them. Institutional change and constraints can cause changes in habits of thought and behavior. They constrain our behavior and develop individual habits in specific ways. Individuals acquire habits consistent with the operation of their constraints. Even when these constraints are removed, habits dispose individuals to act or think in the same old way. This even provides the reconstitutive mechanism of downward

causation from institutions to individuals. The interaction between individuals and institutions recognizes the significance of reconstitutive downward causation acting to some degree upon individual habits of thought and actions (Hodgson, 2004b).

Once habits become established, they become a potential basis for new intentions or beliefs. These transformations have habits as a key mechanism. Accordingly, how institutional structures give to rise new or change habits, the assumption of mechanisms of reconstitutive downward causation should be accepted. Institutions are social structures with the capacity for reconstitutive downward causation that will act upon ingrained habits of thought and action. Powers and constraints associated with institutional structures can encourage change in thought and behavior. In turn, upon the repeated acts, new habits of thought and behavior emerge. These changes not occur firstly upon individual behavior but it has been changed in habitual dispositions. These are associated with changed individual understandings, purposes, and preferences according to institutions, environmental change, or external shock. Hence, individual aspirations and choices are casted in institutional molds. The deliberations take place within and through social institutions. Individuals use institutions and their routines as templates in the construction of their habits, intentions, and choices (Hodgson, 1998b, 2004b, 2006, 2010).

As a result, Hodgson (2004b) concluded that institutions are social structures that have the power to mold the capacities and behaviors of individuals and society in fundamental ways by the capacity to structure, constrain, and enable individual behaviors. Of course, institutions lead to regularities of behavior, concordant habits are laid down among the population, leading to congruent purposes and beliefs. By this way, the institutions' structure is further sustained. Because institutions simultaneously depend upon the activities of individuals and constrain and mold them, through this positive feedback they have strong self-reinforcing and self-perpetuating characteristics. Accordingly, institutions are simultaneously both objective structures and subjective springs of human agency. Institutions link the ideal and the real. The concept of habit, institutions, and the interaction between institutions and individuals helps to construct and to convey between realism and subjectivism via the perspective of institutionalism (Hodgson, 2004b, 2006).

To conclude, Hodgson's notion of reconstitutive downward causation is a powerful means to understand the relationship between habits and institutions, institutions affecting individuals, and the sustaining of social structure. Even though the author has observed that this concept has limits to explain how institutions can create and how the process of institutional change orients during structural transformation of social structure.

1.5.4 Institutional Change

In this section, the attention is to discuss institutional change that will be used to construct a conceptual framework for analyzing agrarian change. The study found that several concepts and theories concerning institutional change exists. Old institutional economics was selected. The study of institutional economics is concerned with the evolution of institutions, focusing on the central problems of institutional change and the role of technology that have influenced and evolved social systems and the social process (Hodgson, 1993). Veblen (1919) argued that institutions were regarded as the unit of relative stability and continuity through time, ensuring that much of the pattern and variety is passed on from one period to the next.

In addition, Veblen (1953) wrote, "Institutions are not only themselves the result of a selective and adaptive process which shapes the prevailing or at the same time special methods of life and of human relations. So that the changing institutions in their turn make for a further selection of individuals endowed with the fittest temperament, and a further adaptation of individual temperament and habits to the changing environment through the formation of new institutions". By this statement, Chavance (2009) shed light Veblen's approach that institutions play an important role in economic life. Institutions are the sources of the change in the process of evolution in economic and social life. This sequence is unfolding and unpredictable due to nonlinearity of social evolution. This evolution may bring regression from the present state and the possibility to create a new institutional arrangement (Chavance, 2009). Following Veblen's ideas, the cumulative causation and the entrepreneur's habitual and instinctual behavior were key components toward explaining the persistence and structural change of institutions. About cumulative causation, Veblen (1919) wrote, "the economic life history of the individual is a cumulative process of adaptation of means to ends that cumulatively change as the process goes on, both the agent and his environment being at any point the outcome of the last process". The study claimed that the cumulative process would be referred to path dependence, even though this word was never stated by Veblen, in the evolutionary process of economics, explaining the institutional change. Institutional change starts with technology that can change habits and behavior in favor of a community. The statement "cumulative causation state to path dependence" and "institutional change move from technological change" are useful concepts for analyzing agrarian change (Veblen, 1919).

Other crucial ideological to institutional change inputs were contributed by Douglas C. North, David Freeny, Vernon W. Ruttan, and Yujiro Hayami. These theories also provide an analytical framework of institutional change and characterize important variables through methodological use.

Based upon a dynamic orientation of institutions, North's work is concerned with the study of economic development by broader question, such as how institutions evolve and why so many economic reforms are unsuccessful. North (1990) assumes that the "institutional rules of games" have a dominating influence on the behavior of individual

agents. The individuals are inherently opportunistic and opportunistic behavior may increase during a period of development, when costs of transacting increase due to interdependency of transacting parties, frequency of transactions, and the complexity of technology.

In explaining changes in institutions, North's central arguments rest on the individual's calculation of benefits and cost as motivating change in institutional arrangements. Like old institutional economics, North (1990) showed that the technology and transaction costs are important factors that shape and play important roles in the evolution of institutions. Innovative technology, new formal political and market institutions are required for economic development to precede and realize gains from trade. In addition, institutions are needed to enforce contracts, secure property rights, and increase access to information. They should be designed to capture more gains from trade by eliminating exchange problems that create transaction costs. The states have an influence on the ability to effectively enforce agreements because they define property rights and supply the resources used in enforcement. The lower transaction costs will result from a well defined legal framework. The introduction of new technology provides opportunities for individuals to affect institutional change. In particular, if the private benefits of a technology exceed the private costs in affecting institutional change, institutional change occurs. Therefore, motivated by the self-interests of individuals or groups of individuals, the institutional changes are largely incremental. This is because "economies of scope, complementarities, and network externalities" bias one's individual assessment of benefits and costs in a manner that reinforces the existing institutional arrangement.

Moreover, North (1990, 1997) suggested that in the long run institutional change as communities' rules of the game and individuals' standard, operating and procedures evolve with the supply of new information. Institutional changes, which arise from the acquisition of skills and knowledge, will in turn change prices, technology, and the level of information costs. To acknowledge North's approach, the path dependence of an economy or political or social culture is one cause for countries varying development patterns. By this notion, a path of relatively high productivity can develop from an existing institutional framework that provides incentives for productive activities. When such incentives result in increasing institutional returns, organizations will evolve to reward increases, and progressively drive the economy. On the other hand, if there exists an institutional framework that rewards unproductive activities, the economy will likely experience a regression or stagnation. Thus, the direction of change is determined by path dependence. The economies of scope, complementary, and network externalities of institutional matrix make institutional change overwhelmingly incremental and path dependent (Davis & North, 1971; North, 1990). North (1990) emphasized the increasing return accounting to both technological and institutional change. North's notion also emphasizes the importance of transaction costs and a point of benefit-cost on a given individual as a source of institutional change.

The study claimed that these factors have been an influence on decisions moving to institutional change in particular the power, resources endowment and legitimation explanation that have much affected this change in countries' development. Of course,

North's notion stated that in the long run economic change is the cumulative consequence of a particular decision by political and economic entrepreneurs affecting economic performance. This notion opens the way to the key analytical understanding of long run economic change through path dependence.

As postulated above, the study claimed that technology, land and labor scarcity are important factors that can change institutional structure in the rubber economy including political and constitution order. What/how do variables of institutions affected can cause change? This question was initially criticized by David Feeny (1993). There was the framework of the demand for, and supply of, institutional change based on institutional analysis that has been a simplistic and general variable related to historical and contemporary institutional change.

Feeny (1993) claimed that his work adopted institutions based on North's definition and was indirectly influenced by John R. Commons. However, the study argued that Feeny (1993) has criticized a basic framework of the demand for, and supply of, institutional change by the new institutional economics and institutional matters. Feeny (1993) stated that the demand for institutional change is derived from the perception that new arrangements will allow for the capture of gains that cannot be appropriated under existing arrangements. This means that agents will demand new arrangements when the net expected benefits to them of creating and utilizing the new arrangement are positive. The viewpoint is that of the individual or a group of individuals for whom the expected benefits exceed the anticipated cost. On the demand side, the important factors consist of relative product and factor prices, the constitutional order, technology, and size of the market. However, Ruttan (2006) argued that the demand for institutional change can be driven by the development of new forms of property rights in land and labor or resource endowments, technical change, and the growth of product demand. For instance, in Japan and Thailand, it is driven by the evolution of private property in land and labor (Feeny, 1982) while technical change and increases in population pressure have induced institutional change in the Philippines (Hayami & Kikuchi, 2000).

On the supply side, the supply of institutional change depends on the capacity and willingness of the political order to provide new arrangements. The existing set of rules of the political orders, and the existing set of institutional arrangements will have a profound effect on both the capability and the willingness of the political order to response to shifts in the demand. The factors that affect the new capacity and willingness of the political order to provide new arrangements, the cost of institutional design, the existing stock of knowledge, the expected cost of implements, the constitution order, existing institutional arrangement, the normative behavioral code, the conventional wisdom, and the expected net benefits to powerful elite decision makers who exercise positions of dominance.

Similarly, Ruttan (2006) claimed that the supply of institutional innovations necessarily involves the mobilization of substantial political resources by political entrepreneurs and innovators as well as cultural endowments. Moreover, Ruttan and Hayami

(1984) have identified the general equilibrium for induced innovation by the relationship between resources endowments, technology, cultural endowment, and institutions employed to analyze the supply and demand for technical and institutional change through a general equilibrium context. Ruttan and Hayami (1984) summarized that technology and resources endowments are relatively strong for induced innovation as well as institutions while those of them are weak to link with cultural endowments. In summary, the researcher argued that the works of Freeny (1993) and Hayami and Ruttan (1984) provide a useful concept on assumptions of institutional arrangements as results of endogenous variables, and present elements of variables of demand for, and supply of, institutional change.

Furthermore, Scott (2001) stated that evolutionary institutions can be classified on three levels. At the micro level, the establishment of institutional arrangements is observed through habits of thought, behavior, and individual actions, which can be assessed by technological use, structure of land and labor, production system, and socioeconomic conditions in each individual. In the meso level, the changes were characterized by practice patterns and reproduction of institutions at collective actions and communities. At the macro level, the societal level has been changing by new institutional structures according to policy in the past. Reactive sequences have been found to affect social changes. This study also focuses on institutional change at both micro, meso and macro level, attempting to analyze the evolutionary process of institutions in respect with path dependence.

In this study position, the study approach accepts a concept of institutions and interaction between habits and institutions with a capacity and mechanism of reconstitutive causation (the habits-based mechanism of reconstitutive downward causation). The idea can be conceptualize as the emergence of institutional arrangements with the capacity of downward reconstitutive causation. These new institutions can cause changes in habits of thought and behavior through rules involved (Hodgson, 2004a). When new habits of thought readily emerge, individuals also change in habitual dispositions that are associated with changed individual understanding, purposes, preferences, and activities. Hence, new institutions can raise new habits of thought, behavior, and activities. The new institutional structure enables new habits of thought, behaviors, and individual and collective actions. The movement of institutional settings occurs as a result of adaptation to the change of social, cultural, environmental and technological circumstances, and external shocks involved through a process of adaption and multiple-level selection that involve central evolutionism (Hodgson, 2004c, 2006; Hodgson & Knudsen, 2006).

After institutions become established, individuals can change them through reconstitutive upward causation. Institutional change is affected by the key factors such as technology, resource endowments, cultural endowments, and the growth of product demand, power and political order. There are various acting degrees of causal cumulative consequences in social and economic evolution that directly and indirectly shape outcomes in the pathway of economic development. Thus, this study can explain institutional change and causal factors of institutional change.

1.5.5 Path Dependence

In this section, the attention is focused on describing the concepts of path dependence and how path dependence orientates institutional change. The study claims that path dependence is a suitable tool for the analysis of institutional change and the evolutionary process of institutions. Path dependence also adequately applies for approaching historical analysis and institutional changes. As Veblen wrote "the economic life history of the individual is a cumulative process of adaptation of means to ends that cumulatively change as the process goes on, both the agent and his environment being at any point the outcome of the last process" (Veblen, 1919:74-75). The study regarded the idea of cumulative causation as path dependence. The path dependent concept and analytical framework as proposed by Mahoney (2000, 2001) have been employed in this study.

Since Paul David elaborated on path dependence in 1985, it has become an increasingly popular concept used by institutionalism in economics and other social sciences (Ebbinghaus, 2005). As Antonelli (2006) stated, the notion of path dependence provides one of the most articulate and comprehensive frameworks to move towards the analysis of the conditions that is possible for an economic system to generate and exploit endogenous growth. Path dependence is an essential tool to move from the analysis of static efficiency and enter into the analysis of the condition for dynamic efficiency. It also provides a unique and fertile analytical framework able to explain and assess the ever-changing outcomes of the combination and interplay between factors of continuity and discontinuity, growth and development, hysteresis and creativity, routines and "free will" that characterize economic action in a dynamic perspective, which is able to appreciate the role of historic time (Antonelli, 2006). Mahoney (2000) stated that many crucial social phenomena can be adequately explained in terms of path dependence in particular the field of economic historians and historical sociology using it as a tool of analysis. The notion of path dependency was applied in the study of institutional change by Ebbinghaus (2005).

The key idea of path dependence is historical sequences in which a contingent point sets into motion institutional patterns or event chains that have deterministic properties (Mahoney, 2001). The concept of path dependence has three defining features. First, path dependence analysis involves the study of casual processes that are highly sensitive to events that take place in the early stage of an overall historical sequence. Second, the early historical events are contingent occurrences that cannot be explained based on prior events or initial conditions in the sequence of path dependence. Third, once contingent historical events take place, path dependent sequences are marked by relatively deterministic causal patterns or what can be thought of as "inertia", this processes tends to stay in motion and continues to track this outcome. The nature of this inertia will vary depending on the type of sequence analyzed. With self-reinforcing sequences, inertia involves mechanisms that reproduce a particular institutional pattern overtime. With reactive sequences, inertia involves reaction and counter reaction mechanisms that give an event chain an "inherent logic" in which one event naturally leads to another event (Mahoney, 2000). Mahoney (2000, 2001) emphasizes the majority of comparative-historical study as the evolutionary process of events from the

past to present that are influenced by history matter. Choices made based on transitory conditions can persist long after those conditions change. The framework of path dependence distinguishes two dominant types of sequences: 1) self-reinforcing sequences and 2) reactive sequences.

Self-reinforcement

A self-reinforcing sequence is characterized by the formation and long-term reproduction of a given institution arrangement. A self-reinforcing sequence are initial steps in a particular direction inducing movement in the same direction, so that it becomes difficult or impossible to reverse the direction. In these sequences, critical junctures determine period of institutional genesis. Critical juncture is characterized by the adoption of institutional arrangements from available options. When an option is selected, it becomes progressively more difficult to return to the initial point when multiple alternatives were still available leading to critical junctures. They are often assessed through counterfactual analysis in which investigators imagine an alternative option had been selected and attempt to rerun history. Here, the critical junctures have two attributions: the first critical junctures are choice points when a particular option is adopted from among two or more alternatives, and one alternative is selected, it become progressively more difficult to return to the initial point. In doing so, not all-choices represent critical junctures; only those choice points that choice of important future outcomes should be treated as critical junctures. The options available during critical junctures are typically rooted in prior events and processes. The degree of antecedent conditions determining actor choices during critical junctures can vary, ranging from choice characterized by a high degree of individual discretion to choices that are more deeply embedded in earlier occurrence. Critical junctures are often moments characterized by contingency in which unforeseen events may have an important impact. Thus, analysts must focus on small events, human agency, or historical peculiarities that lie outside of available theoretical framework.

The analyses focus attention on those key choice points that mark points in history when the range of possible outcomes are substantially narrowed. In counter factual analysis, counterfactual thought experiments can illustrate the importance of a critical juncture by showing that the selection of an alternative option would have led to a dramatically different final outcome. The study must consider a counterfactual antecedent that was actually available during a critical juncture period, and that should have been adopted. In a path of dependence pattern, the selection processes during a critical juncture period are marked by contingency. Contingents refer to the inability of theory to predict or explain, deterministically or probabilistically, the occurrence of specific outcomes. A contingent event is an occurrence that was not expected to take place, thus it gives theoretical understanding of how casual processes work. It is a type of non-systematic variation inherent in the world that cannot be eliminated from causal theories. This means that the initial adoption of selected options during the critical juncture period is therefore a contingent event. In doing research, the analyses must consider an event to be contingent when its explanation appears to fall outside of existing scientific theory. Inasmuch as, there may treat as small events that are too

specific to be accommodated by prevailing social theories and random processes such as natural disasters or sudden market fluctuations.

Returning to analysis of self-reinforcing sequences, after institutional genesis are marked by critical juncture and contingency that selected initial processes or institutional options, which brings about the institutions in the first place, institutions persist by the causes of institutional reproduction. Institutional reproduction is explained by mechanisms derived from predominant theories. The mechanisms of reproduction may be causally efficacious in that they lock-in a given institutional pattern, making it extremely difficult to abolish.

Institutions that rapidly and decisively trigger mechanisms of reproduction are especially capable of seizing opportunities provided by contingent events and thus setting into motion self-reinforcing sequences that are path-dependent. Efficacious mechanisms of reproduction enable an institution to take advantage quickly of contingent events that work in its favor. In institutions that more gradually trigger mechanisms of reproduction, a contingent event may initially favor the institutions, but the institutions will not prevail in the long run over superior alternatives because mechanisms of reproduction are not activated quickly or powerfully enough to capitalize on the early advantage. The combination of contingent with subsequent determinisms via mechanisms of reproduction leads to a central paradox characterizing the outcomes of self-reinforcing. The dominant theoretical framework used to analyze institutional reproduction in sociology can be categorized in terms of utilitarian, functional, power, and legitimation explanations (Mahoney, 2000).

1) Utilitarian explanations: individuals rationally choose to reproduce institutions because of any potential benefits of transformation overweight the cost. As David Feeny notes, individuals will demand new arrangements when the net expected benefits to them of creating and utilizing the new arrangement are positive (Feeny, 1993). This framework was popularly explained in terms of increasing return or to be found inefficient which has been mostly applied by economists. New institutions may work to lock-in prevailing institutional arrangements that are less optimal than previous institutions. Institutional change occurs when it is no longer in the self-interest of actors to reproduce a given institution. Institutions may be inefficient rather than previous alternatives. In the logic of the market, utilitarian theorists often emphasize how increased competitive pressures can lead to institutional transformation. They may also emphasize a learning process that helps rational actors anticipate negative consequences in the future and encourage them to absorb short term costs and make a change in the present. This learning process may be facilitated by a “change agent”. Change agents may help individuals develop a clearer notion of incentive structures as they evolve over time. It means that agents learn to alter the existing institutional arrangement for capturing gains or shift the income distribution (Feeny, 1993). They may help individuals overcome familiar problems of collective action that prevent institutional transformation. However, from the social perspective, it is difficult to evaluate the cost and benefits of alternative institutional outcomes by actors for long run cost-benefits so that utilitarian mechanisms will be enduring outside of the market place.

2) Functional explanation: there have functional of a self-reinforcing process by strong and weak versions. In the weak version, the reproduction of an institution can be explained in terms of its consequences, and compatibility with a wide range of theoretical orientations. In the strong version, institutional reproduction is explained by its functional consequences within choosing institutions. The consequences of institutions for an overall system are also understood to be the cause of reproduction of those institutions. The system functionality may explain the reproduction of an institution once it is created, but it does not also account for the origins of the institutions. This means that the institution is reproduced because it serves a function for an overall system. As a result, it causes the expansion of the institution, enhances the ability of institutions, and leads to institutional consolidation. However, the institution that is adopted may be less functional in the long-run than alternative institutions that could have been developed. Exogenous shock may transform and cause change within system needs.

3) Power explanation: institutions can persist even when most individuals or groups prefer to change it, providing that an elite that benefits from the existing arrangement has sufficient strength to promote its production. This means that an institution is reproduced because it is supported by an elite group of actors. This includes the capability and willingness of the political and constitution order to provide new institutional arrangements (Feeny, 1993). However, these actors make decisions by weighing cost and benefits. The actors with different endowments of resources will typically have conflicting interests vis-a-vis institutional reproductions. To employ a power framework, the genesis of institutions is not a predicable outgrowth of pre-existing power arrangements. When an institution reproduces, it is reinforced through predictable power dynamics. The institution initially empowers a certain group at the expense of other groups the advantaged group uses its additional power to expand the institutions further, the expansion of the institution increases the power of the advantage group, and the advantaged group encourages additional institutional expansion. The empowerment can take place even though the subordinate group favors the adoption of a different institution. Hence, institutions may empower an elite group that was previously a subordinate group. The weakening of elites and strengthening of subordinate groups have encouraged institutional change. In this perspective, institutional reproduction is a conflicting process in which significant groups are disadvantaged by institutional persistence. The presence of conflicts means that a dynamic of potential change is built into institutions, even as a dynamic of self-reinforcement also characterizes institutions. The institutional reproduction by power base may reproduce themselves until they reach a critical threshold point, after which time self-reinforcement gives way to the inherently conflicting aspect of the institutions and eventually to institutional change.

4) Legitimation explanation: institutional reproduction is grounded in actors' subjective orientations and beliefs about what is appropriate or morally correct. Institutional reproduction occurs because actors view institutions as legitimate and thus voluntarily for its reproduction. The decision of actors to reproduce institutions derives from their self understanding about "what is that right thing to do" rather than other aspects. There are habits of thought that make up individual preference and disposition (Hodgson, 2007b). Institutions

will be reinforced through a process of increasing legitimation, if previously available institutions would have been more legitimate. Increasing legitimization processes are marked by a positive feedback cycle in which an initial future decision about what may be the appropriate or right thing to do. As a result, a familiar cycle of self-reinforcement occurs; the institution that is initially favored sets a standard for legitimacy. This institution reproduces because it is seen as legitimate and the reproduction of the institution reinforces its legitimacy. Even though, institution may be less consistent with values of actors than previously available alternatives. Institutional transformation results from changes in actors' subjective beliefs and preferences and not changes in other ones (Mahoney, 2001). However, a legitimation explanation should be expanded to cognitive dimensions of institutionalization that may reinforce the persistence of institutions through internalization and socialization called "sociological institutionalism" (Ebbinghaus, 2005).

Four explanations of self-reinforcement could be crucially used to analyze institutional reproduction and institutional change rather than the economic perspective of increasing return as per North's work. The study should examine their mechanism and outcomes that allow institutional change and alternative mechanisms which may mark in different ways of institutional patterns. To analyze agrarian change, the deterministic pattern of self-reinforcing sequences should identify three featured conditions. The first should be the initial condition during the early stage of the process through alternative choices for selection. The second should be the self-reinforcing processes and exploration of the four explanations of institutional reproduction. Finally, the consequence of self-reinforcing sequence will stabilize in a common phenomena called "institutional lock-in". The study should analyze how institutions go towards stabilization as a lock-in stage, and how institutions would switch to alternatives. In summary, the contingent period corresponds with the initial adoption of a particular institutional arrangement, while the deterministic pattern corresponds with the stable reproduction of the selected institution over time (Mahoney, 2001).

Reactive sequences

Reactive sequences are chains of temporally ordered and causally connected events, both a reaction to antecedent events and a cause of subsequent events. Early events in the sequence are important to final outcomes because a small change in one of these events can accumulate over time and by the end of the sequence make a great deal of difference. Reactive sequences are marked by a backlash process that transforms and perhaps reverses early sequence events. Early events trigger subsequent development by setting in motion a chain of tightly linked reactions and counter-reactions. The final event in the sequence is typically the outcome under investigation, and the overall chain of events can be seen as a path leading up to this outcome. For a reactive sequence to follow a specific path dependent trajectory, the historical event that sets the chain into motion must have properties of contingency (Mahoney, 2000). With reactive sequences, the initial events that set into motion the overall chain of reaction is contingent. This event appears as a "breakpoint" that could not have been anticipated or predicted. The contingent initial events that trigger a reactive causal chain are often the intersection point of two or more prior sequences. These interactions

express “conjuncture” or temporal intersection of separately determined sequences. The point in time at which two independent sequences interact will often not be predictable. Hence, conjunctures are often treated as contingent occurrences. This is true even though each of the sequences that collide to make a conjuncture may themselves follow a highly predictable causal pattern.

In doing research, even knowing of the contingent breakpoint that launches a reactive sequence, it may be difficult predicting or explaining the final outcomes of the sequence. The central object of analysis is to identify a set of sequences and conjunctures, which can be analyzed by a scene by scene description of the particular causal links in the overall chain or the step-by-step approach for exploring specific causal links in the overall chain. By conjunction and counterfactual analysis, the study can identify key choice points in a reactive sequence, marked by the presence of alternative possible paths. These choice points make it easy to explore suppressed historical alternatives and hypothetical paths not taken that could have occurred if particular events in the reactive sequence had been different. The events that make up a reactive sequence are connected by tight causal linkage, called “inherent sequentiality”. This inherent sequentiality is marked by three features.

First, the reactive sequences are often necessary or are sufficient conditions for subsequent events. Causal determinism is sometimes defined by the use of necessary and sufficient conditions, underscoring the deterministic side of reactive sequences. Second, inherent sequentiality permits a fine-grained analysis of the ‘causal mechanisms” that link conditions with final outcomes. Causal mechanisms are the sequence process through which one variable exerts a causal effect on another variable. Each intermediary event represents a causal mechanism that links an initial breaking point with a final outcome. At the same time, causal mechanism connects all temporally consecutive events in the sequence.

The study identifies these mechanisms through the existence of self-reinforcement theories, including utilitarian, functional, power and legitimation frameworks. The final component of inherent sequentiality is a clear temporal ordering among events in a sequence. The establishment of the time order of variables can be done through narrative analysis, which portrays social phenomena as ‘stories” that unfold in a clear chronological order. The chronological ordering of events in narrative is a key reason why reactive sequence appears to follow an inherent logic in which one event naturally leads to another. Indeed, if the events in a reactive sequence cannot be clearly arranged in a precise chronological order, the notion that one event logically follows from another is considerable harder to sustain. The analysis of reactive sequences should be examined for which early contingent events produce a trajectory of change that have a cumulative outcome. The analysis emphasizes exploring contingent events and traces unusual occurrences. The contingent period corresponds with a key breakpoint in history, while the deterministic pattern depends on a series of reactions that logically follow from this breakpoint (Mahoney, 2000).

In summary, path dependence demonstrates that self-reinforcing sequences and reactive sequences explain social and economic change in terms of the evolutionary process

of institutions, emergence of institutions, institutional reproduction, and institutional change. By this approach, the analytical component of path dependence as proposed by Marhoney (2001) was performed in this study. The five analytical components are initial conditions, critical juncture, structural persistence or self-reinforcing sequences, reactive sequence, and outcomes (Mahoney, 2001). These analyses propose to examine how actor choices create institutions at critical moments, how these institutions govern and shape subsequent actor behaviors, and how actors have responded to new institutional arrangements through the outcome of institutional change (Mahoney, 2001).

1.5.6 Methodological Individualism, Holism, and Methodological Institutionalism

In this section, the attention is to discuss methodologies of institutional economics. This study focuses on historical sequences of events, economic performance, and path dependence. These must combine methodological individualism and methodological institutionalism. The proposition that these combination methods will involve a critique of some descriptions should be analyzed as a given individual, some collective phenomena should be explained in terms of holism, and institutional structure should be explained in terms of institutionalism. This means that the analysis entirely emphasizes phenomena from individuals to institutions, and institutions to individuals, which will be taken in social structures.

Petrovic and Stefanovic (2009) stated that the methodology of institutional economics is significantly different from the composition method of mainstream economics based on individualism with mathematic drive. Methodological orientation of institutionalism is much more broadly founded and incorporates insights of holistic, system, and evolutionary epistemological approaches. Old institutional economics is strongly dependent on a descriptive or inductive method. Commitment to practical questions imposes strong reliance on empirical material and detailed descriptions of existing institutional forms.

Methodological individualism and holism must be well balanced and combined within an evolutionary view of institutional dynamics in order to significantly contribute to establishing a realistic approach to economic phenomena. Stanfield (1999) mentioned that methods of evolutionary positivism or radical positivism should commence analysis with the critical historical and comparative method. The analysis tends to rely more upon examination of qualitative empirical information of a historical and cultural nature and upon a descriptive method. Institutionalism relies upon the execution of case studies or field studies, which are specific regarding activities, rules, and the applicable understandings or cultural underpinnings that comprise human behavior unfolding in an institutional context like ethnographic record. Generally, methods of participant observation combined with a critical historical method is a key element in the makeup of institutional economics.

The critical historical method commences analysis with a notation of the significant facts-to-be-explained, in order to examine alternative explanations for these facts, to select or

offer an alternative that corresponds more closely to these facts, and to draw implications for thought and action from these explanations. This method has been called “evolutionary positivism or radical positivism” (Stanfield, 1999). When these statements refer to the methodology of institutionalism, there are qualitative methodology associated with a combination of individualism and holism. Historical and comparative methods will be selected to be compatible with this approach.

According to Hodgson, methodological individualism emphasizes the fact that individuals in the analysis of socio-economic phenomena become prominent with the meaning that in the description of economic phenomena one starts from the action of individuals. The social structures, institutions, and other collective phenomena must be explained through the situations, disposition, and presupposition of individuals involved, corresponding with its definition “one starts from the individual in order to describe certain economic relationships” (Hodgson, 2007c). Many critical studies have confirmed that methodological individualism necessarily incorporates references to social relations. Indeed, methodological individualists propose that social structure, institutions, and other collective phenomena should be explained in terms of individuals involved. By this meaning, the precise definition of this term, leads to the confusion in meaning of individuals. Hodgson (2007c) also argued that methodological individualism fails to specify the doctrine, and is unattainable in practice, in particular applying social science, because methodological individualism requires that social phenomena is fully explained in terms of individuals alone or explained in terms of individuals plus other critical factors such as interactions between individuals.

Conversely, methodological collectivism also known as methodological holism, has similarly to be rejected because explanations entirely in terms of structures, cultures, or institutions are inadequate, when this method removes individual agency and overlooks the diverse characteristics among individuals. This means that both methodologies have problems between conflating individuals and social structure (or interaction between individuals). The problem is that the explanation of individual agency seems to be conflated entirely upon social structure without recognition of individual diversity and cultural variation. The explanation of methodological collectivisms conflates the individual upon society and thereby lacks an explanation or adequate recognition of how individual purposes or preferences may change. In particular, it provides no adequate explanation of how social institutions may reconstitute individual purposes and preferences. Despite the debate on both methodologies, they have much more in common in social research than are typically admitted (Hodgson, 2004b).

In conclusion, Hodgson also shed light that “Social phenomena should be explained in terms of individual and social structure”. This meaning would be described by “methodological institutionalism” (Hodgson, 2004b, 2007c). In the line of institutionalism, institutionalist research must actually start from individuals and social structures or institutions. Institutionalism emphasizes institutions and social structure rather than individuals. This perspective typically defines social structures as interactions between

individuals including a social position that is a specific social relationship with other individuals. The existence of social position implies the existence of institutions with rules associated with that position. However, Udéhn (2001, 2002) claimed that methodological individualism can be distinguished into two types: strong and weak versions. The strong version of methodological individualism suggests that all social phenomena should be explained only in terms of individuals and their interactions. While the weak version also assigns an important role to social institutions and/or social structure in social science explanations. This means that methodological individualism can be explained in terms of individual interactions between individual and social institutions.

Consequently, this study claimed that methodology for institutionalism should consider the matter of fact or reality in field surveys and historical analysis. In parallel, the analyses should be conducted from individuals for analyzing individuals and linking to social phenomena, in turn, methodological institutionalism should analyze social structure and relationships between institutions and individuals. This study combined the observation of individuals with methodological individualism and the observation of institutions with methodological institutionalism.

1.6 A Conceptual Framework of the Study

The study approaches old institutional economics. This study believes that old institutional economics has an adequate theoretical and methodological framework for analyzing agrarian change and the evolution of the rubber economy in southern Thailand. The study proved the postulate hypotheses by five methodological positions: constructionism, institutionalism, evolutionism, hypothetical deductive, and systemic approach. Three theoretical concepts are selected: agrarian change, institutional change, and path dependence according to hypotheses tests. This study combined qualitative methodology and quantitative methodology. Three main data sources come from a survey study through individual interviews, in-depth interviews and documentary analysis.

This study focuses on the agrarian change that is going on, its determinants, and on the evolutions of land and labor in the rubber economy in southern Thailand. Agrarian change is employed to denote institutional change and the evolution of institutions that structure and embed to order habits of thought, behavior, and individual and collective actions in an agrarian society. A conceptual framework of the study build is based on the approach of institutional economics in which institutional change plays a central part to explain and analyze agrarian change. Institutional change illustrated by the changes in land, labor relationships, and the market and relevant factors in the rubber economy. Land and labor evolved individually, and they also combined affecting agrarian change. The study also includes a discussion of the roles of government and the market on path dependence of the rubber economy.

Figure 1-2 illustrates a conceptual framework of the study, comprising of nine elements: the importance of research, the development question, the research questions,

hypotheses, methodological positions, the institutional economics approach, theoretical concepts, the use of these concepts, and analysis and outcomes. Five methodological positions are used in this study: constructionism, institutionalism, evolutionism, hypothetical deductive method, and systemic approach. Constructionism relates to the study with the nature of reality or assumptions about what is real and how it should be studied. Constructionism is concerned with how human interaction helps to create social reality emphasizing that knowledge is subjective, situational, cultural, and ideological. It also emphasizes the following questions: how is reality constructed socially? How do situational and cultural variations shape reality? And what are the ideological and practical consequences of writing and research? (Marvasti, 2004). Methodological institutionalisms in this research emphasize individuals, social structures, and the interactive relationship between individuals and social structure. This study also touches on evolutionism to explain social reality and the world in which we live as social evolution addressing cumulative causal sequences and causal mechanism of institutional evolution (Hodgson, 2004b, 2006).

Hypothetical deductive methods are used for testing hypotheses by identifying the hypothesis to be tested, generating predictions from the hypothesis, conducting research to check these predictions, and testing to validate or reject these hypotheses. If a hypothesis is rejected, we return to the original conceptualization of the problem to propose new hypotheses and to explain why the findings did not support the original expectations (Marvasti, 2004).

This research is based on a systemic approach that is complementary with those of analysis. This study employed a systematic approach as a series of steps in study methods. There is a specific research process to conduct this research. A series of steps are used in this method research. The initial step is the observing of social phenomena, insight institutionalism that could identify the need to resolve the problems. The second step is to precisely identify the problem and to formulate hypotheses based on observed phenomena. The third step is to develop and apply study methods for the solution of the problem and testing hypotheses. In the fourth step, results are subjected to further analyses, tests, and explanation in the social phenomena. In the last step, results are concluded based on data and integrated these conclusions with the existing body of knowledge or to suggest the solution for the future (Singh, 2006).

With these methodological positions, the study approaches institutional economics for theoretical framework and conduct of the study. An institutional economics approach provides an adequate theoretical and methodological framework as Hodgson noted. Hodgson (1998b) stated that the core ideas of institutionalism concerned institutions, habits, rules, and their evolution. Institutional economics approaches the analysis of macroeconomic systems by examining patterns and regularities of human behavior, institutions, and the evolutionary nature of economic processes toward understanding, explanation, exploration, and analysis a great deal of institutional reproduction, formation of institutions, institutional change, cumulative causation, and outcomes. With this approach, the research must develop a

conceptual framework of institutional economics for analyzing agrarian change. This conceptual framework was then be applied to the rubber economy in the southern region.

Three theoretical concepts are selected: agrarian change, institutional change, and path dependence. They were used to test specific and main hypotheses. First, the concept of agrarian change was employed for analyzing the development path of agrarian systems and evolution of land and labor in the rubber economy. It can be considered that land and labor have individual evolution and co-evolution, which have affected agrarian change in terms of reinforcement or constrains. Second, institutional change is proposed to analyze institutional formation, reproduction, arrangements, and cumulative causation of institutions. The analyses also focuses on the structure of institutions embedded land and labor that allows this study to analyze institutional change and their impacts on individuals, collective actions, and economic performance.

Finally, the study approaches the concept of path dependence for analyzing the path dependence of the rubber economy. Path dependent theory proposed by the notion of Mahoney (2000, 2001) was selected. The analytical components of path dependence are: antecedent conditions, critical juncture, structural persistence, reactive sequences, and outcomes. There is an explanation of the analytical structure of path dependence. In this study, the analysis concerns key determinants: policy, market forces, and their interaction to drive agrarian change. In a path dependent explanation, the study starts with the identification of policies and historical sequences of events in the rubber economy since the introduction of rubber to 2012, and then analyzes policy structure, implementation, outcomes, and the period of changes as Annex A shows. Analytical components of path dependence are considerably employed. The analysis examines how policy makers choose policy options, what/how contingent events shape the availability of policy options, how these selected policies shape subsequent events and reactions, and how these farmers and collective actions respond and outcomes. The study claims that the outcomes of path dependence are institutional lock-in in the current situation in the rubber economy in Thailand.

Next, the study analyzed the rubber market and the role of market forces to shape policy and agrarian change and in turn their response in Thailand. The study explores the rubber markets, historical marketing sequences, and their changes emphasizing market structure, market rules, new technology, international interventions, structural change, and price since the introduction of plantation rubber in the early 1900. Regarding the complexity and dynamics of the rubber market, the study begins with an identification of historical sequences of events, consequences, trigger of events, reactive sequences in the world rubber market, and prices as shown in Annex B. Subsequently analytical components of path dependence are also employed to analyze market forces and market institutions. Path dependent explanation of market forces focuses on how market rules and structure of market shaping policy and the government intervention at critical moments, how market forces shape subsequence events and actor behaviors, and how these actors respond to market forces. The analysis emphasizes the roles of market rules and price to constitute structure of policies,

policy decisions, farmers' behaviors, and collective actions including their response to those of impacts.

With a conceptual framework (Figure 1-2), the analysis begin to identify and assess typology of farm trajectory. The study also deeply analyzes patterns of farm changes, the process of farm changes and determinants including institutions shaped in each farm trajectory. The results would have to analyze outcomes of farm trajectories and the occurrences of agrarian change during the period of study as detailed in Chapter 2. Next, the analysis aims to look at share-tapping arrangements focusing on the evolution of labor contracts, labor use, and conceptual framework of share-tapping and economic performances. The analysis also deeply examines determinants and the rules governing share-tapping arrangements that shed light on a set of rules for explaining share-tapping arrangements. Further, the analysis focuses on relations between types of farm trajectories and share-tapping that allow this study to analyze how share-tapping, availability of labor, and the use of hired labor is influencing farm trajectories.

The results analyze institutional lock-in of share-tapping in the rubber economy as detailed in Chapter 3. In order to deeply understand institutional lock-in in respect to farm trajectories and share-tapping, Chapter 4 presents a path dependent explanation emphasizing policies, the government interventions, and market forces, and therefore analyzes both tracing outcomes of farm trajectories and share-tapping. It also helps to analyze how institutions and reactive sequences governing farm trajectories in overall historical sequences including the path developments in the rubber economy. These results use for testing the hypotheses and revising hypotheses. A conceptual framework conveys our research position relying on institutional economics. It also elaborates on the elements of analytical framework, statistical analysis and conducts of study.

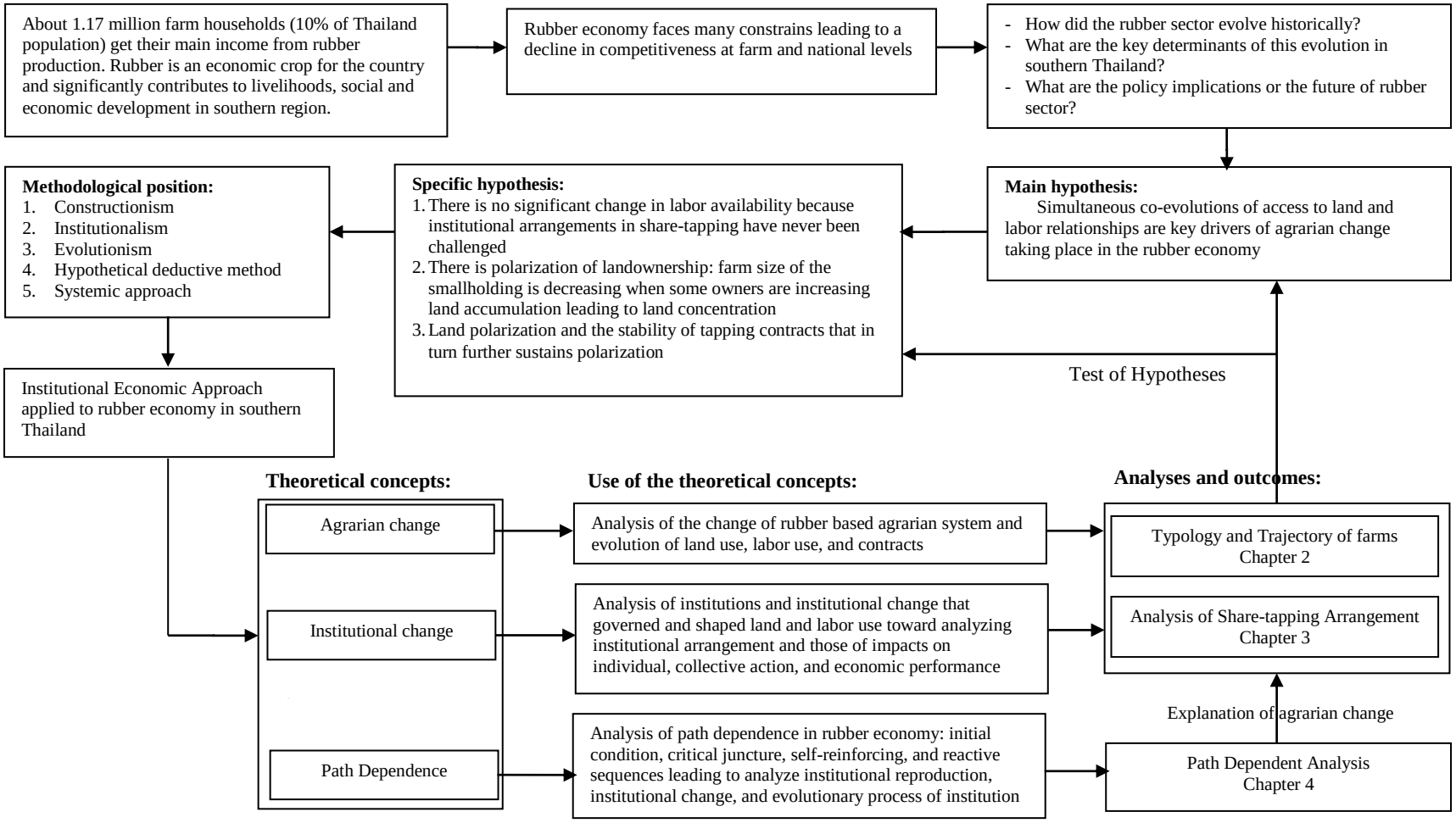

Figure 1-2 The conceptual framework of the study

1.7 Analytical Framework of the Study

Figure 1-3 illustrates the analytical framework of the study consisting of information needs, related data, data sources and data collection methods, data acquisition tools, data collections, data management, and data analysis methods. The study starts with three specific hypotheses that should be tested for answering study questions. Hypotheses can identify the information needed and the related data for testing and evaluating these hypotheses. Information need and the related data come from two main sources: primary data and secondary data. Secondary data is used to obtain documentary and historical analysis of which place or co-evaluate with the primary data. There are categorized data or statistic data and relevant studies. These secondary data come from reviewing various sources in local, national, and international literatures. Secondary data should have the important characteristics of reliability, suitability, and adequacy for document analysis. Primary data are household surveys regarding preliminary interviews, individual interviews and in-depth interviews by conducting through structured and semi-structured questionnaires. Both questionnaires should have validity and reliability by heuristic evaluation. The questionnaires should be pre-tested before finalization for field surveys. The sites of purposive selection for field surveys are within the traditional rubber plantation areas across the southern region in which there is a rubber based agrarian economy. Household surveys were carried out on a purposive sample in selected areas using structured questionnaires including interviewing purposive key informants with a semi-structured questionnaire.

Both secondary data and primary data should have editing, categorizing, coding, and indexing before entering into Microsoft Office Access, Word, and Excel for storing data with a thematic data based framework. This includes editing and coding into SPSS (Statistical Package for the Social Sciences). In this step, the validity and reliability of the data are necessary to ensure significant results and reflecting farm households through key informants and farm discussion. Sorting and synthesizing the data was data reduction and the process of refining data for analysis. Data analysis combines qualitative analysis and quantitative analysis. The mixed methods provided a strong framework for understanding, analyzing, and explanations. They can utilize or strengthen both methods and also help to reduce some of the problems associated by the use of a single method. The qualitative analysis relies on descriptive statistics, narrative analysis, and path dependent analysis while economic performance is assessed. The dissemination and interpretation are important for proving fact-finding and to accept or reject hypotheses through international conferences or published academic journals that provide a critical analysis and synthesis for the writing up of this thesis.

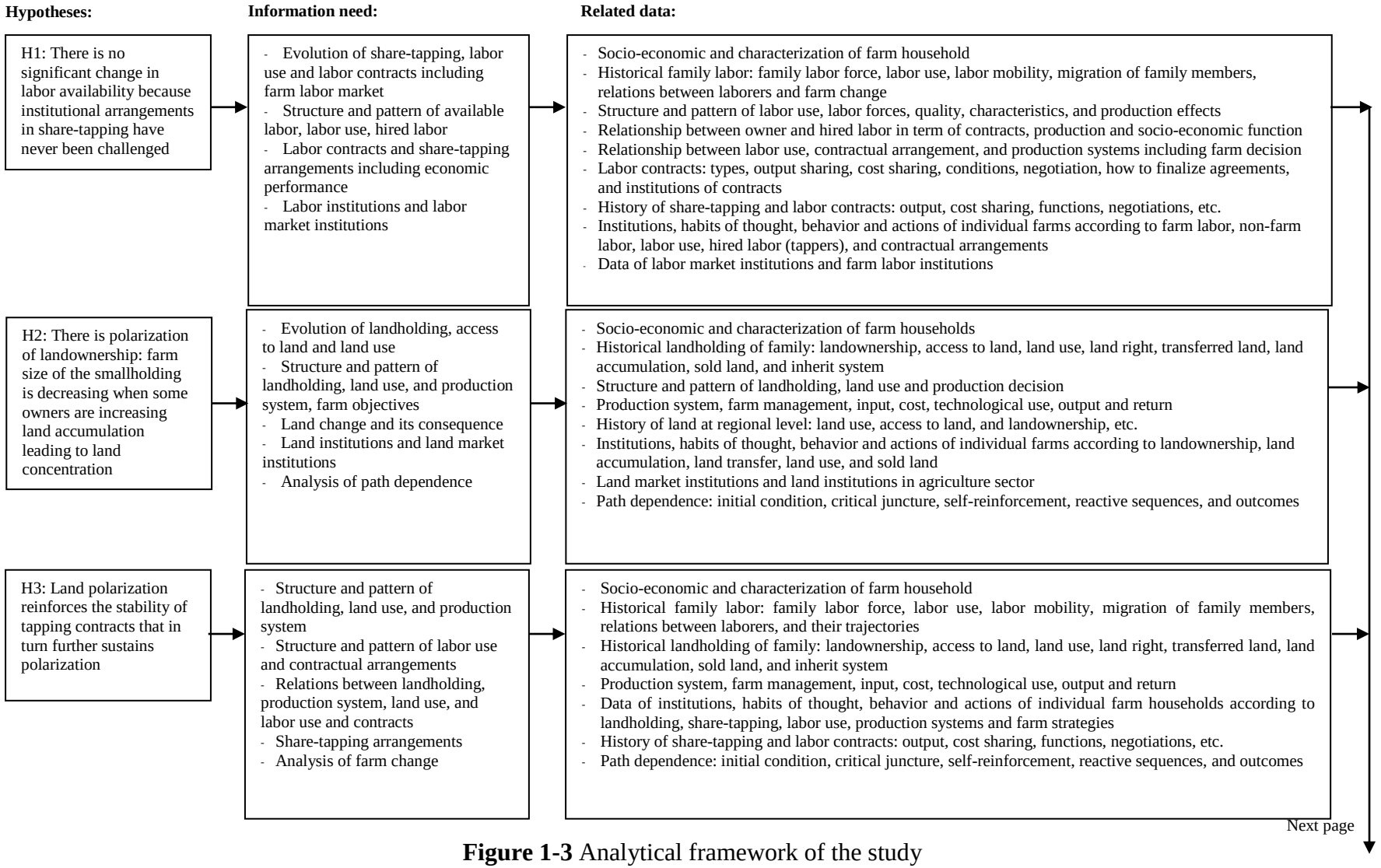

Figure 1-3 Analytical framework of the study

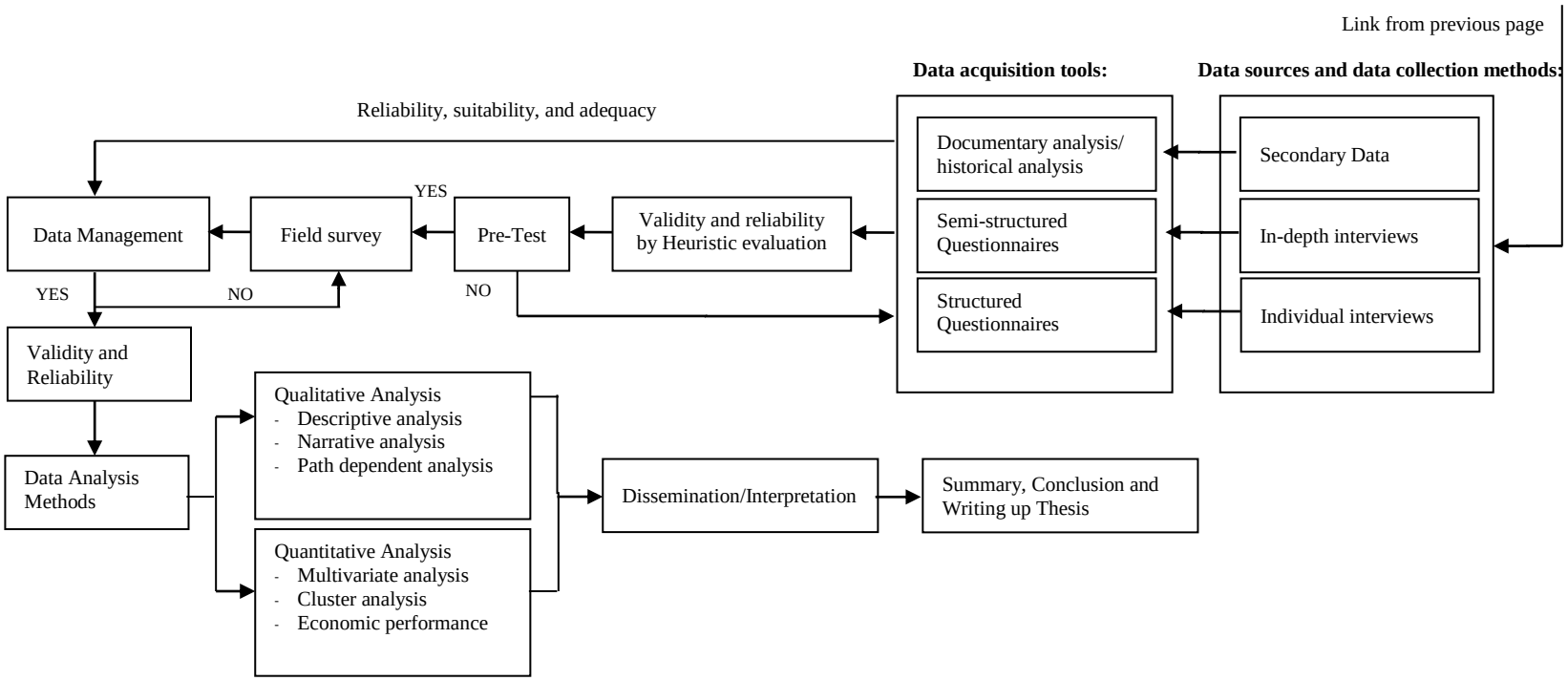

Figure 1-3 Analytical framework of the study (cont.)

1.8 Research Design and Methods

In this study, the field work was conducted in 2011 and 2012. The first was conducted in 2011 using a household survey and in-depth interviews with key informants. The data collections aimed to analyze and assessed farm trajectories and share-tapping arrangements. The second field work was conducted in 2012, using in-depth interviews with representative samples of each farm trajectories and share-tapping as following.

1.8.1 The fieldwork in 2011

1) Selection of the study areas

The southern region in Thailand is the study area because this has been a traditional rubber plantation area with the most rubber areas, and so the rubber economy in Thailand highly depends on this region where the sector faces problems of land and labor as indicated in problem statement. To test the hypotheses, the study focused on representing the rubber based agrarian societies that presented features and characteristics of agrarian change. Deciding the selection of study areas, finding preliminary surveys, and reviewing secondary data, this researcher had been in discussion with advisors and colleagues at Prince of Songkla University; Assoc. Prof. Dr. Somboon Chareonjiratrakul (Faculty of Economics), Assoc. Prof. Dr. Somyot Thungwa (Faculty of Natural Resources), and Assoc. Prof. Dr. Buncha Somboonsuke (Faculty of Natural Resources). As a result, Songkla and Pattalung were the two provinces selected. They are representative situations of agrarian change and path development of the rubber based economy in southern Thailand. In order to ensure validity of province selection, my colleague at Prince of Songkla University and key persons during preliminary survey were validated and confirmed for representatives of the two province selections.

To compare with other provinces in the south region, Songkhla is a center of social and economic development in southern Thailand. This province is the center of social and economic development, trade, and industry as well as rubber development. This province has also now one of the largest numbers of rubber farm households and one of the largest plantation areas in the fourteen southern provinces. Since the 1960s, several government agencies related to rubber developments were established in this area. They include such important institutions as rubber research center, office of re-plantation scheme, and agricultural research center. The first rubber central market was also established in Hat Yai in 1991. Moreover, this province was a center of rubber marketing, trade, industry, and ports. There were advantages for the development of the rubber economy and therefore, social and economic development were driven by a rubber based economy. This area has also characterized by concentrations of large farms and farm capitalist that has been up in technological use and employed hire tappers toward farm business orientation. In fact, this area has various sizes of rubber farm households from the largest to small landholding. Therefore, there were diversifications in farming, labor use, and contracts.

In terms of general perception, this area has a higher social and economic development than other provinces as well as a rapid change of socioeconomic aspects in an agrarian society. Lastly, I decided to select this province because it is similar to the previous study and this researcher's homeland.

Pattalung is located in a rural and remote area where it presented social and economic development of rural society in southern Thailand. This area had historically a center of paddy field based economy while rubber plantation concentrated on uphill and upper zones, representing agricultural zones in most of the provinces in the southern region. Rubber plantation began later with plentiful land where migrated famers had converted deforest and/or forest areas into extensive plantations and food crops from the 1960s-1970s.

Since the 2000s, farmers in this area highly encroached annual crops and used marginal land as rubber plantations in the plains or paddy field areas, in particular. This area has varied in landholding from the largest to very small. It seems that small landholding is in the majority. Labor use and contracts are characterized by traditional agrarian societies. Since the 2000s, the community has changed in its socioeconomic aspect corresponding to rapid social and economic development similar to rural communities in other provinces in the southern region. The study also had observed that wage contracts and stimulation technology were highly adopted in the late 2010s and later it was greatly expanded in other provinces. The emergence of wage contracts may further bring the changes in land, labor, and share-tapping. Lastly, this province is familiar to this researcher from a previous study.

Table 1-1 Informants for informal interviews of preliminary survey in 2011

Sources of informants	Scope and Authority	Songkhla	Pattalung	Total
Farmers	Experienced farmers and local leaders in community	12	8	20
Local thinkers	Well known thinkers in southern Thailand	3	2	5
Government organizations	Rubber research center, ORRAF, Rubber Central Market, Office of Agriculture, Office of Land Development, Office of Labor Recruitment, Office of Agricultural Research, and local government	6	4	10
Trade and marketing	The Thai Rubber Association, Latex Thai Association, and middlemen in latex colleting point and central market	3	2	5
Researchers	Prince of Songkla University	2	-	2
Total		26	16	42

During January and February 2011, a preliminary survey was conducted in the selected provinces and the communities in each province in order to investigate the representative field location through informal interviews with key persons in the field of interest. A snowball method was employed for informal interviews. The preliminary survey also gained more understanding with a general depiction of community phenomena across the southern region. It was necessary for building experience with agrarian change, understanding community history in different aspects of informant experience, and gathering

updated information about rubber plantation owners and share tappers regarding land, labor, technological use, production systems, farm households, and their evolution in the selected areas.

Moreover, this survey also provided a chance to discuss with key persons and experts in fields involved in the rubber based economy. The purpose was to find key informants through reputational and chain referral interviews by key personnel. Informal interviews informed to name others who would be likely key informants in each community who had good reputations and chain referral sampling within the preliminary survey. This method allowed the study to get the names of key informants with varying backgrounds, level of experience, and different perspectives in that they were involved and well informed on their knowledge about communities and the rubber economy. The discussion with key persons in the area helped support my work during the individual farm interviews. It was also useful for planning individual interviews. My colleagues also introduced some informants. Table 1-1 shows that a total of 42 informants were interviewed with the classification of those into five categories: farmers, local thinkers, government organizations, trade, and researchers.

Each province is divided into several districts and sub-districts. Each sub-district consists of a few thousand-rubber farm households. The selection of representative communities in each province was based on the following criteria:

- Rubber based agrarian economy: community historically presenting utilization of land and labor use for rubber plantation as well as social and economic development depending on rubber production.
- Linkage between rural and urban area: community showing the different socio-economic aspects as well as the influence of the non-farm sector.
- Presence of rubber farm households both collaborated with re-plantation scheme and self-investment, and diversified landholding and labor use.
- Appropriate location and accessible area: community location easily accessible to area and research.
- Availability of secondary information: there was sufficient accessibility to existing information related to the rubber economy and objectives of study providing additional benefits in the conduct of this study.
- Convenient and safe to study: the study area was easy for transportation and safe to enter the field.

To decide community selection, these criteria were employed to evaluate each community. The preliminary survey also helped to decide which communities was suitable, practical, and representative of the rubber based community. The first three criteria were important to make decisions that also considered potential communities suggested by my colleagues and key persons in the preliminary survey. The last three criteria were also considered to be realistic to the field survey and be capable of conducting the study without any incidents even if these criteria might create potential bias. In order to ensure the representative communities as per the purpose of research, my colleagues at Prince of

Songkla University validated those communities that helped to cope very well with potential bias.

The preliminary survey was intensively conducted in seven communities in Songkhla and five communities in Pattalung. In each community, informants were selected for informal interviews that would have to understand a general depiction of community phenomena across the study area regarding social and economic development, rubber history, landholding, labor use, and contracts. It also allowed building up of real experience with agrarian change, understanding community history, and collecting general information regarding the number of households, land use, available labor, income, and their evolutions. It included gathering information about locations, rubber production, rubber plantation owners and share-tappers. Then the potential communities for the study were identified.

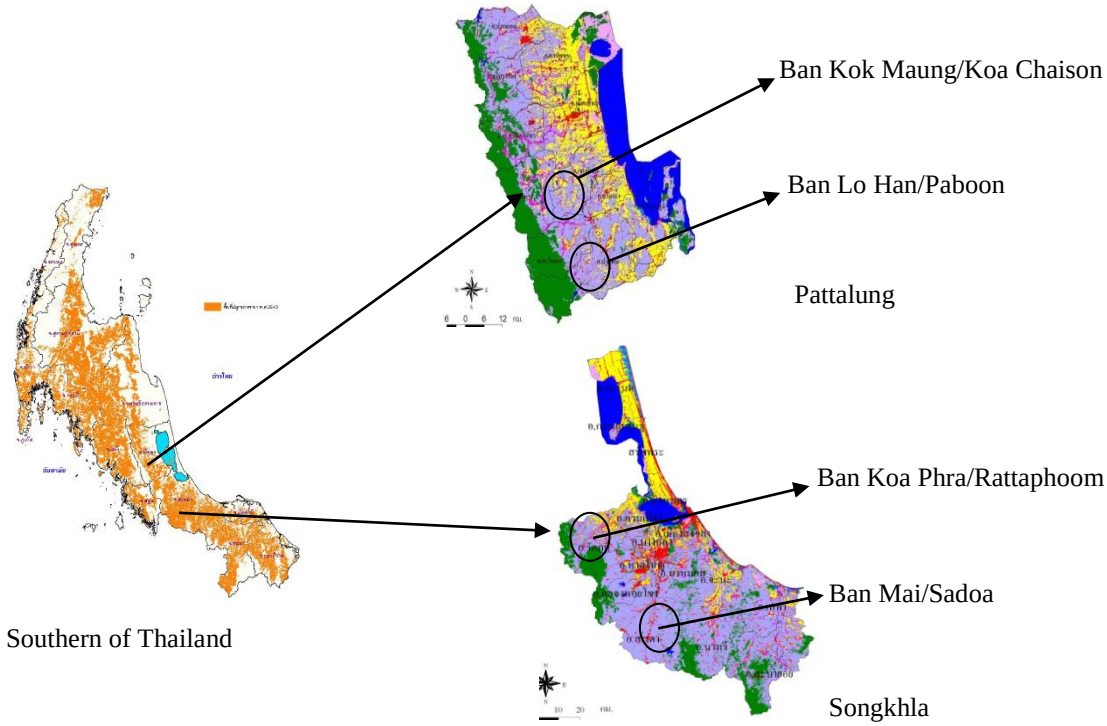

Figure 1-4 Map of selection of field

Remark: light blue color showed rubber plantation area in selection of field survey, yellow color identified area of paddy field and annual crops, and green color is forest area and conservation zone

As a result, four communities were selected: Ban Mai/Sadoadistrict and Ban Koa Phra/Rattaphoom district in Songkhla, Ban Kok Muang/Khoa Chaison district and Ban Lo Han/ Paboon district in Pattalung. According to my informal interviews and the review of secondary data, Table 1-2 presents community characteristics and more details as below:

Ban Mai/Sa-dao in Songkhla had not only long experience with intensive rubber areas since the early twentieth century, but it was also characterized by the various sizes of farms from the largest farm business to very small farms. There were knowledgeable about good

plantation management by medium and large farms. This area also has seen diversification of labor use and contracts.

Ban Khoa Phra/Rattaphoom in Songkhla; this community evolved from unoccupied land, presenting various sizes of farms and also diversified farming and household characteristics. There was representative rubber areas that evolved from settlements with traditional cultivation to diversification of farming. This community is located close to upland and forest zones.

Ban Lohan/Paboon are the areas of rubber plantation in Pattalung. This is a remote community with very intensive rubber areas. The communities historically can be traced to the settlement with various farms from the largest farms to small farms. As well, this community has diversified access to land, labor use, contracts and household characteristics.

Ban Kok Muang/Koa Chaison in Pattalung was characterized by the recent change to a rubber based economy and to become dominated by a majority of smallholdings. This community also presented diversifications of household characteristics and had been changing for land use, labor use, and contracts. Wage contracts for tapping might be originally employed in this area.

Table1-2 Overview of community characteristics

Community Name	Overviews of community characteristics
Ban Mai/Sadoa Songkhlka	One of the largest rubber plantation areas in Songkhla, concentrated with medium and large farms, evolved from preemptive land, characterized by good plantation management, diversified labor use and contracts
Koa Phra/Rattaphoom Songkhla	High ratio of medium and smallholdings, evolved from preemptive land, diversified rubber production, and recent change of labor use and contracts
Ban Lohan/Paboon Pattalung	One of the largest rubber plantation areas in Pattalung, high ratio of medium landholding, evolved from preemptive land, diversified labor use and contracts
Ban KokMuang/KhoaChaison Pattalung	Dominated small landholding, transition from crops to rubber plantation, and recent change of labor use and contracts

In order to ensure validity of representative communities, the selection of research areas was validated through discussions with advisors and my colleagues at Prince of Songkla University; Assoc. Prof. Dr. Somboon Chareonjiratrakul (Faculty of Economics), Assoc. Prof. Dr. Somyot Thungwa (Faculty of Natural Resources), Assoc. Prof. Dr. Buncha Somboonsuke (Faculty of Natural Resources), and Dr. Benedicte Chambon (CIRAD).

2) Population and sample selection

This section describes the procedure to identify sample and sample size in this research. The population was households of rubber owners in the rubber based economy in southern Thailand. Data were collected from both a sample/household of rubber owners and key informants. Quantity data was collected from a household survey. And quality data were done by key informant interviews.

2.1) Key informants

Key informants were persons who have positions of leadership, experience, influential ideas, and authority including stakeholders involved in rubber development. They can be classified into three categories as Table 1-3. First, key informants are expert farmers, local leaders, and local thinkers. These key informants were identified through preliminary field surveys with farmers and key persons in each community.

Second, government officials and authority figures who come from government agencies and have authority and functions involved in rubber development, re-plantation schemes, land tenure, labor use, and agricultural development in the southern region. These persons also played roles as policy makers, executive officers, and official staff in such important organizations as the Rubber Research Institute of Thailand (RRIT), Office of the Rubber Replanting Aid Fund (ORRAF), Rubber Estate Organization (RES), Rubber Research Center, Rubber Central Market, etc. Lastly, the entrepreneurs and traders were local traders, leaders of farm groups, executives of cooperatives, representative persons from rubber factories, exporters, and rubber association. These key informants were introduced by several sources such as the Thai Rubber Association, Rubber Central Market, Head of ORRAF Office in Songkhla and Pattalung, my colleagues at Prince of Songkla University, and preliminary survey. Table 1-3 presents a number of key informants by categories. The list of key informants was made to provide a number of informants by categories that should be conducted to ensure adequate representation of the different experiences and carried out to cover all topics to a point that more key informants do not provide new experience and have already been familiar with a pattern of answers.

Table 1-3 Sources of targeted key informants

Category of key informants	Targeted key informants	Expected informants
Rubber farmers and key persons in each community	rubber owners, share-tappers, experienced rubber farmers, leaders and local thinkers	30
Government organizations in Songkhla, Pattalung, and Bangkok	RRIT, RES, OAE, ORRAF, Rubber Search Center, Rubber Central Market, Department of Agriculture, Department of Agriculture Extension, Land Development Department, Agricultural Research Development Agency, etc.	15
Entrepreneurs and traders in Songkhla and Pattalung	leaders of farm groups, local traders, executive of cooperative, factory, exporters, Rubber Association, etc.	5
Total		50

It also showed reliability, consistency, and sufficiency of information, further interviews might not be necessary. The results of the preliminary survey and my personal contact in a previous study provided for the list of key informants in respect of the information need. Key informants were contacted by mail and phone to introduce the study, objectives, and request an interview with him or her. After that, the available time for in-depth interviews was confirmed on the day to meet for interviews.

2.2) Households of rubber owners

Samples in this research were households of rubber owners and/or rubber farm households. A purposive sampling method was employed in selecting respondents. The attribution of samples comprised of households who owned rubber land, got income from rubber activities, had experience with mature plantations and/or tapping contracts for at least a year, lived in community, and had a willingness to be accessible for farm household information.

These sampling criteria set a list of qualifications of farm households that helped for clear qualification of respondents and also was easy to find them within a short time and less effort. Based on criterion sampling, key persons and farm experts in each community helped to identify who represented households. Even if the number of rubber households were lacking in data, key persons in each community and brief statistic data from local governments, district office, and provincial office allowed this study to estimate the precise number of rubber households and also to understand the broad characteristics of rubber households in a community context.

Sample size was calculated through Yamane's formula as below. This equation assumes a 95% confidence level with the degree of variability P=0.5 and 10% of sampling error for calculation. This formula is shown below.

$$n = \frac{N}{1 + N(e)^2}$$

n = the sample size
N = the population size
e = the level of precision

For example:

The sample size of Ban Mai is assumed a 95% confidence level with degree of variability P=0.5 and 10% of sampling error. It is calculated as below.

$$n = \frac{325}{1+325(0.10)^2}$$

$$n = 77$$

n = the sample size
N = the population size in Ban Mai is 325
e = the level of precision or sampling error is 0.10

After this formula was applied to calculate sample size, a minimum of expected sample 277 required as Table 1-4 shows. To meet the possible inaccuracy and uncompleted information with some questionnaires, the sample surveyed was higher than required.

Table 1-4 Sample size of household survey

Province	District /Sub district	Population in each community	Expected sample size
Songkhla	Ban Mai /Sadoa	325	77
	Ban KhoaPhra /Rattaphoom	262	73
Pattalung	Ban Lo Han / Paboon	190	66
	Ban Kok Muang/ KhoaChaison	144	60
Total		921	277

Sources: Provincial Office of Agriculture of Songkhla and Pattalung, 2009

3) Tools of the field survey

This section describes the process of developing tools for the field survey and preparation of interviews before collecting data. In this study, both structured and semi-structured questionnaires were employed for individual interviews and in-depth interviews, respectively. Questionnaires were formulated corresponding to study questions, objectives, and hypotheses test of the study that indicated what the information and the related data need as per Figure 1-3. The preliminary field survey and review of secondary data also help to develop the first draft of questionnaires.

3.1) Structured questionnaires

Structured questionnaires were composed of open-ended and closed-ended questions. Closed-ended questions are used for specific sets of answers for the respondent individual farm households to give answers with the forms of multiple-choice sets, dichotomous sets, and scales. Open-ended questions left the respondents free to express their thoughts with their own words (Trobia, 2008). The structured questionnaire comprises of four sections (see detail of questionnaires in Annex D). These structured questionnaires were validated by supervisors and researchers from Prince of Songkla University. The Thai version of the questionnaire was conducted for the first pre-testing with 15 farmers in Hat Yai district, Songkhla province (outside the study area) and then followed with the second and the third time of pre-testing with 15 farmers in Hat Yai and Kuan-Neang.

3.2) Semi-structured questionnaires

Semi-structured questionnaires are composed of open and flexible questions to deepen discussion and in-depth interviews with various key informants depending on his/her experiences, backgrounds, and authority. Semi-structured questionnaires can be classified into three categories depending on the three categories of key informants described above (see detail of semi-structured questionnaires in Annex E). With informal interviews during the preliminary survey and my experience in-depth interviews, the researcher revised the semi-structured questionnaires many times for accuracy and validity of information response to three categories of informants. The revision included the advice given by supervisors.

4) In field survey and data collection

4.1) Selection and training of assistants

Prior to the fieldwork, six assistants were recruited from the Faculty of Economics, the Faculty of Liberal Arts, and the Faculty of Natural Resources. The assistants were masters students. They were selected based on at least four criteria: being willing to visit farms across the community, interviewing experience with farm surveys, not living in the selection area, and good understanding of local language. Intensive training was organized for the assistants. The objectives were to understand the field process, ask questions, confidence with farmers, and filling answers for obtaining quality data. They should completely understand every question, restructured questions, and recorded verbal answers meaningful to the questionnaire. These included an understanding of socio-economics and the context of community.

In the pre-field survey (pre-test of questionnaire) and in few days at beginning stage of field survey, the interviews were conducted by the assistants and researcher undertook the role of observer. Then the researcher was able to train the assistants how to ask questions, get meaningful answers, and deal with respondents. This process provided confidential interviews and prevented losing information. In order to ensure the quality of data, a daily group meeting was organized in every working day to check each assistants' questionnaires and to correct recording errors. In this meeting, the field experiences and exchanged data collection technique were shared including preparing plans of fieldwork for the next day. This process was not only beneficial to the quality of information, but it also allowed the researcher to understand history of family of sample and social phenomena in community context by the views of assistants. This was important for most of data collection for structure questionnaires were done by the assistants.

4.2) Household survey

Individual interviews with structured questionnaires was conducted during March and June 2011. In each community, six assistants and this researcher were able to conduct a comprehensive survey because of good field preparation and familiarity with communities. The study also benefited from the help of key persons in each community. In daily working, the data collecting team travelled by van from Prince of Songkla University to the community. During 1-2 hours of transportation, the researcher implemented a daily meeting to provide background information of community such as history, location, socio-economic information, and overviews of household characteristics, which were useful to conduct interviews in the community context. The study assistants also shared interview experience and interview techniques that were useful for the next interviews. In the evening, the study had a short meeting to check number of questionnaires and give solutions if problems occurred. This field process was implemented to ensure validity, quality, and good response rate of questionnaires as well as to encourage confidential interviews with assistants. About 1.5 to 2.0 hours were often needed for completing questionnaires. However, in actual fact, some respondents needed a longer time depending on respondents and assistants to engage in prolonged conversation before and during interviews. Moreover, the assistants also took field

notes in particular regarding interview context. In order to ensure quality and usefulness of questionnaires, the assistants checked every question to complete answer again before returning those questionnaires the next day.

Table 1-5 Actual surveyed sample

Province	District /Sub district	Actual surveyed sample
Songkhla	Ban Mai /Sadoa	120
	Ban KhoaPhra /Rattaphoom	90
Pattalung	Ban Lo Han / Paboon	88
	Ban Kok Muang / KoaChaison	95
Total		393

During March to June 2011, 420 households were interviewed in four communities, even though the field work had a few incident interviews due to high rainy days and a little flooding in some areas. Total interviews were conducted more than the excepted sample size because some samples were discarded with uncompleted interviews, unwillingness to respond with land and labor issues, and excluded from the sample's criteria. Table 1-5 shows number of completed interviews in four communities.

4.3) In-depth interviews

All the in-depth interviews were conducted by this researcher. 75 key informants were interviewed from February to June 2011 as seen in Table 1-6. This is more than expectation as in Table 1-3. This is to ensure sufficient information and does not explore new issues by additional interviews, but that are relevant to study's objectives. In particular, the more interviews usually confirmed or clarified the data that already existed. This information helps this researcher to further details and achieve consistency.

Table 1-6 Surveyed key informants in 2011

Sources	Targeted Key informants	Songkhla	Pattalung	Total
Rubber farmers and key persons in each community	rubber owners, share tappers, experienced rubber farmers, leaders in communities, local philosophers, etc.	25	24	49
Government organizations in Songkhla, Pattalung and Bangkok	RRIT, RES, OAE, ORRAF, Rubber Research Center, Rubber Central Market, Department of Agriculture, Department of Agriculture Extension, Land Development Department, Agricultural Research Development Agency, etc.	14	5	19
Entrepreneurs and traders in Songkhla and Pattalung	leader of farm group, local traders, executive of cooperative, factory, exporters, rubber association, etc.	4	3	7
Total		43	32	75

For all the in-depth interviews, the face-to face interviews were applied allowing for consistency, validity, and reliability in data and interview context. It was also easier for instruction, clarification, and evaluation through cross-examination with other informants. All in-depth interviews were recorded using a digital recorder in parallel with handwritten notes taken in a meaningful context. After that, each interview was transcribed from digital recording to written notes at the end of the working day.

During the ongoing individual interview, in-depth interviews with key informants were conducted in each community in the same day. It further provided confidence of collecting data through crosschecked data between key informants and individual interviews. Because of the difficulty to meet available time of key informants and financial constraints, in-depth interviews were initially conducted with the important key informants who were government agents, local leaders, and traders.

For interviewing each key informant at the first time, the interviews started with introduction of this study, objectives, and why the key informants were selected for their willingness to be interviewed, meaningful information, and maximizing validity and reliability.

With this researcher's experiences, a list of semi-structured questionnaires was always held in hand that was useful and helpful to keep conversation flowing. A set of questions had flexible narrative interviews depending on key informant’s experiences and interest topics. In fact, the semi-structured questionnaires did not present key informants and not ask exactly the same questions but used narrative face-to-face conversations and streaming questions corresponding to interest topics, experiences, situations, environment of interviews, and moving stories. Often, interviews emphasized a flowing narrative of informants and interrupted conversation for handling interviews in that manner. In some cases, informants were interviewed more than one time due to chances of meeting, insufficient information, and repeated field surveys through the period of data collection.

By interview arrangements, key informants decided the time and place for interviews that generally occurred in individual key informant’s house or government office. Before starting the interviews, permission for recording the conversation using a digital recording device was required. Most of the key informants permitted to use a digital recorder. Concerning recording pressure, the device was hidden to relax the interviewees. However, if they did not permit to record, short notes would be used to carefully capture information, and then interviews were immediately written in full at the end of the working day. Some key informants required to terminate recording device in some topics. In the end of the working day, interviews were summarized and were written to depict conversations with each key informant into researcher’s field notes and computer together that prevented any loss of data. With this process, in-depth interviews were obtained with consistency, validity, and reliability.

5) Reviewing secondary data and documentary study

The document reviews are: statistic data and relevant study documents. The first is a category data or published statistics from statistical and category information such as production area, production, yield, rubber price, population, etc. This secondary data consists mainly of statistics and database from the National Statistical Office, Bank of Thailand, RRIT, ORRAF, Office of Agricultural Economics, Department of Agriculture, Land Development Department, Department of Agricultural Extension, etc. Official letters signed by Prince of Songkla University were sent to original sources of documents. These letters required to facilitate and to cooperate for giving access to the existing documents. After that, the researcher contacted by phone the person in charge for visiting and collecting related data. Consequently, the researcher had completely accessible collected data with cooperation, convenience, and fulfilling the demands of study such as annual year statistics and reports of production areas, production, yield, rubber prices, population and housing consensus, agricultural consensus, and re-plantation statistical data, etc. It also included official statistics and consensus data at different times.

Second, the documents were relevant study documents generated by other researchers for different objectives. These documents should be reliable, suitable, and provide adequate information. These sources consisted mainly of books, journal papers, master theses, dissertations, and research papers related to economic development, rural development, agriculture development, political economy, agrarian society, and the rubber economy development. These documents come from several sources such as local, national, and international publications which can be accessed through the library and digital web database at Prince of Songkla University and CIRAD. In addition, secondary data in this research had served to develop theoretical support, to create questionnaires, and to conduct historical and comparative analysis by path dependent analytical structures.

6) Field strategies and quality control of the field survey

The fieldwork was carried out over six months in 2011. The success of the field survey was indebted to the assistance of study colleagues and master students at Prince of Songkla University and preparation of fieldwork. In addition, key personnel in each community helped to facilitate fieldwork and allowed this researcher to interview well-known key informants. A major constraint in the field is the lack of, and the imprecision, of the current data and statistics among real farms, related organizations, and government offices. Unfortunately, the data available at local and central governments were observed fragmented, incomplete, and inaccurate. To cope with these constraints, the obtained data could be confidently checked within and among original sources. To ensure data quality conducting by the assistants, the fieldwork also focused on bias and imprecise data raised by some respondents and shirking of assistants in doing individual interviews. While in the undergoing fieldwork, the close monitoring of interviews, daily meetings, and assistant feedback enabled to investigate interviews and so to enhance the fact finding and data quality. The in-depth interviews in each community also provided capability to link with

broad views of household survey. Finally, all of the data were verified and increased reliable interviews through researcher's screening after the questionnaires were returned to researcher the next day. Therefore, this process was able to gain reliable and qualified data.

7) Leaving the field in 2011

In the third week of June 2011, the data collection was terminated because of saturation and comprehensive data. Before leaving the field, addresses of key persons and the assistants were exchanged for future personal contact and would be the next field survey.

8) Database of the study

During June to July 2011, all questionnaires were cleaned and edited. The most important reason was to strengthen the validity and reliability of data. Number and expression within questionnaires, if it had unnecessary and unpleasant truths to answer for those questionnaires, they were cleaned and edited. This was capable of reducing human error during collecting data. For instance, landholding size, tapping area, and plots were edited and cross checked corresponding to data in part 3 (tapping labor, contracts, and their evolution) and part 4 (evolution of land use and land issues). As well, family members and available family labor should have precise data according to the use of family labor for farm and non-farm activities including the use of hired laborers. Indeed, landholding size needed to be carefully checked and be accurate to landholding alongside history of family regarding land transfer, sold, purchased, and rented land. These included number of working hours, working days, and year of production, yield, and number of labor force. By strengthening work on this process, this study not only provided meaningful data for easily entering data into database, but it also obtained an understanding of the overview and generalities of data, and depicting farm types, pattern of farm changes, trends, and social phenomena in each community context.

The data was inputted into Microsoft Access software. In order to ensure quality and applicability to database, the input data into database started with uncomplicated questionnaires and general data of respondents. Then some data tables could be adjusted to be familiar with answers of questions and table properties. In this stage, all of data had been cleaned, edited, and proofread to be reliable and verified before adding into database. 393 interviews were recorded in mid October 2011, and the database was already used. With more experience and familiarity of researcher with SPSS, SPSS (Statistical Package for Social Science) was selected as the tool of statistical analysis. Making queries formed the selected data used for analysis and discussion; it is data needed to look for answers. Query data were transformed into SPSS, Microsoft Word, and Microsoft Excel that would be ready for the analysis.

1.8.2 The fieldwork in 2012

In this section, the attention is to describe the fieldwork in 2012 for problems of the second fieldwork, selection of study areas, population and sample selection, tools of the field survey, and data collection. The study also presented what pending questions needed to be answered through the second field survey. The fieldwork experiences and practices in the field were practically described.

1) Problems in the second fieldwork

As discussed above, the first fieldwork focused on main study questions: "How did the rubber sector evolve historically?" What were the key determinants of this evolution in southern Thailand?" To test hypotheses, 393 household interviews and 75 of key informants were done with structured and semi-structured questionnaires. All of data stored were into database based on Microsoft Access, which was already used for statistical analysis and interpretation in November 2011. The analysis started with making descriptive analysis in order to deeply understand all variables and households' characteristics. The study developed combining multivariate statistic techniques and a systematic technique used for assessment of farm trajectories and patterns of clustered farm pathway. These were obtained with the six types of farm trajectories and 22 patterns of clustered farm pathways. The result was also the analysis of share-tapping arrangements.

Rather than statistical analysis, the main objective was that the results brought to interview the representative samples and key informants attempting to analyze what/how farm trajectories occurred, process of farm changes, determinants and the impacts to the farms. The specific objectives were to address as in the following.

1. To examine land and labor institutions and their determinants. This included analyze what/how accumulation and reduction of landholding occurred along a family lifecycle and how landholding and the use of labor linked together and further influenced farm trajectories.
2. To analyze what/how share-tapping contracts evolved and their determinants including why share-tapping contracts persisted in the rubber economy. The study also proposed to examine to what extent expansion of wage contracts and those impacts on share-tapping contracts. Furthermore, the analysis emphasized to examine what/how institutions embedded on share-tapping contracts and their determinants.
3. To analyze path of rubber development in Thailand. The study also proposed to examine to what the roles of policy, the government interventions and the market influencing on path of rubber development, farm trajectories, and share-tapping.

2) Selection of the study areas

The study area was the same as the first field survey: Ban Mai/Sadoa district and Ban Koa-Phra/Rattaphoom district in Songkla, Ban Kok-Maung/KhoaChaison district, and Ban Lo-han/Paboon district in Pattalung as Figure 1-4.

3) Population and sample selection

Table 1-7 lists key informants. The first informants were retained from households who were members of six farm trajectories. These farms should have a representative structure and characteristic of each farm trajectory. 75 of the total farms were initially targeted for key informants of which constituted about 30% of 220 samples.

Table 1-7 Sample size according to categories of key informants in 2012

Category of key informants	Target of key informants	Expectation of informants
Rubber farmers and key persons	TR1	5
	TR2	10
	TR3	6
	TR4	7
	TR5	26
	TR6	17
	local philosophers	4
Government organizations	RRIT, RES, ORRAF, Rubber Research Center, Rubber Central Market.	10
Total informants		85

Other key informants were local thinkers and executives or authorities of government agencies involving rubber development such as the Rubber Research Institute of Thailand, Rubber Research Center, Rubber Central Market, and Office of Rubber Re-plantation Aid Funds. In fact, the first survey and personal researcher contact provided an adequate list of informants in respect of information needed. In doing so, names and addresses from the household survey were used to identify the representative samples belong to the six types of farm trajectories. Representative informants were retained from household members of each farm trajectory.

4) Tools of the field survey

Semi-structured questionnaires were employed for in-depth interviews. Semi-structured questionnaires were used for guiding questions in interviews comprising of three sections detailed in Annex F.

5) Data collection

90 key informants were interviewed from June to September 2012. Table 1-8 presents the actual interview samples. In doing this, all interviews were recorded using a digital recorder and handwritten notes and so transcribed to written notes at the end of the working day. Before entering the village, 3 or 4 key informants in the same village would have available time for interviews. The interviews generally occurred at marketing places and informant houses. It was easily to start interviews because farm structure and characteristics were understood.

Table 1-8 Actual surveyed sample size according to categories of key informants in 2012

Category of key informants	Target of key informants	Sample size
Rubber farmers and key persons	TR1	10
	TR2	14
	TR3	12
	TR4	10
	TR5	17
	TR6	18
	Local philosophers	4
Government organizations	RRIT, RES, ORRAF, Rubber Research Center, and Rubber Central Market	5
Total informants		90

To keep in mind the guiding questions, the conversation was kept informal and had a dynamic narrative corresponding to household's history, farm changes, sequent events, determinants, and their perspective on life. Importantly, some informants helped to contact other key informants who had experienced the same or the different changes as study required. With this process, the number of interviews increased in some trajectories, especially TR1, TR2, TR3, and TR4.

Key informants increased until more information did not provide new data/experiences and already had familiarity with patterns of answers. Interviews also showed consistency, reliability, and sufficiency of data indicating that more interviews might not be necessary. Number of informants by TR5 decreased due to consistency data and no finding of new experiences. Additional informants mostly retained from the representative sample in the first household survey except new informants found in TR1 and TR3 whose had been introduced by key informants during the fieldwork.

1.9 Chapter Outlines

The study is presented in five chapters. The first chapter provides an introduction of problem statement, objectives, hypotheses, outcomes of the study, study methods, and literature reviews. This chapter also illustrates the study design and methods adopted to obtain data and fieldwork in detailing procedures from preparing fieldwork, preliminary field survey, being in the field, and leaving the field. This also explains obtaining data collection, handling data, and analysis. The second chapter presents the study findings of farm trajectories and farm typologies. This includes explaining methods that the study developed for analysis of farm trajectories. The third chapter presents the results of analysis of share-tapping arrangements. The study results also show conceptual framework of share-tapping contracts, the set of rules embedded in share-tapping and then applies to explain share-tapping arrangements. This chapter also emphasizes explaining the evolution of share-tapping and the use of hired laborers. In the fourth chapter, the study findings are presented with an emphasis on path dependent analysis to explain policy and institutional arrangements governing farm trajectories and share-tapping. This includes explaining path dependence of market forces and relations between policy and market forces. Lastly, in the fifth chapter the conclusion and discussions of the study findings are presented together with the policy scenario suggested in the study findings.

Chapter 2

Typology and Trajectory of Farms

This chapter presents the results on the typology of the farms' trajectories. The study also addresses the development of methods for analyzing farm trajectories using the combination of two statistical analyses (multivariate analysis and systematic clustering technique), completed by field validation. This chapter is organized as follows.

Section 2.1 presents a brief explanation of population and agricultural transformation in Thailand. Section 2.2 gives an overview of rubber production in Thailand. Section 2.3 describes characteristics of the respondents. Section 2.4 presents the methods for the analyzing of farm trajectories this study developed for this sample group. Section 2.5 presents the results of the typology of farm trajectories. Section 2.6 presents the analyses of the six farm trajectories. Section 2.7 describes the relationship between farms and non-farms. Section 2.8 presents the analysis of farm polarization. The final section, 2.9, provides a conclusion and summary.

2.1 Population and Agricultural Transformation in Thailand

2.1.1 Population

In 2010, the population of the country was about 65.5 million people, about 8 times larger than the first population census in 1909. From 1909 to the pre-war period, the population substantially increased from 8.1 million people in 1909 to 14.5 million people in 1937 with the annual growth of above 2.0 percent prior to WW II and rose to 26.3 million people with an annual growth of about 3.0 percent after WW II.

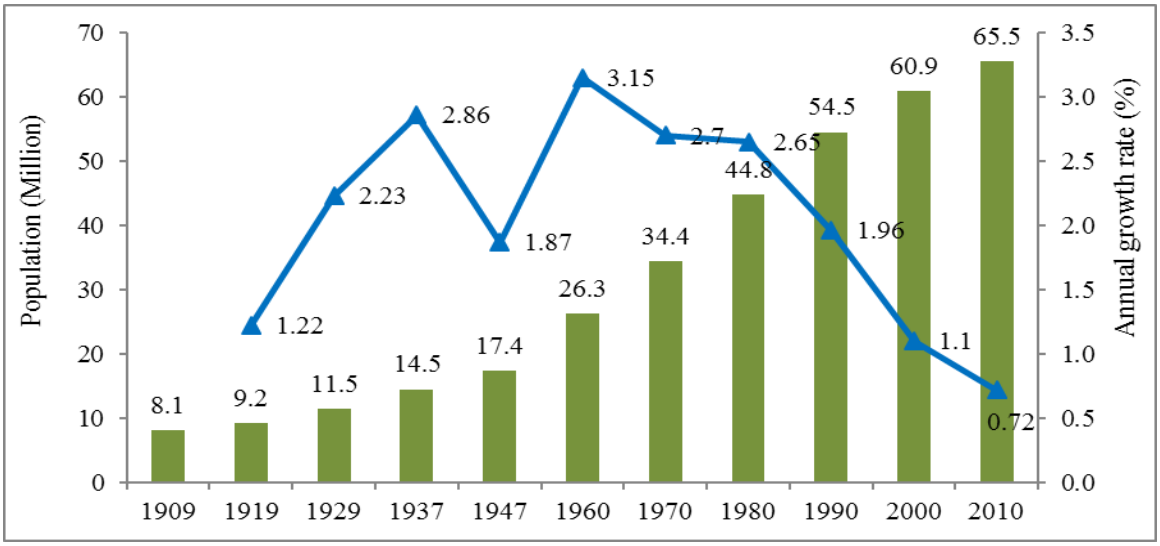

Figure 2-1 Population and the annual growth rate of population in Thailand 1909-2010
Source: NSO, 2013

This remarkable rapid rate was due to decreasing death rates and high birth rates. One reason for the high growth of population was improvements in medicine and public health programs as well as social and economic development. Since 1960, population growth has slowed considerably. The annual population growth significantly declined from 2.7 percent from 1960 to 1970 to 0.72 percent from 2000 to 2010 resulting from a dramatic and continual decrease in the birth rate (Figure 2-1). Then due to declining fertility and death rate since the 1960s, Thailand's age pyramid has changed from a broad-base with high fertility age structure to one in which each of the 5-year cohorts aged 15-39 was larger than the 5-year cohorts in the childhood ages, as seen in Figure 2-2. This means that Thailand is entering a new era of slow population growth and eventual decline. The changing population structure is of a crucial importance i.e. changes in age structure, availability of labor forces, family size, education, skills, and geographic distribution.

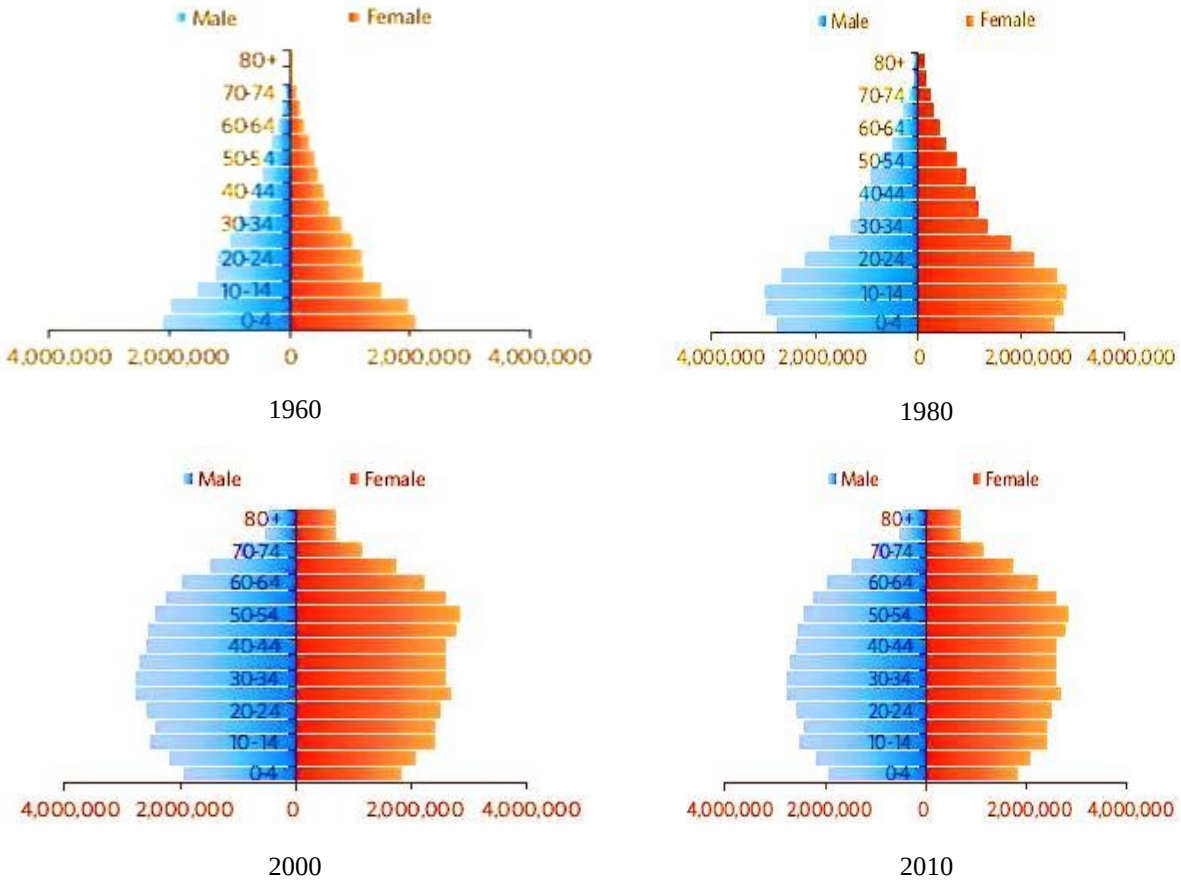

Figure 2-2 Population age pyramids of Thailand in 1960-2010
Source: UNFPA, 2011

Parallel to this, the average size of households has dropped from 5.6 people in 1960 to 5.2 people in 1980 and to 3.2 people in 2010 (Figure 2-3). In 2010, Thailand had 20.3 million households. There was a very substantial decline in the average number of living children and taken place by older persons. This would considerably decrease the number of the labor force per household. The family structure has become a nucleus family rather than extended family, which declines in total proportion of household.

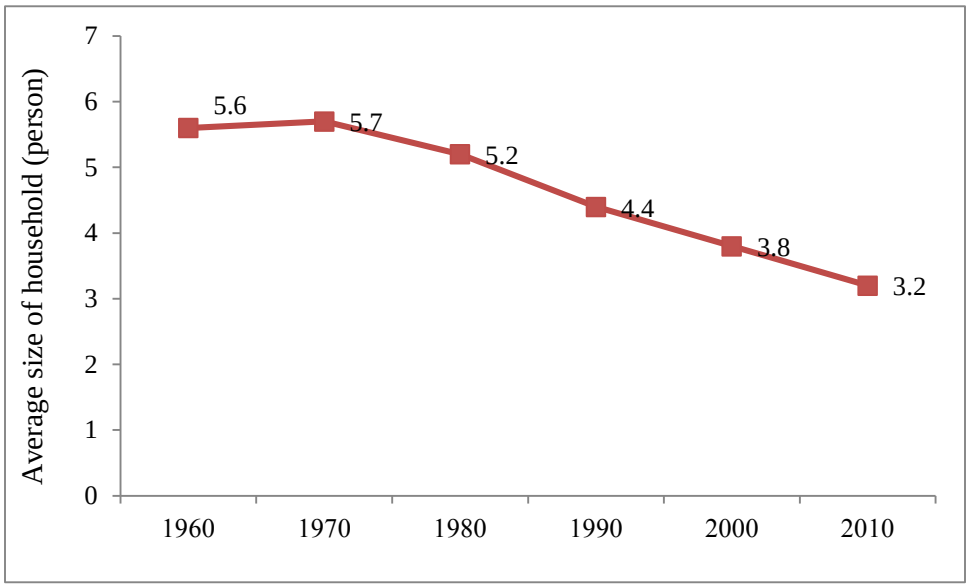

Figure 2-3 The average size of households in Thailand during 1960-2010
Sources: NSO, 2013

2.1.2 Labor force and farm labors

The labor force of Thailand increased continually from about 21.62 million people in 1980 to about 30.0 million people in 1990 and continued to increased to 39.3 million people in 2012 (Figure 2-4). The labor force had increased at a faster pace than the population because there had been some changes in the population structure. However, the first two population censuses indicated that the share of labor force in the farm sector had continually decreased since 1960 from 82 percent to less than 41 percent in 2012 (NESD, 2012; NSO, 2013). Figure 2-4 shows that the labor force migrated from the farm sector to the non-farm sector (the manufacturing and service sectors). Non-farm share increased from 30.0 percent in 1980 to 59.0 percent in 2012 at the rate of 2.5 percent. The rapid economic development since the 1980s had increased an aggregated demand for labor and led to increasing competition for labor among sectors. Migration of labor between farm and non-farm further increased in response to higher real wages (NESD, 2012). As a result, available labor in the farm sector declined especially for the 15-24 age group (Pongsakorn et al., 1998). The employment structure had changed. Indeed, not only the share of labor in farming has fallen but also available laborers for the agriculture sector had declined. Aging farmers and workers were no longer fully replaced (OID, 2011; NSO, 2013).

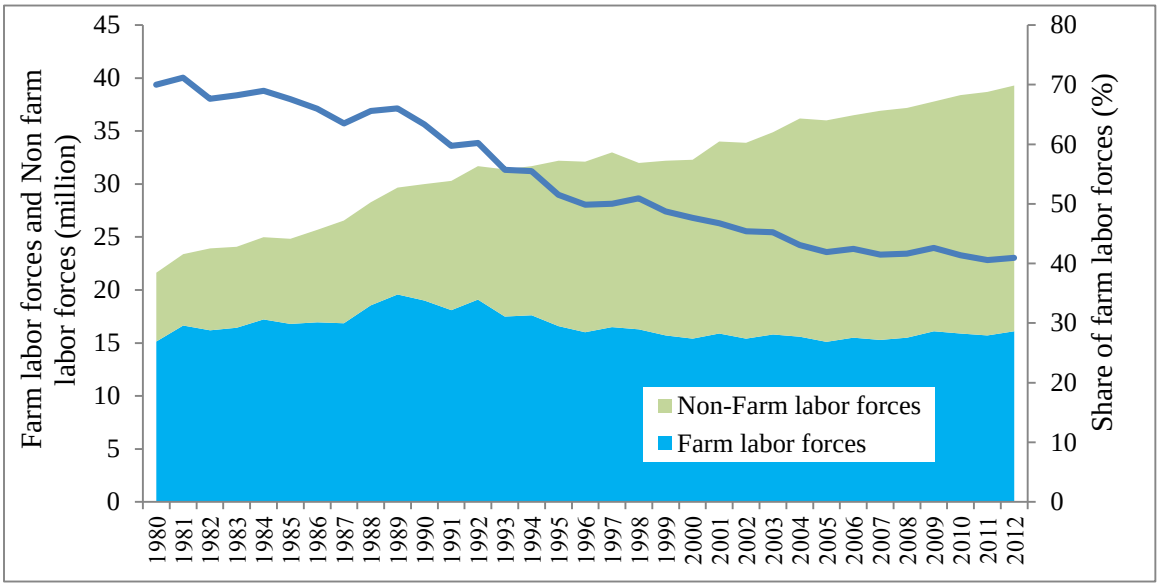

Figure 2-4 Numbers of farm and non-farm labors and the share of farm labors during 1980-2012
Source: NSO, 2013

2.1.3 Role of the farm sector in the Thai economy

Thailand had implemented several national development plans. The first one began in 1961, and now Thailand is under the Eleventh National Economic and Social Development Plan. Figure 2-5 presents the average GDP of Thailand and share of GDP at a constant price for the whole economy i.e. the farm sector and non-farm sectors according to the national development plans. This highlights the role of policy and the government interventions in economic development.

Historically, the Thai economy depended on the farm sector in terms of production, employment, and foreign earnings. In the late 1950s, the government took an active role in economic development by promoting both the growth of the farm sector and the growth of newly developing industries. These were the first policies to encourage a transition. In response, the share of the farm sector in GDP rapidly declined from 50 percent in 1951 to the average of 29.83 percent in the first plan while the share of non-farm sectors grew to 70.17 percent in the first national plan (NSO, 2013). The farm sector contributed approximately 20 percent to GDP during the 1980s with the average growth rate of about 4.8 percent. The non-farm sector was the largest. The growth rate was above 8.0 percent during the first to fifth national plans and grew at double digits during the sixth national plan. Its share accounted for almost 86.57 percent in the sixth national plan and grew to 90.0 percent of GDP during the eighth to tenth national plans, even if the growth varied. Nevertheless, the share of the farm sector in GDP continued to decline. The share of GDP shrank to 8.7 percent in the tenth national plan with growth of 1.7 percent. Then although the GDP for the farm sector slightly increased, its share of total GDP had decreased continually (Figure 2-5) and its growth also declined with even negative growth seen since the

seventh national plan. This was mainly due to the growth of non-farm sectors associated with the drop of production in response to the world market, deterioration of natural resources, and weather. Fortunately, Thailand has been successful in its agricultural development. The farm sector still plays a role in the Thai economy in terms of food, foreign earnings, absorption of labor employment, supply of raw materials for related industries, and multifunctional agriculture.

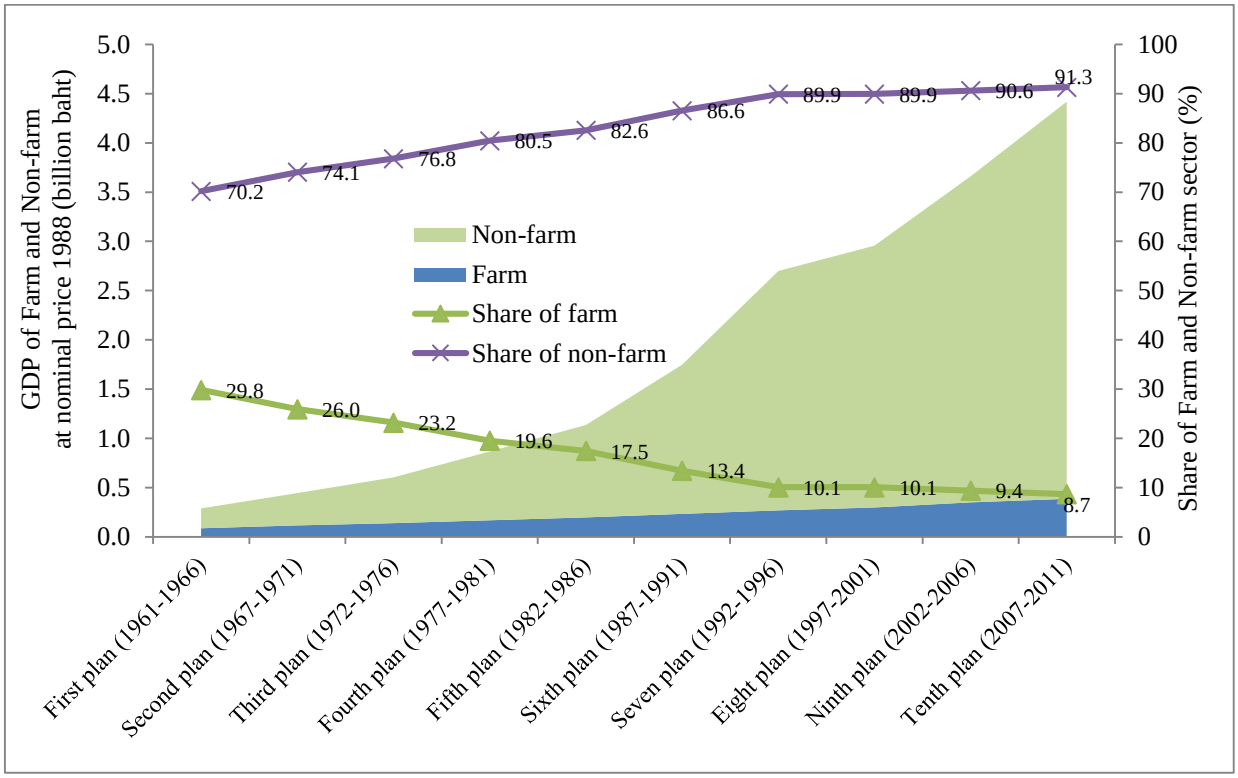

Figure 2-5 GDP at nominal price 1988 according to farm sector, non-farm sector, and its share during 1961-2011

Source: NESD, 2012; NSO, 2013

During the 1960s to the 1980s, the agricultural sector had played an important role for social and economic development based on low cost exported orientation and later achieved with industrialization. Government emphasized promoting agriculture exports and later the supply of agriculture vertically integrated with factory processing and agro-industry. Farm growth was attributed to land expansion and rapid growth in the rural population during the demographic transition. Since the early 1990s, the government also promoted non-farm sectors for an export orientated economy that hopefully changed the national industrialization program. At the same time, the farm sector began transformation. Agricultural growth slowed down because of available land reduced, but productivity of land and labor increased notably (Siamwalla, 1995). The low world price of agricultural products from 1980-1996 also caused slow growth of the farm sector.

However, the decline of the farm sector still facilitated the growth of the non-farm sector. The Thai economy grew rapidly driven by the growth of manufacturing at an annual average of 10 percent. Labor left farms to find jobs in manufacturing and services in response to high real wages and improved education. They hoped to gain higher salaries, better regarded jobs, and a better livelihood in urban areas. As a result, households have become diversified sources of income generation.

During the economic crisis of 1997-1998, the farm sector resisted damage better than other sectors. Unemployed laborers in non-farm industries were absorbed by the farm sector when they went back to their hometowns. The farm sector provided the economy with sources of food and raw materials important to domestic stability and further supported the recovery of the Thai economy (OID, 2011). After the crisis, the growth of agro-industry could take advantage from the devaluation of the baht, low cost of raw materials, and growth of the Chinese economy. Crisis economy was also made stable in growth in the non-farm sector rather than the past. In the 2000s, farms grew again mainly responding to the world commodity boom and government policies. Growth was based on intensification, specialization, and high value markets. Thailand retained considerable competitive advantage and was still the world's leader of natural rubber, frozen foods, sugar, and a multitude of fresh fruits and vegetables.

2.2 Overview of Rubber Production in Thailand

2.2.1 General description of rubber production

RRIT (2012) recommends that rubber plantations should be located not higher than 600 meters above sea level. The land must be flat or hilly with slopes of less than 35 degrees. In the areas where the slope is more than 15 degrees, farmers have to make contour lines in order to prevent soil erosion. Appropriate soils have clay-loam to sandy clay-loam texture and should be fertile with top soils deeper than one meter. The favorable pH of soil varies from 4.5-5.5. Annual rainfall is to be not lower than 1,250 mm with 120-150 rainy days. Clones (budded planting material) are the key factors for the potential productivity of a rubber plantation. Thailand has achieved replanting with high yield clones in smallholdings. There are various varieties of clone. Clonal recommendations are adapted according to the different locations, weather, and specific condition of farms. RRIM600 has been widely planted due to the outstanding adaptation against disease and to the environment. RRIT 251 is promoted due to its yield being higher than RRIM600 whereas RRIT 408 is appropriate to plant in new areas. Generally, the planting density is 475 or 500 trees per hectare. Weeding between the tree lines is done 2-6 times a year during the immature stage when the frequency of weeding is high. The application of fertilizer is important for the growth of rubber trees and productivity. Most fertilizers are inorganic and may be complemented with organic fertilizers.

Several factors should be considered for level of application such as soil quality, clone, age, etc. During the immature stage, pruning is done regularly and selectively in order to produce a suitable length of trunk for tapping and to increase leaf area and growth rate. It also helps to minimize wind damage. Food crops and legumes may be grown between rubber rows as well as the nurturing of animals such as poultry, pigs, and sheep. Intercropping can generate additional income for farmers in the first three years. The intercrops should be considered carefully during the mature stage, especially arable crops will fear a possible reduction of yield and high cost of production (RRIT, 2012).

Generally, a rubber tree takes approximately seven years to come to the mature stage. It will have an economic period of more than twenty years. Latex harvesting is done through tapping, consisting of shaving rubber bark to allow latex to flow. Natural rubber can be produced throughout the year except during the winter (March-April in the South) when farmers usually stop tapping. In addition, during the rainy season (October-December), production is usually lower as latex cannot be harvested when it rains. In order to enable high return and lengthen the economic life span, farmers start to tap when the girth is 50 cm. at 150 cm. above ground level. The recommended tapping systems are S/2 d2, S/2 2d3, and S/3 2d3, but the S/3 3d4 is commonly used in smallholding plantations.

The method for tapping rubber has not been changed for years. The “Jeak-Bong” knife is used to cut a thin layer from the intact section of the bark at an angle of 30° from the top left to the bottom right in order to expose the optimum number of latex vessels. The tapping should be performed deeply enough to cut maximum latex vessels but should not reach the wood to avoid wounds that would result in low productivity in the next renewable bark. Tapping wood should also not be too thick to prevent high bark consumption that would reduce the productive life of the plantation. Latex begins to flow into a latex cup below the cut.

On tapping days, tappers will start to tap early morning or after midnight depending on tapping size, number of tappers, location, age of rubber tree, skill, and so on. In cases of tapping in the early morning, tapping tasks should be done from 6:00 – 7:00 am. Generally, the tappers will return a few hours later for collecting fresh latex between 9:00-11:00 am. When selling the collected latex will be brought to market, which can be middlemen, cooperatives, or farm groups. The working time will finish before 12 am. On the average, the total working time is about 6-8 hours. If the latex is transformed to unsmoked sheets, the farmers have a small building for processing the rubber sheets at home. The latex coagulates with acid in trays and then will be squeezed with small sheeting machines. The sheets are then hung outside on poles to dry. The sheeting tasks will be done in the afternoon from 12:00 pm to 14:00 pm. The average working time is about 10-12 hours per tapping day depending on the number of laborers, quantity of latex, and scale of sheeting. The dry sheets are sold after a week or a few times per month to middlemen or the cooperative. As the recommendation of RRIT, the appropriate number of

tapping days is less than 160 per year, but the tapping days in smallholdings can exceeded 200 days per year with an intensive tapping system or old trees. Tapping capacity per tapper is 500 trees or 7 rai per day depending on skill, location, age, biophysical properties of trees, and so forth. The skilled tapper, associated with good farm maintenance, will be able to tap rubber trees up to 35 years old. Tappers can be family labor or hired labor. The hired tappers earn by share-tapping contracts as the study will discuss in the next section.

2.2.2 Trends in rubber production and price

(1) Rubber areas

South Thailand is the first rubber producing region in terms of areas and production where climate, soil, and topography are appropriate to grow rubber trees. The first expansion was towards the east region and later to northeast and the north in the 2000s (see details in Annex A). Figure 2-6 shows rubber areas and tapped areas from 1900-2012. Although the first plantation was created in 1900, the first data available were for 1913. The recorded rubber of 1,600 hectare was presented in 1913 and substantially increased to 290,560 ha in 1941. A large expansion of new planting was observed between 1930-1941 and continued at a high rate of expansion after the war. Regarded to high expansion of rubber areas, rubber has dominated the southern economy since the 1960s. Rubber areas increased substantially during 1960-1980 from 492,800 ha in 1960 to 1.54 million ha in 1980. There was a slowdown during the 2000s and then rose gradually in the 2010s. This expansion had been caused by government programs and price responses. As a result, rubber areas expanded from 481,440 hectare in 1960 to 3.08 million hectares in 2012. Tapped areas generally increased later due to the time lag of tapping years and followed the trend of rubber expansion.

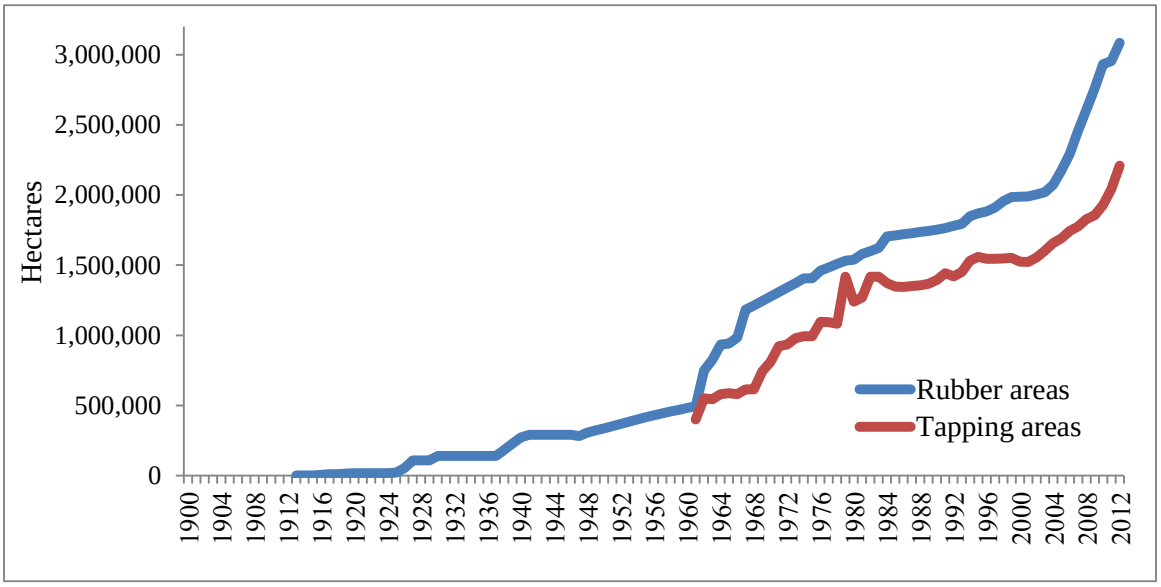

Figure 2-6 Areas of rubber plantation and tapping areas in Thailand during 1900-2012

Source: Nehmer, 1959 for data of 1900-1948; RRC, 1971 for data 1949-1960; RRIT, 2012 for data 1961-2012

(2) Rubber Production

Figure 2-7 shows the evolution of rubber production in Thailand during 1900-2012 (see details in Annex A). Rubber production steadily increased from the first records in 1906 to 1943. During WW II production closed. Rubber rapidly recovered full potential production in the post war period. Between 1948 and 1960, the increment of production had been attributed to the expansion of rubber areas.

Since 1960, production has increased continually as a consequence of rubber expansion, replanting with high yield clones, and government programs. As a result, Thailand has become one of the largest producers and exporters of natural rubber since the early 1990s. It represents about one third of the total natural rubber production in the world.

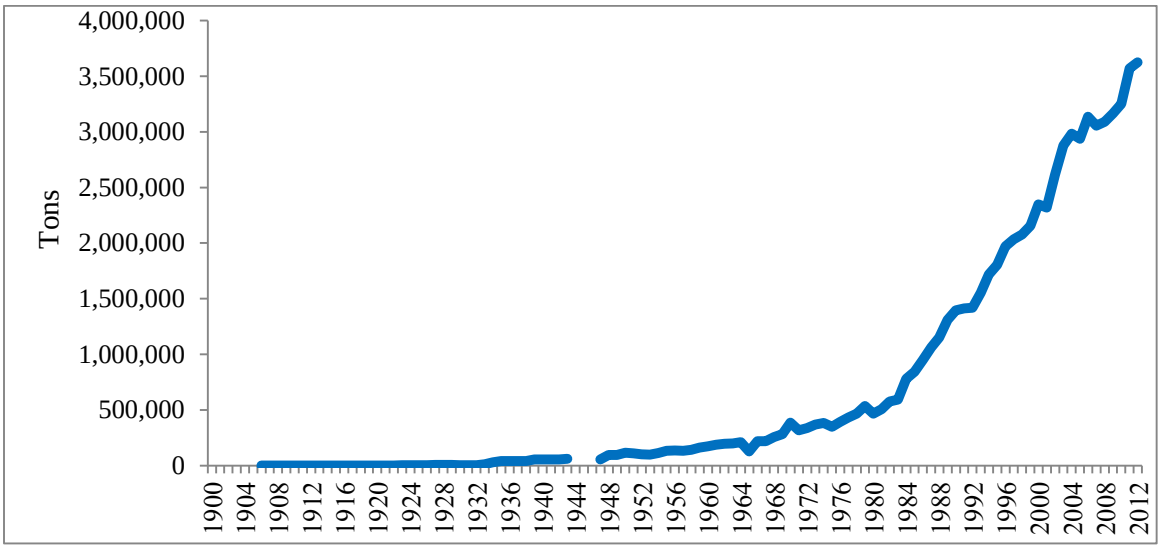

Figure 2-7 Natural rubber production in Thailand during 1900-2012

Source: Nehmer, 1959 for data of 1900-1948; RRC, 1971 for data 1949-1960; RRIT, 2012 for data 1961-2012

(3) Yields

Figure 2-8 presents the evolution of the average yield during 1961-2012. The average yield was about 400 kg per hectare during 1961-1983 because the share of plantations with low-yield varieties was still high and the replanting was progressive. Because of adoption of high yield varieties, the yield had increased continually from 570 kg per hectare in 1984 to the peak of 1,815 kg per hectare in 2004 and then steadily decreased to 1,643 kg per hectare in 2012. Decrease in yield was due to widespread expansion of rubber plants in less appropriate conditions of adopted/adapted technologies, and more exploitation of old trees.

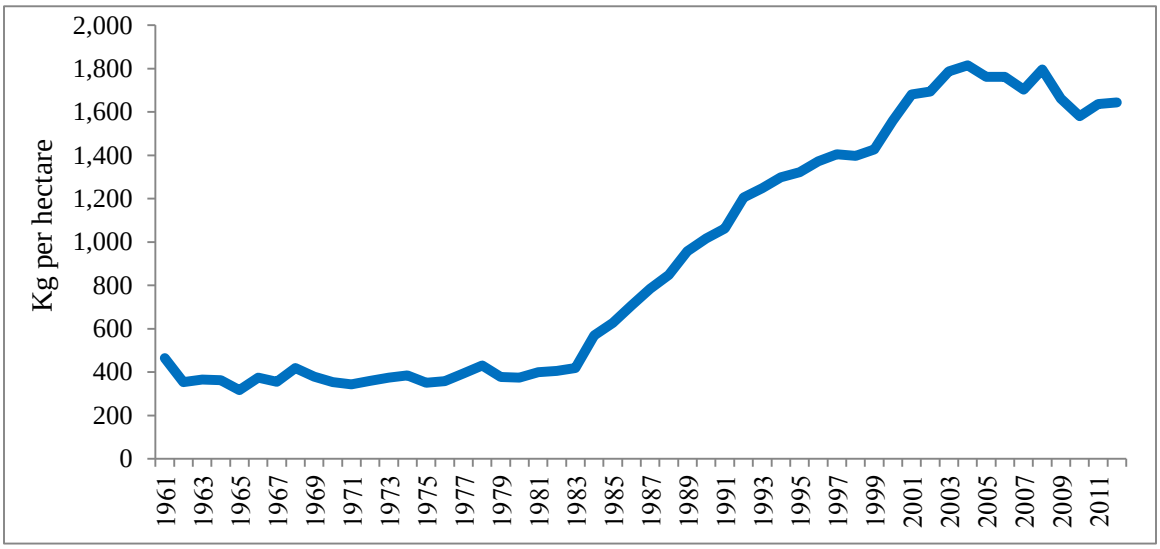

Figure 2-8 Yield of natural rubber in Thailand during 1961-2012
Source: OAE, 2012 data for 1961-1980; RRIT, 2013 data for 1981-2012

(4) Price of natural rubber

The market for natural rubber is highly competitive and prices are sensitive to even small changes in the supply and demand imbalance. The demand for natural rubber and its supply are quite insensitive to price changes in the short term. This low price elasticity to price movement causes natural rubber price to fluctuate widely (Nehmer, 1959; Haque, 1971; Grilli et al., 1980). The price of natural rubber is shown in nominal terms in Figure 2-9. Five major price peaks can be identified when rubber prices rose substantially above trend as years 1905-1910, 1950/1951, 1973/1974, 1979/1980, and 2003/2011(see detail in Annex B).

The first price boom of 1905-1910 was driven by industrialization and motorization in Western industrial countries. It was a response to high growth of automotive industries and related industries in the U.S.A. The 1950/1951 peaks could largely be attributed to the outbreak of the Korean War and heavy stockpiling by the U.S.A. However, the high growth of automotive industries also presented more direct market influencing boom conditions of demand (Grilli et al., 1980). The world motor vehicle production had increased by 34 percent in 1955. Prices had declined and fluctuated during the 1960s and thereafter showed the slowdown trend of downward prices in the 1970s (Haque, 1972). A sharp peak of natural rubber prices occurred in 1973/1974 as a consequence of the oil crisis. The subsequent increase of crude oil price substantially affected the short and the long run cost of synthetic rubber and had shifted to natural rubber which was relatively low cost (Barlow, 1978). Similarly, the 1979/1980 peak could largely be attributed to the oil crisis. After the shift of price affected by the oil crisis in 1973/1974 and 1979/1980, prices had continued to decline and fluctuated highly during 1981-2000 even when international price stabilization under INRO was conducted. A short peak in 1996 responded to speculation in the rubber market and extraordinary demand from China and Russia. The general trend of falling prices continued until they recovered in 2003.

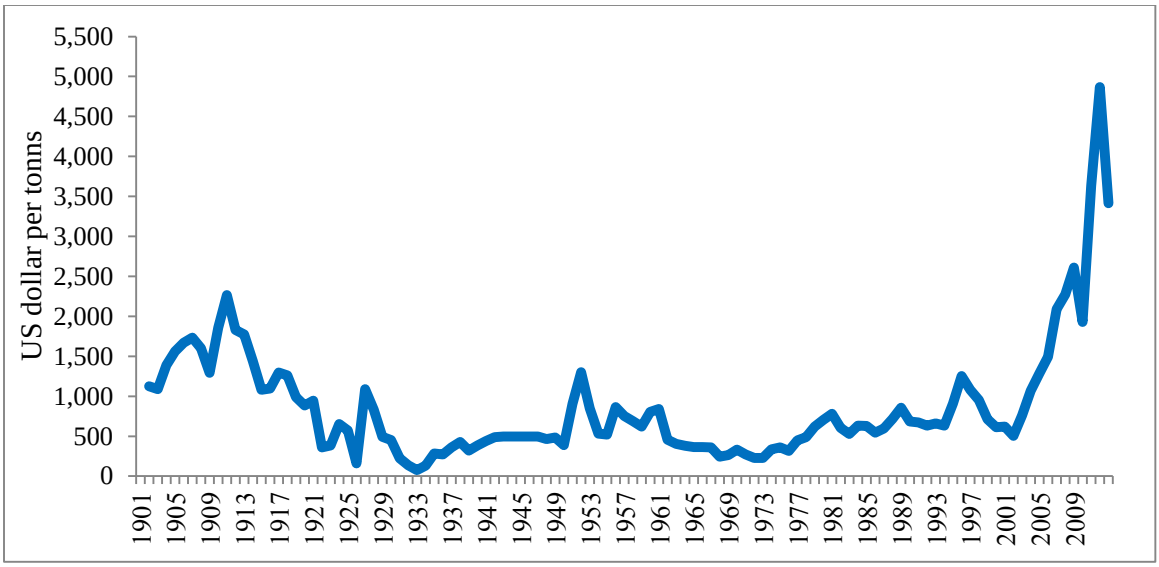

Figure 2-9 Nominal price of natural rubber in Thailand during 1901-2012
Source: 1901-1934: Nehmer, 1959 data for 1901-1934; RRIT 2013 and OAE, 2013 data for 1934-2012:

During 2003-2011, the natural rubber price had also soared above the trends. The record highs in natural rubber price in this period were the results of strong demand for tires for automotive production and growth of global demand especially from China and emerging markets together with higher oil prices. Moreover, supplies of rubber were tight due to unfavorable weather conditions some years in major producers (UNTACD, 2012). Afterward, it can be observed the slowdown of prices and its decline in Figure 2-9.

(5) Number of rubber holdings

It can be observed in Table 2-1 that in 2013 the number of rubber holdings accounted for approximately one-fifth of total holdings in Thailand. Shares of rubber holdings had risen to 6.7 percent in 1978 to 19.8 percent in 2013 or the number of rubber holding increased by about five-times from 1978.

Table 2-1 Number of farm holdings, number of rubber holdings, agriculture areas, and rubber areas according to agricultural consensus

Year	Number of farm holding		Agriculture Areas		Number of rubber holding		Rubber Areas	
	Country	South	Country	South	Country	South	Country	South
1978	3,970,510	561,289	93, 466,200	11,017,321	266,017	251,126	4,431,892	4,103,370
1993	5,647,490	799,167	118,762,944	16,271,276	539,476	490,747	9,460,678	8,266,595
2003	5,814,679	886,948	112,685,474	14,930,366	610,790	540,985	9,644,428	8,083,626
2013*	5,900,000	1,000,000	114,600,000	14,700,000	1,170,000	970,000	16,300,000	9,500,000

Sources: NSO, 1978, 1993, 2003, 2013
*Preliminary report 23-september-2013 by NSO

During the whole period, the southern region displayed the largest number of rubber holdings and rubber areas. A marginally small share was occupied by east, north-east, and north regions. Over the last decade, the number of rubber holdings gradually increased about one-time where it had dominated in the southern region and also substantially developed in north-east and north region. It is noteworthy that rubber grew continuously in terms of numbers of holdings and rubber areas. There has been a surge in numbers of rubber holdings and rubber areas during the last decade.

2.2.3 Trends in prices of farmland

Farm transformation is characterized by resource endowment of land, labor, capital, and other factors, by consequently relative prices of these resources, by different technology and by policy and institutions. Indeed, substantial increased land price reflected an allocation of land for economical profits to the farmers concerned and also indicated level of accessibility to land by small farms. In this section, the study presents the evolution of land price based on the survey because the statistical data of land prices remained unconfident and lack of accessibility.

Figure 2-10 presents the average market price of land located in the areas with suitable conditions for farmland, especially rubber plantations. The average price of land was low, less than 1,000 baht per rai, during 1950-1960 and steadily but slowly increased until 1980. The low price of land reflected the abundance in Thailand which allowed high expansion of farmland in this period. Since 1961, price of farm land rose throughout much of the post implementation of NESDP in 1961-1980. The important factors were population growth, expansion of economic crops, government policies, and declining abundance of new land. The price of land increased continually until 1990 and rose substantially during 2000-2010.

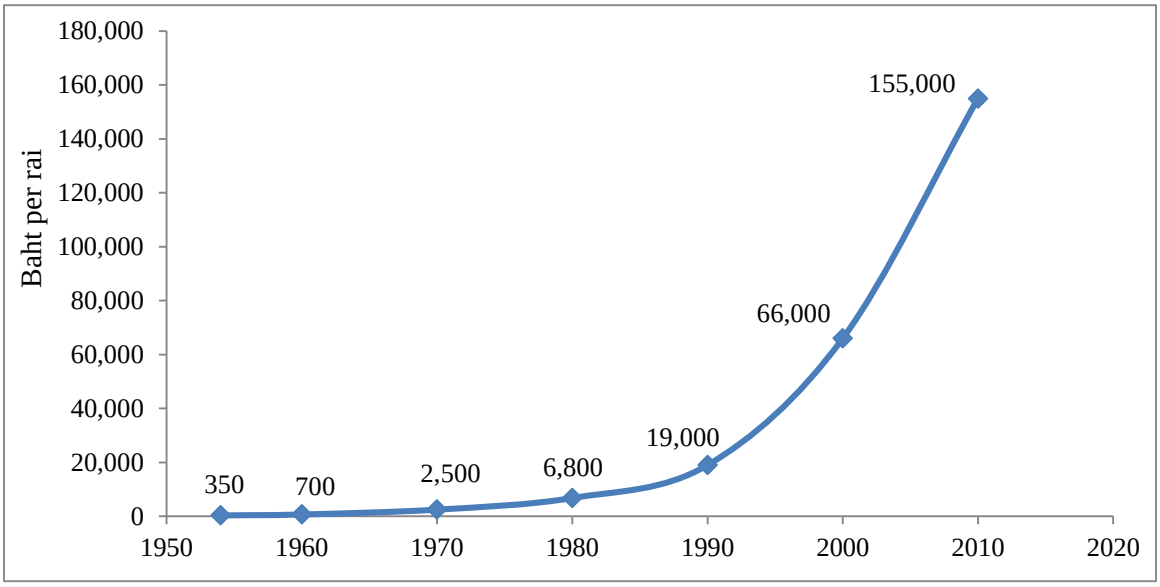

Figure 2-10 Market price of farmland in Southern Thailand during 1950-2012

Source: the survey data in 2011

During the 1960s, respondents stated that land did not have value indicating plenty of land was still available. The price of land had started to increase after the 1970s where new infrastructure and roads gradually developed. Between the 1980s-1990s, prices continued to increase where demand for farmland increased due to positive returns from rubber over other crops as well as rising pressure of population. Since 2000, the rising price of farmland was related to the rubber boom together with high economic development in the non-farm sector inducing competition between farm and non-farm sectors for land use. However, the price of land depended on many factors to explain the variations in price with such importance as location, size, land tenure, soil quality, topography, land types, competition, local institutions, and so forth. All factors played a role in determining the market price for parcel-specifics.

2.3 Characteristics of the Respondents

2.3.1 Gender and age of household heads

The distribution of respondents by gender and age is shown in Table 2-2. The dominant figure of household heads was 59.3% male and 40.7% of female reflecting the fact that men were traditionally the household head. The age of household heads ranked from 20 to 83 years with an average of 46 years. Age above 40 years constituted a larger part, about 62.5% of household heads.

Table 2-2 Gender and age of household heads

Items	Nb. of sample, n=393	%
Gender		
Female	160	40.7
Male	233	59.3
Age (year)		
20-30	47.0	12.0
>30-40	100.0	25.5
>40-50	111.0	28.2
>50-60	83.0	21.1
>60	52.0	13.2
Mean	46.0	
Min, Max, SD, Skewness	20.0, 83.0, 13.0, 0.35	

2.3.2 Education of household head

Table 2-3 shows the distribution of respondents' education level. All farmers had some education even if some of them only completed informal education which meant that they attended temple schools and offices of informal education. Generally, farm household head aged over 40 years had attended to primary or lower primary school corresponding to Thailand's education system which has required children to attend four years of school since 1921. The great changes in education have occurred in the past 20 years when educational law has required

six years for primary education since 1980, in recent times, with nine years for secondary school level by the current law, which all children seem to be achieving. Thus, it appears that the education level of household heads has been relative in accord with requirements by law.

Table 2-3 The education of household heads

High level of educations	Nb. of sample, n=393	%
Primary school or lower level	239	60.5
Secondary school level	50	12.7
High school level	33	8.4
Diploma	20	5.1
University	19	4.9
Informal education	33	8.4

2.3.3 Household size and family labor

Table 2-4 shows that the majority of households have below five family members. The average was 4.3 people per household. Table 2-5 presents the composition of family members by age group. The households consist of husband, wife, their children, and elderly parents. The data also show that females constitute slightly larger family membership than males.

Table 2-4 Family members of the respondents

Family member	Nb. of sample, n=393	%
1-2	49	12.5
3-5	270	69.2
6-7	62	15.0
>7	12	3.3
Mean	4.3	
Min., Max., SD.	1, 10, 1.5	

Table 2-5 Family structure of household according to age group and gender

Group of age (year)	Male	Female	Total (%)
0-14	0.4	0.5	0.9 (20.9)
15-24	0.4	0.4	0.8 (18.6)
25-35	0.3	0.4	0.7 (16.3)
36-59	0.7	0.7	1.4 (32.6)
>=60	0.2	0.3	0.5 (11.6)
Total (%)	2.1 (46.5)	2.2 (53.5)	4.3

Table 2-6 presents the composition of family members according to family labor and activities. Family members aged ≥ 15 years who was old enough to become available for the family labor force was 3.4 persons per household. 2.1 persons engaged full-time in farm activities and 0.5 persons working full-time with non-farm employment. 0.8 persons were not

available for work because either they attended at high school, university or they were housewife, elderly man, or persons with health problems. Males participated a little bit more in farming operations contrasting with females who were more occupied by non-farm activities.

Table 2-6 Family structure of household according to gender, available of labors and their activities

Items	Male	Female	Total (%)
Family member	2.1	2.2	4.3
Family member aged ≥ 15 years	1.7	1.7	3.4 (79.1)
Attended Education	0.3	0.3	0.6 (14.0)
Farm labor	1.1	1.0	2.1 (48.8)
Non-farm labor	0.2	0.3	0.5 (11.6)
Not working	0.1	0.1	0.2 (4.7)

2.3.4 Landholding

Table 2-7 presents the distribution of respondents by size of their holdings. The landholding size ranked from 0.1 to 312 rai with the average of 20.7 rai per house (3.3 ha). The majority of respondents had landholdings less than 30.0 rai, reflecting the dominance of small holding farms. Almost a quarter of respondents had less than 5.9 rai with the average size being 2.7 rai. In contrast, 5.9% of respondents had landholdings over 60 rai with the average size of 104.9 rai. So land distribution was very unequal. 21.4% of the smallest-sized farm households owned only 2.6% of the total land area in this sample. On the other hand, 5.9% of the respondents who had landholding of more than 60 rai, constituted 29.6% of the total owned land.

Table 2-7 The distribution of household according to landholding

Class size	Nb. of sample n=393	Average of size (rai)	% of owners	% of owned land
Less than 5.9	84	2.7	21.4	2.6
6 – 14.9	131	9.8	33.3	15.7
15 – 29.9	92	19.3	23.4	21.8
30 – 44.9	44	34.3	11.2	18.5
45 – 59.9	19	50.1	4.8	11.7
≥ 60	23	104.9	5.9	29.6
Mean	20.7			
Min, Max, SD.	0.1, 312, 28.3			

2.3.5 Agricultural experiences of the respondents

Table 2-8 shows agricultural experience for the respondents in terms of number of years. The average agricultural experience was 23.2 years, ranging from one to 64 years. There is positive skewed distribution reflecting a large portion of long agricultural experience for the total respondents. Considering the economic life span of plantations with more than twenty five years,

about 50% of the respondents had experience enough to carry out more than one life cycle of a plantation.

Table 2-8 Agricultural experience of household heads

Agricultural experience (year)	Nb. of sample	%
<5	24	6.1
≥5-10	54	13.7
>10-20	115	29.3
>20-30	110	28.0
>30-40	56	14.2
>40	34	8.7
Mean	23.2	
Min, Max. SD. Skewness	1.0, 64.0, 13.0, 0.54	

Remark: agricultural experience is a working year in the farm

2.3.6 Rubber based farming systems

It can be observed in the studied areas as seen in Table 2-9 that there are seven main types of rubber based farming systems: mono-rubber, rubber-rice, rubber-fruits, rubber-oil palm, rubber-livestock, rubber intercropping, and rubber-integrated farming systems.

Rubber and other crops can be grown in the same plot as rubber and in a different location. Intercrops are annual crops grown during the immature stage and perennial crops during the productive stage. Diversification of rubber based farming systems aims to increase diversified sources of farm income, increase utilization of land and labor, food security, and promote sustainable livelihoods. Traditionally, after slash and burn, intercrops were cultivated in-between rubber rows for 2-3 years. Afterward, rubber, mixed fruits and timber trees were established. There had been complementary farming system operations which can earn cash income and food for family consumption. After the replanting scheme was implemented, farming systems based on rubber associated other activities offered less diversification and rubber mono-culture came to dominate.

Table 2-9 Types of rubber based farming system

Types of rubber based farming system	Nb. of farms	Percentage	Average areas of rubber	Average of other activities
Rubber-monoculture	317	80.7	22.7	-
Rubber-rice	15	3.8	9.8	3.5
Rubber-fruits	22	5.6	19.3	5.6
Rubber-livestock	18	4.6	11.0	-
Rubber-Oil palm	14	3.6	27.0	12.0
Rubber-integrated	10	2.5	12.0	4.0
Rubber-intercrop at immature stage*	45	-	-	-

Remark: rubber-intercropping at immature stage often changed into others at the current period

As seen in Table 2-9, rubber-monoculture accounted for a large proportion in the studied areas. Accordingly, the farming system of rubber associated/intercrop with rice, fruits, and livestock gradually has converted into rubber-monoculture in the last decade in response to high rubber price. Other reasons were high production cost, low availability of labor, price fluctuations, increased change of weather, and deficiency of investment. Rubber-rice systems had been widely applied in the lowland. The main objectives were family consumption and surplus for earning income. Rubber based farming systems tended towards diversification in the upland. Rubber had intercropped with fruits, timber trees, traditional vegetables, and annual crops, which were generally planted in different sites and intercropping in the same plot. Sala and hreang were economically valuable crops that commonly were intercropped with rubber. Fruits were often mixed in the same plot such as durian, sala, rambutan and longong, etc. This was widely applied by smallholdings in Ban Koa-phra and Ban Lohan.

In the example of the rubber-livestock farming system, types of livestock were cows, poultry, and goats. Poultry commonly had varied to rise for home consumption. About 2-6 cows were primarily raised that could be occasionally sold for additional income each year. This farming system had been favored by smallholdings because of the low cost of production, a few working hours per day, and high prices. However, the reduction of grass land apparently constrained this farming system.

Rubber-oil palm substantially increased in terms of number of farms and areas in response to new cash crops, intensive labor technology, and government extension. This farming was widely applied in the lowland to replace old rice areas and flood land. High investment and high price of input constrained to be adopted by smallholdings. The rubber-integrated farming system was mixed farming of more than two farm activities such as rubber-rice-livestock, rubber-fruit-livestock, and rubber-rice-fish. Because of low availability of labor, high production cost, and high rubber prices, this farming system gradually decreased and further tended to appreciate two economical farm activities or rubber-monoculture. In cases of rubber-intercrop at the immature stage, about 14.2 percent of total households had experience with rubber-intercropping at the immature stage such crops as pineapples, corn, ground peanuts and other vegetables. However, when rubber grew over 36 months, farming system changed to other types.

2.3.7 Non-farm activities and their roles in households

It can be observed in Table 2-10 that about 48.8 percent of total households had some family member engaged in non-farm activities. Non-farm activities here include self-employment and wage employment. The main non-farm employments were manufacturing, services, government office, and self-employment (own-business, trade, wholesalers, services and grocery shops). Industrialization and the growth of the rural economy has brought great non-farm employment during the last decade, especially manufacturing, services, trades, and exports.

Respondents presented that the average share of non-farm labor increased from 0.13 person per household in 1990 to 0.50 persons per household in 2010. Non-farm activities played important roles by increased household income contributing to improving livelihood and by influencing farm activities with potential implications for investment in production.

Table 2-10 The distribution of household according nonfarm activities

Characteristics	Nb. of sample, n = 393	%
Non-farm activities	192	48.8
Type of nonfarm activities		
- Self-employment	66	34.3
- Manufacture, companies and services	52	27.1
- Government officers	51	26.6
- Paid laborers and workers	23	12.0

Young laborers and highly educated laborers tended to be employed by non-farm employment regarding to a high level of education, skills, labor attributions, and high accessibility to employment opportunities. Often parents also had encouraged them to enter the non-farm labor market because of relative earnings being higher than the farm activities, land constraints, price fluctuation, and risks in farm production. They were employed by government offices, manufacturing, companies, and service. In the last decade, the growth of the rural economy and expansion of industry deliberated high growth of self-employment, especially wholesalers, shops, trade, and services. Typically, these self-employments were mostly established and managed by young laborers.

Middlemen in latex collection mostly associated with rubber production as a part of the farm enterprise. Moreover, family labor with less education and smallholdings strongly relied on wages as workers and paid labor in manufacturing, industry, trade, construction, and other private services. They were driven to find alternative activities to sustain or improve livelihood, to manage risks, to cope with income shocks, and investments in the farm and other assets.

2.4 Methods for Analyzing Farm Trajectories

2.4.1 Methodological approaches for analysis of farm trajectories

The aim of analyzing farm trajectories is to understand processes of structural and/or organizational changes over a defined time period with respect to farm outputs, land, labor, farming systems, and reactions to policy reforms. A farm trajectory consists of a series of farm stages and deterministic patterns related to major periods in the farm life cycle or in the history of the farm household. Analyzing a farm trajectory is complex because many internal and external drivers of change are involved and these may vary over time. The analysis should also assess the degree of change at both farm and family levels as well as the links between the two (Garcia-Martinez et al., 2009; Rueff & Gibon, 2010). The “pre-specific method” (Rosenberg &

Turvey, 1991) or quantitative methods can be used to build farm trajectories (Landais, 1998; Iraizoz et al., 2007).

The pre-specific method assesses general trends of change and the process of change based on the knowledge of local experts and judgments made by researchers. In this method, researchers constructed indicators to measure structural change, functional change, and their successive stages. In-depth interviews, focus groups and local historical documents are classical methodological approaches used to identify a farm typology over time.

The pre-specific method was applied by Capillon (1993) to describe the history and structure of farms in central France. Mottet (2005) also employed this approach to analyze the transformation of a livestock farming system in a mountainous area of France. This qualitative method provides a graphic presentation in the form of a phylogenetic tree that describes the trajectories of change (Capillon, 1993; Perrot et al., 1995; Landais, 1998; Mottet, 2005). The results are validated by the farmers, key informants, and local experts. The pre-specific method yields an accurate typology of farms and a representation of how they change. As the sample of farms is usually small, its cost is limited, making it a useful method for building typologies. However, as it is based on the knowledge and judgment of researchers, it is subjective and could exclude or ignore certain trajectories, hence reducing the quality of the analysis. The lack of statistical interpretation also prevents the identification of homogenous groups (Landais, 1998; Iraizoz et al., 2007).

The quantitative method based on multivariate analysis is widely used to analyze typologies of farming systems and farms (Landais, 1998; Kobrich et al., 2003). Iraizoz et al. (2007) stated that many farm typologies were weakened by falling to the different process of farm development and could not capture the dynamics of structural change due to use of data for a single year. Multivariate analysis relying on data for a single year has limited the ability of such analysis to what Landais (1998) called "*the evolution trajectories of farms*". Cots-Folch et al. (2009) expanded the application of multivariate analysis and cluster analysis to identify farm trajectories of change in a Mediterranean mountain environment by using two sets of data collected in 1986 and 2005. Garcia-Martinez et al. (2009) also applied this approach to identify the trajectory of a cattle farming system and the drivers of change in the Pyrenees between 1990 and 2004. Rueff et al. (2012) used this approach to analyze long-term farm and family trajectories for the years 1950 to 2003 also in the Pyrenees Mountains (France). Although these authors (Cost-Folch et al., 2009; Garcia-Martinez et al., 2009; Rueff et al., 2012) used a limited set of variables and small sample, they succeeded in identifying meaningful trends and assessing the development paths of family farms.

Rueff and Gibon (2010) argued that multivariate statistical techniques used to analyze long-term farm and family trajectories allowed to identify both the scale of change and the

relationship between the farm and the family's temporal pattern of change. However, the method used for the analysis of trajectories of change was no proven formal procedures to assess the trajectories of farms (Iraizoz et al., 2007; Rueff & Gibon, 2010; Rueff et al., 2012). Multivariate analysis was shown to be quite efficient in giving a dynamic view of change in each trajectory, but up to now, the studies of multistage was limited. The difficulty was the link of the intermediate stage, especially when two farms that were the same type at the initial and the final stages of the period analyzed could have changed in different ways. This is particularly true in the case of a long study period. Moreover, researchers who establish farm trajectories of change must be sure that the pathways represent real farms, but no formal procedure has been developed to validate results and to perform optimality tests. The aim of the present study is to overcome these two main methodological limitations to the analysis of farm trajectories of change.

2.4.2 Multivariate analysis and analytical procedures

This study uses multivariate analysis to build a typology of farm trajectories. Six steps are employed: 1) determination of the specific theoretical framework for typification, 2) selection of variables 3) collection of data 4) factor analysis 5) cluster analysis and 6) validation (Escobar & Berdegue, 1990; Kobrich et al., 2003; Valbuena et al., 2008).

In the first step, the study identified the purpose of classification (i.e. analyze the change of rubber family farms in southern Thailand) and proposed the hypothesis (i.e. polarization of farm structure during the past 20 years). In the second step, consistent with our hypothesis, the study identified appropriate variables to assess farm changes over time (Kobrich et al., 2003). The selected variables were judged to assess changes over time measured from the start of the time period to the present. It was also necessary to assess the set of the variables that was relevant to the problems being investigated (Aldenderfer & Blashfield, 1984). A review of the literature was conducted to identify variables that had been theoretically or empirically linked with farm trajectories. These variables presented data availability, relevance to the research objective, and the quality of information (Kobrich et al., 2003; Iraizoz et al., 2007). Monetary variables were discarded because of high inflation and because data were missing for the initial year (1990) and for the intermediate year (2000). The study selected a set of qualitative and quantitative variables of farm structures. Land, labor, and demographic variables were suitable for analysis of the farm trajectories. The study used primary data from our own field surveys collected during the third step. Each variable had a value for the three stages (initial, intermediate and final).

In the fourth step, using the Kaiser-Maiser-Olkin measure and Bartlett's sphericity test, the study checked if the selection of variables was appropriate for principal component analysis to highlight the correlations among the variables (Kobrich et al., 2003). A Kaiser-Maiser-Olkin value greater than 0.5 and the significance of Bartlett's sphericity test at a probability value $p<0.000$ were used as thresholds to indicate their fitness for the analysis (Kobrich et al., 2003).

Principal component analysis with varimax rotation was performed on the selected variables that reduced the number of factors to the extracted factors and further known to be correlated. Principal component analysis with varimax rotation obtained factors with orthogonal helped to avoid multicollinearity among the variables used in the cluster analysis. Factor analysis defined correlation among variables that constructed multidimensional space of variables in each factor and analyzing the nature of interrelationships among a typically large number of variables by defining a set of common underlying factors (Iraizoz et al., 2007). The correlation matrix to eliminate uncorrelated variables and the one with lowest coefficient of variant of each pair with linear dependence were analyzed (Kobrich et al., 2003). Each selected variable had a variance greater than 0.5. Factors with eigenvalues >1.0 or more were selected as factors for cluster analysis (Kobrich et al., 2003; Iraizoz et al., 2007; Cots-Folch et al., 2009).

In the fifth step, the study performed a cluster analysis, using a combination of hierarchical and non-hierarchical methods to identify farm trajectories. A hierarchical method was used to identify a preliminary number of clusters, clustering outlines, and profiles of the cluster centers; then the observations were analyzed by a non-hierarchical method to achieve the final cluster solution (Hair et al., 2010). The combination of these two methods allows benefiting from the advantages associated with hierarchical and non-hierarchical methods while at the same time minimizing the drawbacks (Punj & Steward, 1983 cited by Iraizoz et al., 2007).

The study applied the hierarchical cluster analysis technique using squared Euclidean distances and Ward's aggregation method to identify the number of clusters and the center of the cluster. The agglomeration coefficient and the dendrogram were used to identify preliminary number of clusters. Agglomeration coefficient presents the two clusters that are combined at each stage and the increase in heterogeneity (reduction in within cluster similarity) that occurs when two clusters are combined. The observation in a sudden jump upwards in the agglomeration coefficient was used to identify a potential cluster solution. The graphical result is a dendrogram, which presents a hierarchical tree structure. The hierarchical clustering method requires a certain degree of familiarity with the data to be able to decide where to cut the hierarchy (number of clusters) and how to interpret the resulting groups. A cutting line on the dendrogram was established subjectively to identify the number of clusters by plotting the number of clusters against the change in the fusion coefficient. In the following step, a non-hierarchical clustering technique was applied in order to assess the stability of the final cluster solutions in which the hierarchical results were used to determine the initial value of K-mean and then nonhierarchical clustering developed to optimize cluster solutions by reassigning observation until maximum homogeneity (similarity) within clusters is achieved (Hair et al., 2010).

In the sixth step, analysis of variance (ANOVA) was further carried out to test the validity of the cluster solution and the resulting profiles (Kobrich et al., 2003; Iraizoz et al.,

2007; Cots-Folch et al., 2009). Discriminant analysis was also applied on the retained variables for proposing to test homogeneity of variance and absence of multicollinearity. This method considered to produce more accuracy the actual configuration from the views of a farm trajectory.

2.4.3 Systematic clustering technique

The study developed a systematic clustering technique to capture the farm change over time by measuring the change of clusters from the start of the time period to the present and to further analyze the dynamics of structural change of the farms. There is a repeated clustering technique, which the study called "a systematic clustering technique". This method allowed to specify temporal farm changes at different stages called a "farm pathway", and to test the robustness of types of farm trajectories previously identified with the multivariate statistics analysis on the variables for the whole study period. Following the same procedures used for the first method (2.4.2), the study made three typologies of farms: one at the initial date (1990), one at the intermediate date (2000) and one at the final date (2010). The study selected a ten-year period because it enabled this study to measure the amplitude of on-going changes and was easily captured. The four steps of the analysis were: 1) selection of variables 2) principal component analysis 3) cluster analysis and 4) identification of patterns of clustered farm pathways.

In the first step, variables were the same set as section 2.4.2 accounting the value of the variables at three time periods. The specific value of variables chosen to partition farms present: the value in the initial (1990), intermediate (2000), and the final (2010). The values of variables in 2010 were selected to establish systematic clustering in order to identify the number of clusters and clustering profiles which would be retained to apply in the cluster analysis based on the value of the variables in intermediate (2000) and the initial year (1990). There were two reasons for building systematic clusters based on the value of the variables at the final year (2010). Firstly, there was the current situation of the farm which was reasonable to track back patterns of farm change and its succession. The second was that it was necessary to capture the differentiation of farm changes and to account for the variety in temporal succession of the farms with respect to long-term farm development.

In the second step, factor analysis was employed on the value of variables in the final year (2010), using the same procedures used for the first method (2.4.2, in the fourth step). In the third step, the retain factors used for cluster analysis using the same procedure as 2.4.2 (in the fifth step). The significant differences among clusters were verified by analysis of variance (ANOVA). Therefore, the study identified cluster of farms, which were coded by numeric cluster and clustering profiles.

These retained number of clusters were used for the cluster analysis on the values of variables in the intermediate (2000) and the initial year (1990), respectively. Following the same procedures used for the first method (2.4.2), the study made three typologies of farms: one at the initial date (1990), one at the intermediate date (2000) and one at the final date (2010). As the results of these three clustering analysis for the three dates (1990, 2000 and 2010), each observation (individual farm) could be identified with a cluster numeric code. Thus, each individual farm could get a combination of three cluster numeric codes based on the values of variables in 1990, 2000 and 2010, which the study called "*patterns of clustered farm pathway*". The number of clusters would be characterized temporal farm structure; this was individual farm change overtime observing through the change in clustering numbers during the three time-periods.

In the fourth step, once patterns of clustered farm pathways were identified, they were all regrouped according to the typology of farm trajectories established with the first clustering method (2.4.2). Patterns of clustered farm pathways allowed us to identify different individual farm trajectories, to highlight the dynamic views of farm change, and to reveal structural linkages between the initial, intermediate and the final periods. The study compared the typology of farm trajectories established using the systematic clustering techniques at different years with trajectory typologies produced by multivariate analysis (2.4.2) performed on the complete data set to test the robustness and reliability of the results.

2.4.4 Field validation of the types of farm trajectories

Once the study checked the consistency of the trajectory typologies obtained from the two methods, the study validated the results in the field by interviewing representative farmers and local experts. The knowledge and points of view of the experts completely summarized overall change, structural trends, and the impact of change. The objective was to compare the results of the statistical analysis with data from real farms and the experts' points of view to confirm and validate farm trajectories. In doing in-depth interviews conducted with farmers in representative sub-samples of each of the six farm trajectories as well as with experts confirmed that this study's typology of farm trajectories represented real farms and was not invented by the data or by the statistical analyses. These interviews also gave this study a deeper understanding of their past development, the process of change, and of their impacts on the farms.

2.5 Typology of Farm Trajectories

2.5.1 Multivariate analysis for analyzing typology of farm trajectories

1) Selection of variables

From the total of 393 rubber farmers interviewed, 220 provided complete data for the period 1990 to 2010. These 220 respondents were therefore retained for this study (number of sample analyzed detailed in Table1, Annex C). The 19 variables selected are listed in Table 2-11. Each variable had a value of the variable at three time-periods: subscript by 1990, 2000, and 2010, giving total of 57 values.

The first group of variables was related to the land, size of the landholding, total area under rubber, area under mature rubber, area under immature rubber, share-tapping area (area belonging to the farmer and tapped by hired laborers), off-farm area (area tapped by the farmer but belonging to another farmer), amount of land per laborer, and amount of land under mature rubber per laborer. The second group of variables was related to labor: number of family workers, family tappers, hired tappers, non-farm laborers (family labor working outside agriculture sector), off-farm laborers (family labor working for other farmers), and the use of laborers. The third group of variables was related to demographics: age, gender, education, and agriculture experience of the farmer interviewed.

Table 2-11 Variables used in PCA

Variables	Descriptions and units
LHH	= landholding (rai)
RLH	= land planted with rubber (rai)
MRLH	= mature area of rubber land (rai)
OFFL	= off-farm land with rubber (rai)
SLH	= share-tapping land tapped by hired labor (rai)
LHFL	= landholding per family labor (rai per labor)
RLFL	= rubber land per family labor (rai per labor)
MRFL	= mature rubber land per family labor (rai per labor)
FML	= number of family labor ≥ 15 years (person)
FTP	= number of family tapper (person)
HTP	= number of hired tapper (person)
UFL	=1 if use only family labor, 0 if otherwise
UHL	=1 if use only hired labor, 0 if otherwise
UFHL	=1 if use family and hired labor, 0 if otherwise
UOFL	=1 if use family on farm and off farm, 0 if otherwise
UFFL	=1 if use family only off farm, 0 if otherwise
FAG	= household head (HH)'s age (year)
FGD	= 1 if HH is male, 0 if otherwise
FED	= 1 if HH finished primary school, 0 if otherwise

2) Principal component analysis

Principal component analysis was applied on 57 variables. Eight factors showed eigenvalue greater than 1.0, explaining about 85.30% of the total variance. However, five factors fallen flat components, explaining 75.3% of the total variance (see Figure 1 in Annex C). Therefore, a five-factor solution was adopted, which was more than satisfactory explaining 75% of the total variances (Haire et al., 2010). These factors had an absolute value of correlation greater than 0.5 as in Table 2-12. The Kaiser-Maiser-Olkin value was 0.800 with p-value = 0.000 indicating that the data matrix has sufficient correlation to justify the application of principal component analysis. The Bartlett's sphericity test had a significant value $p < 0.0005$, which indicates that the hypothesis that the correlation matrix is the identity matrix can be rejected (see Table 2 in Annex C). This result confirms the selected variables were fitted to form factoring and also had appropriate variables and was suitable to proceed with the PCA. The variables were reduced into the five factors (presenting eigenvalue greater than 1), which all together explain 75.3% of the total variance in the data set as shown in Table 2-12. These factors represent direction of change as follows:

Principal component 1 (PC1) shows highly positive correlation coefficients with variables of landholding, land use, and the use of hired labor in 1990, 2000, and 2010. These variables have high scores above 0.700 and contribute to about 42 % of the total variance. It means that the size of landholding is an important factor which explains the farm structure. The close correlation between landholding and rubber land indicates that landholding is mostly devoted to rubber plantations. Farms with high variance for this factor show large landholding and orientation towards rubber farm enterprises.

Principal component 2 (PC2) is positively correlated with variables of the use of hired labor in 1990, 2000, and 2010 and is negatively correlated with family tappers for the same periods. These variables have a score higher than 0.700 and they explain about 12% of total variance. This factor represents the dependence of farms towards hired labor. There is an inverse relation between the use of hired labor and number of family tappers. It means that farms use a high proportion of hired labor due to low availability of family tappers. Therefore, the high variance of PC2 expresses a farm orientation towards the dependence on hired labor.

Principal component 3 (PC3) is positively correlated with the use of family labor for off-farm tapping in 1990, 2000, and 2010 and the size of off-farm tapping areas for the same periods. They explain about 10% of total variance. This factor indicates the intensity for off-farm tapping in farms: farms with a high variance for this factor correspond to the ones with the highest participation to off-farm tapping activity for both numbers of laborers and off-farm areas.

Table 2-12 Principal components of selected eigenvalue, explained and accumulated variance, and correlation coefficients of the variables with the different PC

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
LHH_2010	**.929**	-.017	-.102	-.060	.135
LHH_2000	**.944**	.062	-.087	-.070	.166
LHH_1990	**.876**	.068	-.074	-.086	.056
RLH_2010	**.938**	-.014	-.107	-.066	.113
RLH_2000	**.948**	.063	-.092	-.076	.147
RLH_1990	**.886**	.072	-.073	-.092	.060
SLH_2010	**.899**	.128	-.026	-.023	.001
SLH_2000	**.946**	.188	-.031	-.038	.109
SLH_1990	**.823**	.250	-.032	-.065	.091
OFFL_2010	-.145	-.090	**.800**	.429	-.102
OFFL_2000	-.132	-.072	**.804**	.446	-.079
OFFL_1990	-.084	-.037	**.691**	.459	.022
LHFL_2010	**.895**	-.014	-.039	-.024	-.171
LHFL_2000	**.854**	.115	-.095	-.057	.237
LHFL_1990	**.904**	.090	-.078	-.081	.127
RLFL_2010	**.882**	-.015	-.039	-.025	-.184
RLFL_2000	**.877**	.123	-.105	-.065	.222
RLFL_1990	**.912**	.093	-.078	-.088	.135
FML_2010	-.069	-.216	.055	.061	.116
FML_2000	.068	-.137	.007	.033	-.031
FML_1990	.066	.012	-.045	-.013	-.001
FTP_2010	-.163	**-.700**	.063	.106	.017
FTP_2000	-.112	**-.764**	.041	.101	.081
FTP_1990	-.140	**-.721**	-.059	.168	.118
HTP_2020	**.781**	.374	-.066	-.049	.291
HTP_2000	**.810**	.331	-.066	-.069	.353
HTP_1990	**.728**	.326	-.003	-.072	.247
UHL_2010	.148	**.861**	-.080	-.019	.077
UHL_2000	.117	**.883**	-.076	-.012	-.029
UHL_2010	.177	**.811**	-.045	-.024	-.173
UFHL_2010	.428	-.203	-.102	-.102	**.680**
UFHL_2000	.456	-.196	-.098	-.130	**.753**
UFHL_1990	.458	-.079	-.067	-.109	**.703**
UOFL_2010	-.108	-.082	-.106	**.783**	-.079
UOFL_2000	-.128	-.099	.274	**.813**	-.129
UOFL_1990	-.085	-.059	.229	**.794**	-.005
UFFL_2010	-.131	-.091	**.743**	.071	-.113
UFFL_2000	-.079	-.018	**.772**	-.136	-.015
UFFL_1990	-.051	.010	**.743**	-.198	.032
Eigenvalue	16.54	4.78	3.97	2.15	1.92
Percentage of variance	42.42	12.26	10.18	5.52	4.92
Cumulative% of variance	42.42	54.68	64.86	70.38	75.3

Principal component 4 (PC4) has a high positive correlation coefficient with the use of family labor mixed on-farm and off-farm in 1990, 2000, and 2010, explaining about 5.5% of total variance. Farms that have the highest variance for this factor show a high percentage of family labor tapping both on-farm and off-farm. It means that family laborers work on both the owner's plantation and off-farm areas under share-tapping contracts.

Principal component 5 (PC5) is positively correlated with the variables of the use of family labor and hired labor in 1990, 2000, and 2010, explaining about 5% of total variance. It is associated with the structure of labor use in plantation. Farms that have a high variance for this factor use both family labor to tap on-farm and hired labor for their own share-tapping areas. These farms own medium-large landholdings and share-tapping land.

Figure 2 in Annex C shows the factorial plane composed of three dimensions used to interpret the relationships among variables as defined in Table 2-12.

3) Cluster analysis

A hierarchical cluster analysis was performed on the five retained factors of the PCA. The agglomeration coefficient and the dendrogram were used to choose the preliminary number of cluster. The dendrogram in Figure 2-11 shows a graphical representation of the hierarchical tree structure solution. A cutting line on the dendrogram was established subjectively to identify the number of clusters by plotting the number of clusters against the change in the fusion coefficient. The choice of a particular fusion coefficient depends on the research objectives. Cutting line A separates two large homogenous groups, "*Patterns of Evolution (PE)*". Pattern of evolution 1 (PE1) concerned 26.3% of the total of 220 samples, whose landholding and/or hired labor on the farm increased. This change represents a structural trend toward a growing farm enterprise and/or increasing dependence on hired labor. Pattern of evolution 2 (PE2) concerned 73.7% of the total of 220 samples that can be characterized by the decline of farms into small farms today. PE2 comprised farms whose landholding remained stable or decreased.

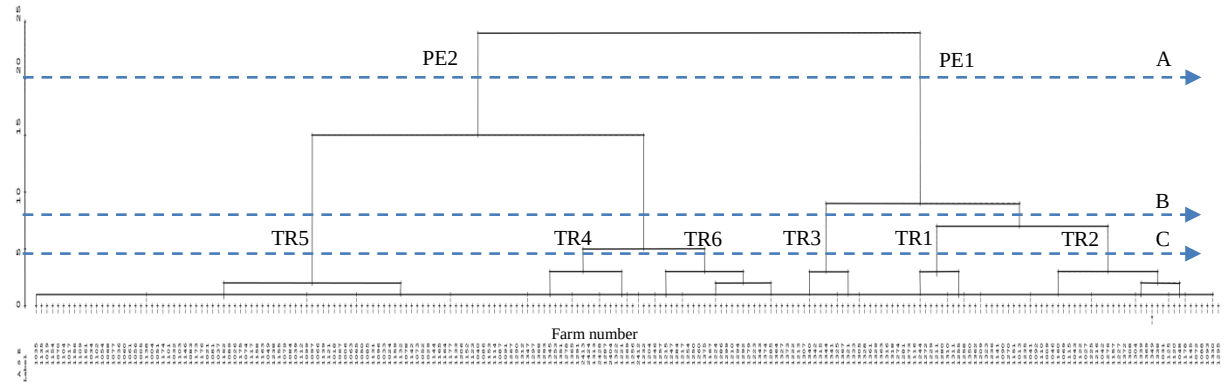

Figure 2-11 Dendrogram resulted from clustering pattern and trajectory in a total of 220 samples
Remark: Dendrogram is resized for presentation propose, see original Figure 9 in Annex C

Then, cutting line C (i.e. from line B to C in Figure 2-11) divided each pattern of evolution into smaller homogenous groups characterized by specific "farm trajectories (TR)". Six farm trajectories were adopted. Agglomeration coefficient of the Ward's cluster analysis was also used to help identify the appropriate number of clusters. The results of agglomeration coefficient are not shown here because of the same potential number of clusters by the dendrogram. The number of clusters from the hierarchical results was used as the initial value of K-mean and then developed non-hierarchical clustering until an optimal cluster solution was achieved.

A six-cluster solution was the optimum typology of farm trajectories as it gave the most significant results. Table 2-13 shows the statistics for each trajectory and quantitative change among farm trajectories. The results of ANOVA among the six-farm trajectories were statistically significant.

Pattern of evolution 1 (PE1) concerned 26.3% of farms which experienced an increment of landholding and/or hired labor. This evolution presented a structural trend toward a growing farm enterprise and/or high dependence on hired-labor. This pattern of evolution consisted of three trajectories.

Growth of large family farm enterprises (TR1); this trajectory comprised 4.1% of farms. These were large farms that experienced the biggest increment of land and use of hired labor. Landholding grew mainly during the 1990-2000 period and remained stable. The number of family tappers decreased even if family labor slightly increased. In these farms, farm family labor was mainly dedicated to farm management with limited family tapping activity. The increase of landholding associated with a decrease of family tapping labor led to employing more hired labor and the area under share-tapping increased. This trajectory presented the highest land/labor and rubber land/labor ratios.

Growth of medium family farm enterprises (TR2); TR2 comprised 14.5% of farms. Farmers experienced a moderate increase of landholding and an increase of the use of hired labor. Farms in this trajectory were the second largest for landholding. As it was the case for TR1, the increment of land holding was high during the period 1990 to 2000 and slowed down thereafter. Family labor slightly increased while the number of family tappers has remained stable in the past 20 years. Hired laborers were employed to complete insufficient family labor for all mature rubber plantations. Land/labor ratio was lower than in TR1 but larger than in other trajectories.

Table 2-13 Characteristic of selected clusters of farm households and P-Value of the one way analysis of variance

Name of variables	TR 1 n= 9	TR 2 n=32	TR3 n=17	TR 4 n=23	TR5 n=84	TR6 n=55	CLU Mean	CLU: S.D.	CLU: Min.	CLU: Max.	P-Value
No. of farms (%)	4.1	14.5	7.7	10.5	38.2	25.0					
LHH_2010	151.8	45.0	28.4	24.9	14.6	7.5	25.0	33.80	1	312.0	0.000
LHH_2000	150.4	44.4	28.1	50.3	14.6	8.6	27.7	35.70	1	300.0	0.000
LHH_1990	119.4	35.5	25.5	74.3	14.1	10.1	27.7	35.20	1	300.0	0.000
RLH_2010	137.3	44.1	28.0	23.7	14.0	6.9	23.7	31.70	1	312.0	0.000
RLH_2000	136.0	43.5	27.8	48.4	14.1	7.9	26.5	33.70	1	300.0	0.000
RLH_1990	116.1	35.0	25.0	71.5	13.5	9.4	26.8	33.90	1	300.0	0.000
MRLH_2010	116.0	35.8	22.3	21.1	12.1	3.1	19.3	28.90	0	300.0	0.000
MRLH_2000	130.6	42.8	26.6	46.7	13.4	7.3	25.5	32.50	0	300.0	0.000
MRLH_1990	100.7	34.1	25.0	65.7	13.1	8.6	25.1	29.70	0	300.0	0.000
SLH_2010	106.0	20.8	22.3	13.6	0	0	10.5	28.50	0	300.0	0.000
SLH_2000	122.1	27.2	24.7	35.3	0	0	14.5	32.70	0	300.0	0.000
SLH_1990	90.4	17.5	23.1	57.3	0	0	14.0	30.50	0	200.0	0.000
OFFL_2010	0	0	0	0	0	13.4	3.5	7.10	0	45.0	0.000
OFFL_2000	0	0	0	0	0	11.4	2.9	6.60	0	45.0	0.000
OFFL_1990	0	0	0	0	0	5.4	1.3	4.70	0	27.0	0.000
LHFL_2010	50.6	13.4	13.0	12.4	5.2	2.4	11.3	23.80	0.02	312.0	0.000
LHFL_2000	52.1	16.3	13.7	16.3	5.5	3.3	11.3	14.40	0.05	100.0	0.000
LHFL_1990	51.2	15.6	11.7	20.6	6.1	4.6	11.2	12.90	0.05	100.0	0.000
RLFL_2010	45.8	13.2	12.9	11.8	5.0	2.3	10.9	23.60	0.05	312.0	0.000
RLFL_2000	47.1	16	13.5	15.7	5.3	3.0	10.7	13.00	0.05	100.0	0.000
RLFL_1990	49.8	15.3	11.6	19.8	5.9	4.2	10.8	12.50	0.05	100.0	0.000
MRFL_2010	38.7	10.7	10.2	10.5	4.3	1	8.9	22.40	0.05	300.0	0.000
MRFL_2000	45.2	15.8	12.9	15.1	5.1	2.8	10.4	12.70	0.05	100.0	0.000
MRFL_1990	43.1	14.9	12.2	18.2	5.7	3.9	10.3	11.40	0.05	75.0	0.000
FML_2010	3.0	3.2	2.2	2.0	2.8	3.1	2.8	1.20	1	6.0	0.000
FML_2000	2.9	2.7	2.1	3.1	2.6	2.6	2.7	0.80	1	5.0	0.015
FML_1990	2.3	2.3	2.2	3.6	2.3	2.2	2.4	0.70	2	5.0	0.000
FTP_2010	1.0	2.2	0	1.1	2.1	2.3	1.9	1.10	0	6.0	0.000
FTP_2000	1.4	2.2	0.4	1.9	2.1	2.2	2.0	0.90	0	5.0	0.000
FTP_1990	1.8	2.1	1.2	2.1	2.1	2.1	2.0	0.70	0	4.0	0.000
HTP_2010	8.7	2.8	3.1	1.8	0	0	1.2	2.30	0	12.0	0.000
HTP_2000	9.7	3.3	3.1	3.3	0	0	1.4	2.60	0	12.0	0.000
HTP_1990	7.9	2.2	2.3	5.4	0	0	1.4	2.80	0	14.0	0.000
UHL_2010	0.2	0	1	0.5	0	0	0.1	0.34	0	1	0.000
UHL_2000	0.2	0	0.8	0.3	0	0	0.1	0.31	0	1	0.000
UHL_1990	0.1	0	0.5	0.2	0	0	0.1	0.23	0	1	0.000
UFHL_2010	0.8	1	0	0	0	0	0.2	0.38	0	1	0.000
UFHL_2000	0.8	1	0.2	0.4	0	0	0.2	0.42	0	1	0.000
UFHL_1990	0.9	0.7	0.2	0.8	0	0	0.2	0.43	0	1	0.000
UOFL_2010	0	0	0	0	0	0.4	0.1	0.29	0	1	0.000
UOFL_2000	0	0	0	0	0	0.7	0.1	0.29	0	1	0.000
UOFL_1990	0	0	0	0	0	0.3	0.1	0.28	0	1	0.000
UFFL_2010	0	0	0	0	0	0.6	0.2	0.37	0	1	0.000
UFFL_2000	0	0	0	0	0	0.3	0.1	0.21	0	1	0.000
UFFL_1990	0	0	0	0	0	0.1	0.1	0.11	0	1	0.104

Toward patron farms (TR3); this trajectory concerned 7.7% of farms. The size of landholding increased slightly during the 1990-2000 period and then remained stable. Size of landholding was about two-times lower than TR2. Family labor remained stable but family tapping progressively decreased until there was no more family tapping in the plantations at the current period, and it was fully substituted with hired labor. The number of hired laborers had increased considerably. This is the only trajectory where all owners have now only non-farm activities.

Pattern of evolution 2 (PE2) was observed for a large number of farms, 73.7% of farms that could be characterized as small farms in the current period. This pattern concerned farms with stable or declining size of landholding. This pattern of evolution includes three trajectories.

High structural change of farms (TR4); this trajectory included 10.5% of farms. Farmers experienced a large decrease of landholding throughout the study period and at the same time labor change considerably decreased. The highest reduction of landholding occurred during the period 1990 to 2000 and decreased further in the 2010s. Rubber land, mature rubber land, and share-tapping areas decreased accordingly. At the same time, family labor slightly decreased. The number of family tappers also decreased. The number of hired-laborers also sharply decreased consistent with the reduction of share-tapping areas.

Stability of family farms (TR5); TR5 groups a large number of farms; 38.2% of farms were in this trajectory. It was characterized by family farms that experienced stability of landholding and use of family labor since 1990. Landholding size was comparatively small for the whole period of study. Family labor slightly increased but the number of persons involved in tapping had not changed since 1990. They engaged full-time on their own plantations and did not need to employ hired labor. It was the only trajectory where the size of mature rubber land was in line with the tapping capacity of family labor. Land per labor therefore was the second lowest of all trajectories.

Declining very small farms (TR6): TR6 was observed for 25.0% of farms. This trajectory was characterized by farms that owned very small landholding and used only family labor. Landholding was comparatively small in 1990 and slightly decreased throughout the period of study. The number of family tappers slightly increased regarded the increase in family labor. Small landholding and availability of family tappers caused the adoption of off-farm land under share-tapping. It was the only trajectory where farms had off-farm lands. Off-farm areas under share-tapping sharply increased during 1990 to 2000 and slightly increased thereafter. As a result, in 2010, size of off-farm was larger than the owner's plantations. The ratio was reversed during the period. Mature rubber area was at the lowest in the 2010s due to the replanting of old rubber trees. Farms in this trajectory had the lowest land/labor.

Six trajectories have been significant in different structural changes and characteristics as Table 2-14 shows. The study had observed that growth, decline, and stability were significant trends of trajectories. Stability of family farms was dominant in rubber farm holdings. Growing farm structure was characterized by the proportion of large and medium family farm enterprises (TR1 and TR2) and might include movement toward patron farms (TR3). These trajectories tended to increase landholding and the use of hired labor. A significant decline in the structure of farms was observed in the trajectory of high structural change of farms (TR4) and might include cases that farm structures had already been very small by trajectory of declining very small farms (TR6).

Table 2-14 Six farm trajectory characteristics

	Land size in 2010	Evolution of the size	Labor use (type of labor) in 2010	Family labor (tapper)	Hired-labor (tapper)
TR1: Growth of large family farm enterprise	Large farm	Increase	Hired labor	Decrease	Increase
TR2: Growth of medium family farm enterprise	Medium farm	Increase	Mixed hired labor and family labor	Tend to increase	Increase
TR3: Toward patron farms	Upper small farm	Increase	Hired labor	No more family tappers	Increase
TR4:High structural change of farms	Upper small farm	High decrease	Mixed hired labor and family labor	High decrease	High decrease
TR5: Stability of family-farms	Small farm	No change	Family labor	No change	-
TR6: Declining very small farms	Very small farm	Decrease	Family labor	Slightly to increase	-

In order to validate significant farm trajectories, a discriminant analysis was performed on the retained variables. Table 3 in Annex C shows that only five functions are displayed. A large eigenvalue by function 1, 2, and 3 explained about 63.8%, 17.2%, and 9.1% of variance. High canonical correlations indicate that there were extreme discriminations among clusters. Wilks' lambda was highly significant with $p < 0.000$. The lambda of 0.000, 0.002, and 0.020 had a significant value that provided the proportion of total variability not explained about 0%, 0.2%, and 2.0% by the differences among clusters. Thus, six farm trajectories appeared to differ as in Table 4 in Annex C.

Figure 2-12 shows that the canonical discriminant function is very useful to visualize the relationship between six farm trajectories. It indicates a significant distinction among trajectories where each member of trajectories plotted in the space is defined by the two discriminant functions.

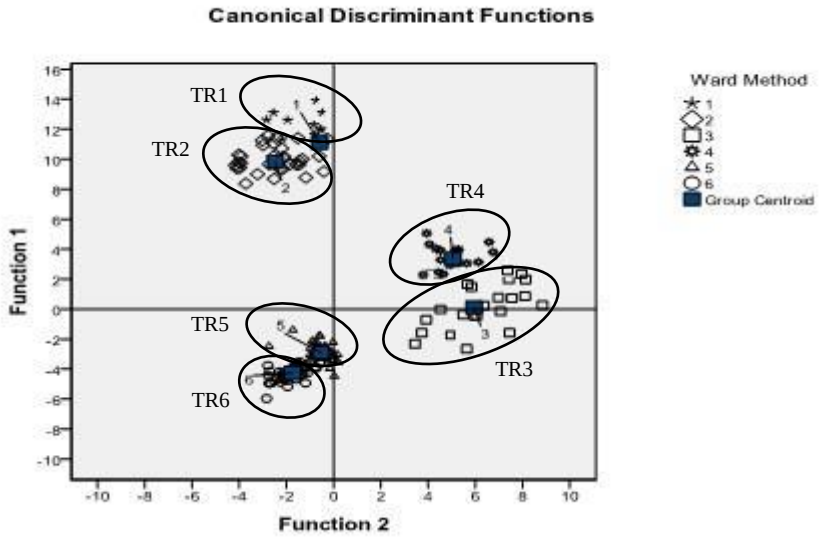

Figure 2-12 Canonical discrimination functions of six-farm trajectories

2.5.2 Systematic clustering analysis

1) Selection of variables

Nineteen variables were the same as multivariate analysis and were judged suitable for factor analysis. Variables are listed in Table 2-11. Each variable could be presented in three forms: the values of the variables at 2010 (subscript "_2010"), the values of the variables at 2000 (subscript "_2000"), and the values of the variables at 1990 (subscript "_1990").

2) Principal component analysis on the values of the variables in 2010

A principal component analysis was performed on the values of the variables at 2010. The results showed a six-factor with eigenvalue of more than 1.0, but the first four factors were retained, explaining 79.30% of the variance as Figure 3 in Annex C. The KMO test showed a value of 0.718, greater than 0.5, while the Bartlett's sphericity test was highly significant to be a satisfactory probability value $p < 0.000$ as Table 5 in Annex C. These measures indicated that the selected variables were appropriate to proceed with the PCA. The four factors can be described as follows (Table 2-15). These factors represent direction of change as follows. Figure 4 in Annex C shows the location of main variables in the tri-dimensional space defined by PC1, PC2 and PC3.

Principal component 1 (PC1) showed highly positive correlation coefficients with variables of landholding, land use, use of labor, mixed family and hired labor, and the number of hired labor. PC1 contributed to 46.83% of the total variance. It meant that the size of landholding and the use of hired labor were important factors to describe the farm structure. The highest scoring farms on this PC1 indicate large landholding and high proportion of hired labor.

Principal component 2 (PC2) was positively correlated with variables of number of family laborers and family tappers. This factor explained 14.91% of total variance. This factor represented that the higher family laborers the higher family tappers. Farms scoring high on this factor were characterized by adequate family tappers in plantations or farm orientation towards family farms.

Table 2-15 Principal components of selected eigenvalue, explained and accumulated variance, and correlation coefficients of the variables with the different PC for the value of the variables in 2010

PC	Eigenvalue	%Varian explained	% Varian accumulated	Variables	Correlation with the PC
PC1	7.49	46.83	46.83	SLH_2010	0.951
				RLH_2010	0.946
				MRLH_2010	0.946
				LHFL_2010	0.940
				RLFL_2010	0.936
				MRFL_2010	0.925
				LHH_2010	0.919
				HTP_2010	0.781
				UFHL_2010	0.512
PC2	2.38	14.91	61.74	FML_2010	0.901
				FTP_2010	0.699
PC3	1.67	10.45	72.19	UFFL_2010	0.930
				OFFL_2010	0.894
PC4	1.13	7.11	79.30	FAG_2010	0.773
				UHL_2010	0.762
				FTP_2010	-0.519

Principal component 3 (PC3) was positively correlated with the use of family labor only for off-farm tapping and with the size of off-farm tapping areas. This factor explained 10.45% of total variance. This factor indicated the intensity for off-farm tapping areas in farms. Farms scoring high on this factor had the highest off-farm tapping activity and used family labor only for off-farm tapping.

Principal component 4 (PC4) had a high positive correlation coefficient with the use of hired labor and age of household head and negative correlation with the variable of the number of family tappers. This factor explained 7.11% of total variance. Farms that had the highest variance for this factor showed an older age of household head and low available of family tappers then they employed hired-labor.

3) Cluster analysis

These four factors were retained for cluster analysis. Using the criteria outlined in 2.4.3, a five-cluster solution was adopted. Figure 2-13 shows the results of the hierarchical cluster analysis. The cutting line B yielded the most significant results with a five-cluster solution. Five clusters were adopted and each cluster was identified by a coded cluster number (CLU: 1, 2, 3, 4, 5). All individual farms were distributed in the clusters and consequently received a coded cluster number for the value of the variables in 2010. Table 2-16 profiled the cluster showing the mean values for each of the variables. It also showed the results for the analysis of variance (ANOVA) which presented statistical significance among clusters.

Following the systematic clustering procedures by the retained five-clusters, factor analysis and followed with cluster analysis as 2.4.3 section was carried out on the values of the variables in 2000 and the values of the variables in 1990 (see the results of PCA in Annex C). Figure 2-14 and 2-15 present dendrogram according to the values of the variables in 2000 and 1990, respectively. The cutting line B in each graph was considered to be optimum one for five clusters of farms to establish numeric clusters in each farm over studying time. These clusters were compared by analysis of variance (ANOVA).

Table 2-17 and Table 2-18 show the statistics for each cluster and the significant difference among clusters. There was identification of one of five-numeric clusters to code on individual farm according to the values of the variables in 2000 and the values of the variables in 1990. The characteristics distinguishing the five clusters are the following.

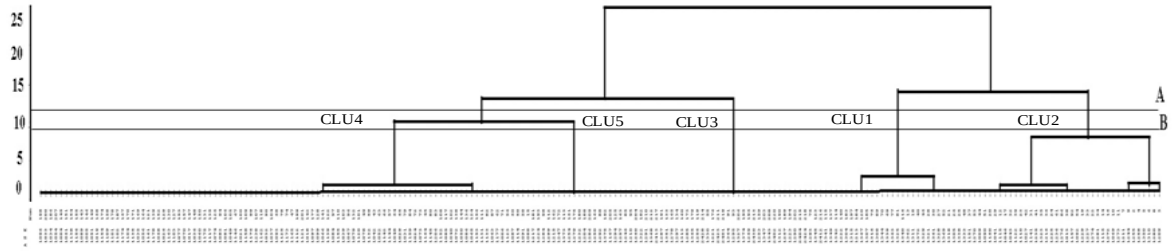

Figure 2-13 Dendrogram result from clustering farms according to the values of the variables in 2010

Remark: Dendrogram is resized for presentation proposes

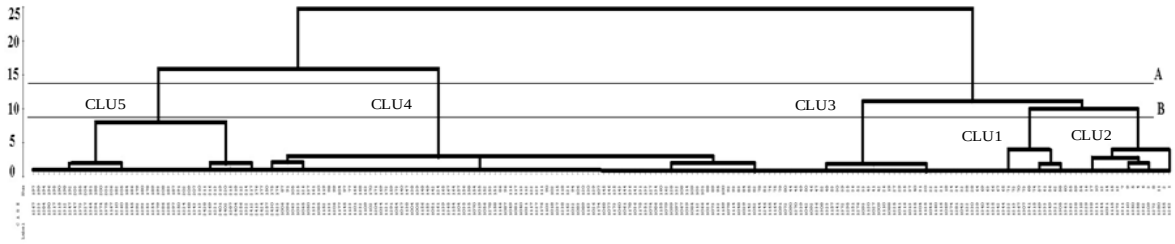

Figure 2-14 Dendrogram result from clustering farms according to the values of the variables in 2000

Remark: Dendrogram is resized for presentation propose

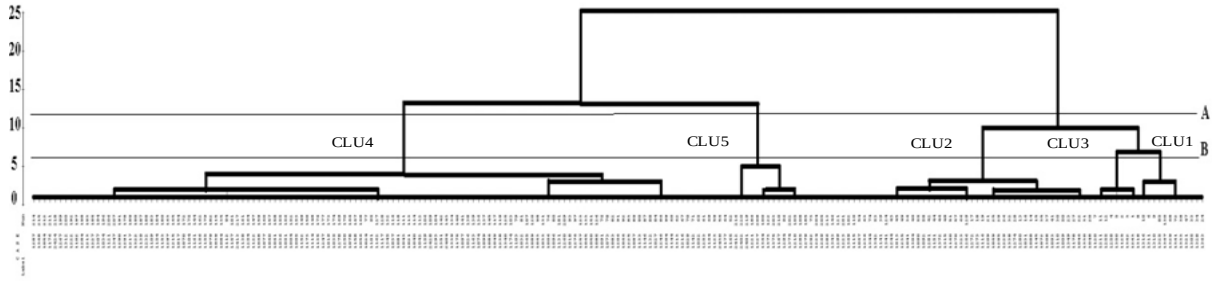

Figure 2-15 Dendrogram result from clustering farms according to the values of the variables in 1990

Remark: Dendrogram is resized for presentation propose

Table 2-16 Characteristics of the selected clusters, mean of the variables, and P-value from the ANOVA according to cluster of farms in 2010

Name of variable	CLU1 n= 9	CLU2 n=33	CLU3 n=28	CLU4 n=94	CLU5 n=56	CLU Mean	CLU: S.D.	CLU: Min.	CLU: Max.	P-Value
% of Farms	4.1	15.0	12.7	42.7	25.5					
LHH_2010	151.8	44.5	28.0	15.4	7.6	25.0	33.8	1	312	0.000
RLH_2010	137.3	43.7	27.8	14.6	7.1	23.7	31.7	1	312	0.000
MRLH_2010	116.0	35.7	24.0	12.5	3.1	19.3	28.9	0	300	0.000
SLH_2010	106.0	20.8	24.0	0	0	10.5	28.5	0	300	0.000
OFFL_2010	0	0	0	0	13.6	3.5	7.1	0	45	0.000
LHFL_2010	50.6	14.4	14.8	5.5	2.5	8.8	23.8	0.02	312	0.000
RLFL_2010	45.8	13.1	14.7	5.2	2.5	8.4	23.6	0.02	312	0.000
MRFL_2010	38.7	10.7	12.7	4.5	1	6.8	22.4	0.02	300	0.000
FML_2010	3.0	3.1	1.9	2.8	3	2.8	1.23	1	6	0.000
FTP_2010	1.2	2.2	0	2.1	2.3	1.9	1.1	0	6	0.000
HTP_2010	8.6	2.7	3.2	0	0	1.2	2.2	0	12	0.000
UHL_2010	0.2	0	1	0	0	0.1	0.34	0	1	0.000
UFHL_2010	0.8	0.9	0	0	0	0.2	0.38	0	1	0.000
UOFL_2010	0	0	0	0	0.4	0.1	0.29	0	1	0.000
UFFL_2010	0	0	0	0	0.6	0.2	0.37	0	1	0.000
FAG_2010	57.7	48.7	63.4	52.8	49.5	52.9	11.5	21	83	0.000

Table 2-17 Characteristics of the selected clusters, mean of the variables, and P-value from the ANOVA according to cluster of farms in 2000

Name of variable	CLU1 n= 14	CLU2 n=38	CLU3 n=22	CLU4 n=99	CLU5 n=47	CLU Mean	CLU: S.D.	CLU: Min.	CLU: Max.	P-Value
% of Farms	6.4	17.3	10.0	45.0	21.4					
LHH_2000	135.6	43.1	32.8	14.7	8.2	27.7	35.7	1	300	0.000
RLH_2000	124.6	42.7	31.7	14.1	7.7	26.5	33.7	1	300	0.000
MRLH_2000	115.7	42.3	32.2	13.4	7.1	25.5	32.5	0	300	0.000
SLH_2000	105.7	26.6	30.8	0	0	14.5	32.7	0	300	0.000
OFFL_2000	0	0	0	0	13.3	2.9	6.6	0	45	0.000
LHFL_2000	43.2	14.8	15.3	5.6	3.1	10.4	14.4	0.05	100	0.000
RLFL_2000	39.6	14.6	14.9	5.4	2.9	9.9	13	0.05	100	0.000
MRFL_2000	36.8	14.5	15.1	5.1	2.7	9.6	12.8	0.05	100	0.000
FML_2000	3.1	2.9	2.1	2.6	2.7	2.7	0.88	1	5	0.004
FTP_2000	1.6	2.3	0	2.1	2.2	2	0.94	0	5	0.000
HDT_2000	8.6	3.2	3.2	0	0	1.4	2.6	0	12	0.000
UHL_2000	0.2	0	1	0	0	0.1	0.31	0	1	0.000
UFHL_2000	0.8	1	0	0	0	0.2	0.42	0	1	0.000
UOFL_2000	0	0	0	0	0.8	0.2	0.37	0	1	0.000
UFFL_2000	0	0	0	0	0.2	0.1	0.22	0	1	0.000
FAG_2000	48.9	38.4	51.6	40.8	38.4	41.5	12.6	22	72	0.000

Table 2-18 Characteristics of the selected clusters, mean of the variables, and P-value from the ANOVA according to cluster of farms in 1990

Name of variable	CLU1 n= 15	CLU2 n=43	CLU3 n=9	CLU4 n=129	CLU5 n=24	CLU Mean	CLU: S.D.	CLU: Min.	CLU: Max.	P-Value
% of Farms	6.8	19.5	4.1	58.6	10.9					
LHH_1990	130.7	43.5	36.3	13.5	8.3	27.7	35.2	1	300	0.000
RLH_1990	124.3	43.3	35.8	12.9	7.3	26.8	33.9	1	300	0.000
MRLH_1990	106.7	42.9	38.6	12.2	6.7	25.1	29.7	0	200	0.000
SLH_1990	103.6	27.5	38.6	0	0	14	30.5	0	200	0.000
OFFL_1990	0	0	0	0	12.3	1.3	4.8	0	27	0.000
LHFL_1990	42.6	16	16.4	6	3.6	11.5	12.9	0.75	100	0.000
RLFL_1990	40.5	15.9	16.1	5.7	3.1	11.1	12.5	0.75	100	0.000
MRFL_1990	34.8	15.8	16	5.4	2.9	10.4	11.4	0.75	75	0.000
FML_1990	3.1	2.7	2.2	2.3	2.3	2.4	0.71	2	5	0.000
FTP_1990	1.7	2.2	0	2.1	2.2	2	0.71	0	4	0.000
HTP_1990	8.7	3.4	4.2	0	0	1.4	2.8	0	14	0.000
UHL_1990	0.3	0	1	0	0	0.1	0.23	0	1	0.000
UFHL_1990	0.7	1	0	0	0	0.2	0.43	0	1	0.000
UOFL_1990	0	0	0	0	0.8	0.1	0.28	0	1	0.000
UFFL_1990	0	0	0	0	0.1	0.1	0.11	0	1	0.000
FAG_1990	41.1	32.3	30.6	28.6	28.8	30.3	14.3	21	62	0.022

Cluster 1(CLU1): Large family farm enterprises with the cluster accounted for 6.8% 6.4%, and, 4.1% of the total farms in 1990, 2000, and 2010, respectively. Farms owned the largest landholding and use of hired labor. This cluster showed high specialization and intensive capital in plantations. Over the period of the study, plantations had been administered by farm managers who were owners or family members. Many hired-laborers were employed for share-tapping areas. Depending on his positive attitudes toward farm life and efforts to be more efficient to manage farms, some owners might work on small size areas. This cluster also recorded the highest presence of hired-labor, the second lowest of family tappers, and the highest land per labor, consistent with the commercial nature of the farms.

Cluster 2 (CLU2): Medium family farm enterprises with the cluster consisted of medium farms that owned the second largest landholding and use of hired labor. This is the third largest cluster representing 19.5%, 17.3%, and 15.0% of the total farms in 1990, 2000, and 2010, respectively. Like cluster 1, this cluster presented specialization and intensive capital in plantations. They had a higher number of family tappers than cluster 1. In all the farms, family members might work as tappers and/or farm managers. Hired laborers were employed for share-tapping areas. This cluster corresponded to family farms with moderate commercial profiles.

Cluster 3 (CLU3): Patron farms with the cluster comprised of farms that owned small to medium landholding and used only hired labor. It is constituted 4.1%, 10.0%, and 12.7% of the total farms in 1990, 2000, and 2010. The percentage of farms in this cluster sharply increased during 1990 to 2000 and slightly increased in 2010. This was the only cluster where family laborers dedicated full-time to non-farm employment including some farms owned by retired people. Hired laborers were employed to tap all their plantations. Owners worked part-time to manage plantations and contracts.

Cluster 4 (CLU4): Small family rubber farms which was the largest cluster representing 58.6%, 45.0%, and 42.7%, of the total farms in 1990, 2000, and 2010, respectively. This cluster was characterized by small landholding and use of family labor. Family laborers were engaged full-time in plantations. Paid labor might be used for particular heavy jobs such as weeding control, but there was no hired labor for tapping. This cluster also differed from the others by the importance of rubber in terms of income generation for household income. This cluster had decreased during the past 20 years.

Cluster 5 (CLU5): Very small rubber farms with the cluster were characterized by very small landholding and use of family labor for on-farm and off-farm tapping. It represented 10.9%, 21.4 %, and 25.5% of the total farms in 1990, 2000, and 2010, respectively. This cluster gathered the second highest number of farms in 2010, and the proportion of farms in this cluster greatly increased during 1990 to 2000. This cluster showed the lowest landholding and it was the only cluster with off-farm tapping under share-tapping. It meant that family labor worked as

tappers to tap rubber for other owners. Off-farm areas under share-tapping were larger than owner's rubber lands with regard to availability of labor, skill, rubber experience, size of immature rubber, and time.

4) Identification of patterns of clustered farm pathways on individual farms

Once the five-clusters were systemically identified on the value of the variables in 2010, 2000, and 1990, respectively, each individual farm was coded by one of the five clusters (CLU; 1,2,3,4 and 5). 22 patterns of clustered farm pathways were generated as seen in Table 2-19. These could be considered as "individual farm trajectories". Numeric cluster and its change during the three time-periods enabled to identify temporal farm structures in each period, successive structure, and temporal changes in farm's specific condition at each time step.

Table 2-19 The 22 patterns of clustered farm pathways: each pattern is composed of a succession of three stages, and each stage will be representing one of the 5 coded cluster numbers

Coded cluster number			Number of farms
1990	2000	2010	(of a total of 220)
1	1	1	7
1	1	3	2
1	3	3	4
1	1	4	1
1	2	4	2
1	4	4	1
2	1	1	2
2	2	2	20
2	1	2	2
2	2	3	3
2	3	3	7
2	2	4	7
2	4	5	1
3	3	3	8
4	2	2	8
4	4	2	2
4	3	3	4
4	2	3	1
4	4	4	84
4	5	5	22
4	4	5	8
5	5	5	24

Remark: Coded cluster number; 1 = CLU1, 2 = CLU2, 3 = CLU3, 4 = CLU4, 5 = CLU5

2.5.3 Patterns of clustered farm pathways, refining six-farm trajectories

To check the robustness of the results of six trajectories (TR1 to TR6), individual farm trajectory corresponding patterns of clustered farm pathways was grouped into six-farm trajectories (Table 2-20). This produced two main results. First, each trajectory corresponded to specific and different sets of patterns of clustered farm pathways. Secondly, each farm trajectory corresponding to the same clusters made by the value of variables in 2010 was not obvious.

Once the coherence of the results was established, a third result was the apparent robustness of farm trajectories. By combining the two methods, i.e. multivariate analysis and systematic clustering technique, the study obtained a better understanding of the six general types of trajectories through compositions of the patterns of clustered farm pathways and their temporalities of farm change as in Table 2-20.

Table 2-20 The 22 patterns of clustered farm pathways refined the six-farm trajectories: each line represents a pattern of clustered farm pathway with the coded cluster number for each of the three years (1990, 2000, and 2010)

Rubber farm trajectories	Pattern of clustered farm pathway			% of farms
	1990	2000	2010	
TR1: growth of large family farm enterprise	1	1	1	3.2
	2	1	1	0.9
TR2: growth of medium family farm enterprise	2	2	2	9.1
	2	1	2	0.9
	4	2	2	3.6
	4	4	2	0.9
TR3: toward patron farm	3	3	3	3.6
	4	3	3	1.8
	2	3	3	1.4
	4	2	3	0.5
	2	2	3	0.5
TR4: high structural change of farms	1	1	3	0.9
	1	3	3	1.8
	2	2	3	0.9
	2	3	3	1.8
	1	1	4	0.5
	1	2	4	0.9
	2	2	4	3.2
	1	4	4	0.5
TR5: stability of family farms	4	4	4	38.2
TR6: declining very small farms	5	5	5	10.9
	4	5	5	10.0
	4	4	5	3.6
Discarded pathway	2	4	5	0.5

Once all patterns of clustered farm pathways had been established, each typology of farm trajectories composed of the patter of change in clustered farm pathway as following;

1) Growth of large family farm enterprises (TR1): this trajectory was characterized by two patterns of change in clustering from 1990 to 2010: 1-1-1 and 2-1-1. The first pathway 1-1-1 corresponded to the growth of farm structures within the cluster of large family farm enterprises. It meant that about 3.2% of farms were already large and highly capitalized in 1990. They continued to grow. The second pattern comprised of 0.9% of farms relying on pathway 2-1-1 that was characterized by farms with structural characteristics of medium family farm enterprises in 1990 and had grown in terms of landholding and increased the use of hired labor, becoming large family farm enterprises during 2000. These pathways remained into clusters of large family farm enterprises in 2010 who was observed to be specialized and high capital intensity in rubber production.

2) Growth of medium family farm enterprises (TR2): this trajectory was characterized by several patterns of clustered farm pathways: 2-2-2, 2-1-2, 4-4-2, and 4-2-2.The pathway 2-2-2 showed that about 9.1% of farms grew within clusters of medium family farm enterprises. These medium farms experienced a moderate increase of landholding and dependence on hired labor, but there was not enough to push them to the large family farm enterprise. 0.9% of the medium farms under pathway 2-1-2 increased the size of landholding. Using hired labor between 1990 and 2000 allowed them to be in cluster 1 in 2000, but this increase was not sustainable. The pathways 4-2-2 and 4-4-2 corresponded to family farms that evolved into medium family farm enterprises. 3.6% of farms increased farm structures and then changed clusters between 1990 and 2000 (4-2-2). For 0.9% of farms, the change had occurred after 2000 (4-4-2). All pathways were going toward the cluster of medium family farm enterprises in 2010. They received inherited land through and thereafter purchase of land increased. If farms gradually evolved from small family farms, purchase of land was relatively high. Specialization and capital intensity were high, the same as TR1.

3) Toward patron farms (TR3): this trajectory groups with five patterns of clustered farm pathways were 3-3-3, 4-3-3, 2-3-3, 4-2-3, and 2-2-3, respectively. Farms in this trajectory had substantially diversified farm structures at the initial period such as patron farms, medium family farm enterprises, and family farms, but all of them had evolved into patron farms in 2010. The pathways 3-3-3 included 3.6% of farms that maintained the structure of a patron farm since 1990. The pathways of 4-2-3 and 4-3-3 showed that the farms were structured as family farms in 1990 and grew into patron farms when some of them (0.5%) went through medium farms enterprises at the intermediate period. The pathways of 2-3-3 and 2-2-3 consisted of 1.9% of farms. The farms were medium family farm enterprises in 1990 and evolved into patron farms during 2000 or 2010. Unlike TR1 and TR2, the specialization and capital intensive in the

plantations were low. They got farmland through inherited land of family and continued to invest in expansion.

4) High structural change of farms (TR4): this trajectory was characterized by patterns of clustered farm pathways: 1-1-3, 1-3-3, 2-2-3, 2-3-3, 1-1-4, 1-4-4, 1-2-4, and 2-2-4 from 1990 to 2010. High structural changes occurred when farms experienced a large decrease of landholding and change in the use of labor. The pathways of 1-1-3 and 1-3-3 groups with 2.7% of farms corresponded to large family farms in 1990 or until 2000 and substantially declined in farm structure downward into small patron farms in 2000 or 2010. The pathway 1-1-4, 1-4-4, and 1-2-4 included 1.9% of farms where they were large family farm enterprises in 1990 or until 2000 and substantially downsized into small family farms during the past 10 years or even before. The largest decrease of landholding was observed during 1990 to 2000. The pathway 2-2-4 included about 3% of farms. The farms were medium family farm enterprises in 1990 or until 2000 and experienced rapid change of structure downward to a family farm between 2000 and 2010. The pathway 2-3-3 and 2-2-3 consisted of 2.7% of farms that had known the structural change from medium family farm enterprises downsizing into patron farms at different periods. All farms in this trajectory were currently grouped into patron farms or small family farms in 2010. The largest change of farm structure was mainly due to sale of land, transfer of land to family members and change of labor use. One main critical reason was the sale of land related with socioeconomic pressure and vulnerability of livelihood. These farms faced financial stress from gambling, special cases of accidents, education of family members, and business investments. It was also associated with high land price leading to highly accelerating the sale of land. In cases of inheritance, the customary rule was that land was divided into equal plots to be given to family members. This resulted in rapid decrease of landholding and then owners held a small size for retirement. Labor use also changed considerably in line with landholding.

5) Stability of family farms (TR5): this trajectory included only farm pathway of 4-4-4, and constituted about 38.2% of farms. They kept structural characteristics of family farms over the period 1990 to 2010. No change of farm structure in terms of landholding or available family labor was observed during the period of study. This trajectory was characterized by cluster of small family farms. Farms got landownership holding through inheritance and marriage, and later some farms might acquire a small parcel regarding to the financial position. A constant of family labor is that husband and wife work full-time in the plantation while younger labor tends to move toward non-farm employment. Level of household income depended on the size of tapping area and so rubber income generation enough for overall living cost and family expenditures.

6) Declining very small farms (TR6): this trajectory was characterized by patterns of clustered farm pathways: 5-5-5, 4-5-5, and 4-4-5. Farms in this trajectory were small or very small landholdings and used family laborers both for on-farm and off-farm tapping activities

over the period of our study. The pathway of 4-5-5 and 4-4-5 consisted of 13.6% of farms in which they were structured as family farms in 1990 or until 2000 and gradually declined into cluster of very small farms in 2000 or 2010 while increased off-farm tapping land. About 11% of farms undergoing farm pathway of 5-5-5 corresponded to the farms that retained the characterization of very small farms over the period of study. These were the poorest households. Land pressure and financial stress were higher than other trajectories. Due to the small size and availability of labor, the adoption of off-farm with share-tapping employment was high. These farms were important sources of available skilled labor to supply large family farm enterprises, medium family farm enterprises, and patron farms.

Table 2-15 shows that farm pathway 2-4-5 observed as special farms that medium family farm enterprises rapidly decreased farm structure becoming family farms in 2000 and thereafter declined further into very small farms in 2010. This was a special case of pathways that farm structure changed rapidly into cluster of very small farms. The study proposed to discard this pathway because it did not relate to profiles and structural characteristics of any six-farm trajectories.

2.6 Analysis of the Six Farm Trajectories

This section gives emphasis to the understanding of historical events and consequences that shaped farm trajectories including the relationship between farm trajectories and share-tapping arrangements. In each trajectory, the study also presents evolution of landholding, labor use, farm management, performance, and farm institutions.

2.6.1 Growth of large family farm enterprises

This trajectory included farms that evolved toward large family farm enterprises following two-farm pathways (Figure 2-16). The first pathway (1-1-1) corresponded to the owners who already had a large farm size and experienced the increment of landholding and hired-labor. In the samples of this study, they were children or grandchildren of Chinese immigrants. The grandfather of the family had immigrated for plantation work and accessed a large amount of land after World War II. Some rubber owners had been shareholders in estate companies as stated by Songprasert (1993). They had a complete knowledge of new technology of plantations from Malaysia, and some of them also held plantation and related rubber businesses that they could heavily invest in new areas. They began to claim unoccupied land and purchased land with the lowest price from local people. The result was a large acquisition of landholding. These farms were observed across the region in Hat yai to Sadao district in Songkhla province, Thailand. They have held rubber as family enterprises from that generation till today.

Moreover, during the post World War II period, the political conflicts between the Chinese communist party and the government of Malaysia led many Chinese communists to migrate into Sadao area. They occupied more than a thousand rai per family for plantations, and some of them established estate companies, and this business is still existing today. For such, the respondents who owned the estimation of landholding about 1,500, 2,500, and 5,000 rai stated that those of landholding were claimed in the state land during the mid-1960s. At that time, local people were not interested in the value of rubber. They mostly wanted to own land for rice and had less claimed new land located in the uphill and deforest areas. Thus, migrants could get large landholdings for new rubber plantations. Even if some areas were owned by local people, lands could be purchased at a cheap price. All of the landholdings were devoted to rubber plantations with technology that they had experienced in Malaysia. It appeared that the Chinese came with more capital, new technology, and knowledge.

Interviews revealed that during the 1960s-1980s, accumulation of land had gradually developed because land was cheap and abundant in remote areas. The acquisitions of landholdings had steadily increased after 1990 through the purchase of land belonging to smallholders. Land accumulation was the goal of families that could benefit on returns and property. High capital and specialization in rubber businesses encouraged some of them to establish rubber processing factories and became exporters.

Others had expanded business outside the rubber sector such as in the hotel and commercial trade. Importantly, rubber plantations were still seen as assets of the family and would earn money to support their non-farm businesses. Interviews also found that these families had an important role for initial expansion of large new planting in north-east and north regions. They were heavily invested in estate plantations in Laos.

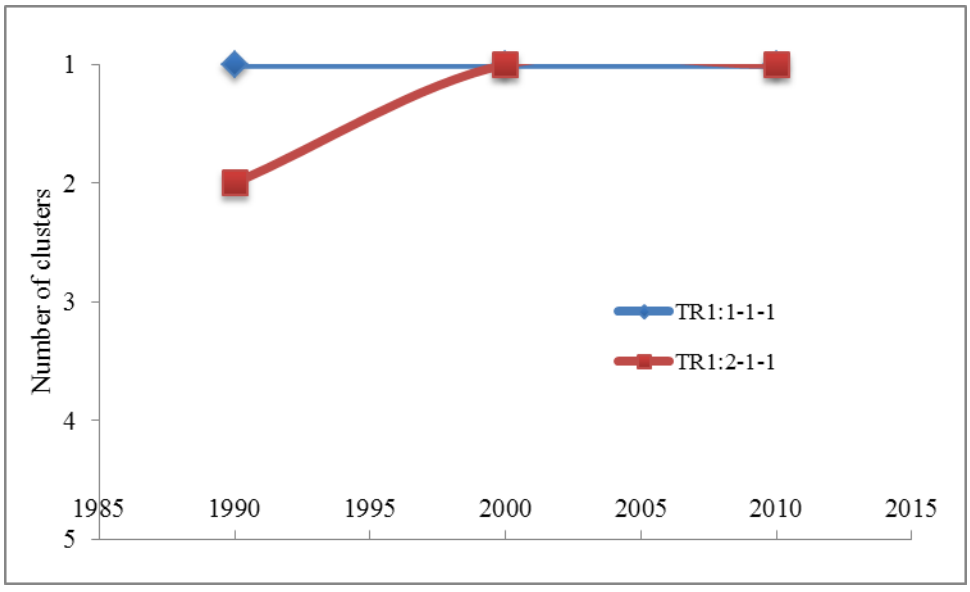

Figure 2-16 The 2 pathways for the trajectory "Growth of large family farm enterprise"

The second pathway (2-1-1) corresponded to the rubber owners who were mostly Chinese or Sino-Thai to claim unoccupied land. During the early 1960s, large unoccupied areas of land were claimed to be owned in response to the rubber price boom in 1950/1951. Respondents revealed that the families began to mark the size of land that they needed to own by big trees or small canals which might extent to reach evergreen forest zones, reflecting large new land to occupy. Land had been not easily opened up from the forest by slash and burn activities. Heavy machines could be used for rapid land clearing. In order to have a large farm, a large number of family laborers and cooperatives shared laborers helped them to expand farming areas in new land. The process of access to land through unoccupied areas was hard work and difficult for the first settlement, and then the settlement could be occupied at the range of 50-300 rai. In the first year, they began to cultivate annual crops for food and planted rubber in the second year. Rubber plants could be collected from seedlings in Chinese plantations or a particular farms had bought a good yield variety of expensive seeds from Malaysia. Some farms also started to build paddy fields in lowlands or wetland areas. A free land or cheap land from the first settlement encouraged their relatives and friends from the old village to move into new settlement areas. These farms were pioneers to introduce plantations in Ban Lo-han, Ban Koa-phra and Ban Kok-maung. This process declined after the 1980s due to unoccupied land to reach government reserves and the implementation of the land act for conservation and forest areas. And so, purchased land became the main way to accumulate landholdings.

Interviews revealed that rubber provided a standard of living and was the only source of household income. High returns by the first rubber plantation had been re-invested to more acquisition of land during the 1970s-1980s where land was still at a low price. The purchased land continued to increase during 1990-2010 due to capital accumulation and more access to credit. They thought that land prices would increase, and then they should purchase now if they had money. In 2012, they had a high social status, were leaders of community, or local philosophers. In many cases, they developed businesses related to value added rubber products consistent with a large rubber output. The change in the rubber marketing system such as rubber smoked sheet factories or middlemen for latex collection reflected the emphasis on family farm enterprises. As well as this many cooperatives or groups of rubber farmers also developed through their leaders that could identify their roles in the community and prospective farm enterprises.

These farmers were Chinese descendants who were diligent, hard working, could endure difficult situations, and had expertise in commercial business. The Kongsi system observed by Chinese or Sino-Thai was an important traditional institution to arrange capital and landholdings and also governed shared landownership and financial returns for family members. The study had observed an embedding of the Kongsi system affecting family members shared landownership and perhaps working together. Many returns from plantations had accumulated under Kongsi where everyone had mutual ownership and allocated under supervision of their

parents or elder sons. Kongsi provided a means to have a large accumulation of landholding and supporting of capital to invest in related business or outside of rubber. Interviews revealed that Kongsi would pay for all costs of education for children and grandchildren. If a family member wanted to establish a business, Kongsi would support it. It was therefore mainly capital for business expansion and their investments in commercial trade, industry, and real estate. Large rubber plantations could earn sustainable capital accumulation to support growing farms and to promote their businesses in non-farm activity. At the present, plantations under Kongsi support their business and therefore the inheritance to each family had serious problems for future generations. On the other hand, many families had agreed to maintain their plantations as assets of the family or consortium's rubber under a governing brotherhood by attempting to strengthen family structures. Figure 2-17 shows that landholding increased over the study time. The increments of landholding also were purchased land and inheritance land where Chinese or rich men had married.

The data presents that prices of vacant land was about 5,000 to 10,000 baht per rai in 1990 that increased to range of 30,000 – 80,000 baht per rai in 2000 and rose to range of 100,000 to 200,000 baht per rai after 2010. High land prices reflected limited available land, high demand of land, and population growth. Many large farms argued that the increment of landholding was higher during the 1970s-1980s due to cheap and abundant land. Uphill and deforestation zones where suitable areas for plantation were cheap and then are highly accumulated. In particular, they had owned landholdings with no land rights, but land with the right was in favor to acquire.

As in Figure 2-17, land acquisition continued during 1990-2000 due to low land prices to compare with the current period. After the 2000s, they preferred to purchase rubber land both mature and immature plantations where rubber trees could be tapped soon and presented economic scale per plot. It seemed that many respondents in this trajectory wanted to continually accumulate land, but most land sold were small parcels and unsuitable land for rubber trees. Most large farm owners also invested to acquire land in the north and north-east regions where large areas of land was still available and cheaper. It appeared that land consolidation steadily increased by accumulation of small parcels according to high fragmentation of land in the studied area. The study had observed that the owners could decide to purchase any land depending on his preference and expectation in return with regard to their capital and high accessibility to credit. Often nearby plots with their own plantations were purchased because it could increase the size of the plot, facilitated farm management, and increased efficiency of contractual arrangements in the same area. Land could be sold in small parcels at a high price and driven by speculation where it occurred in business locations or towns. The study should note these farms that all of them showed high capital with a good attitude to conducting farm enterprise.

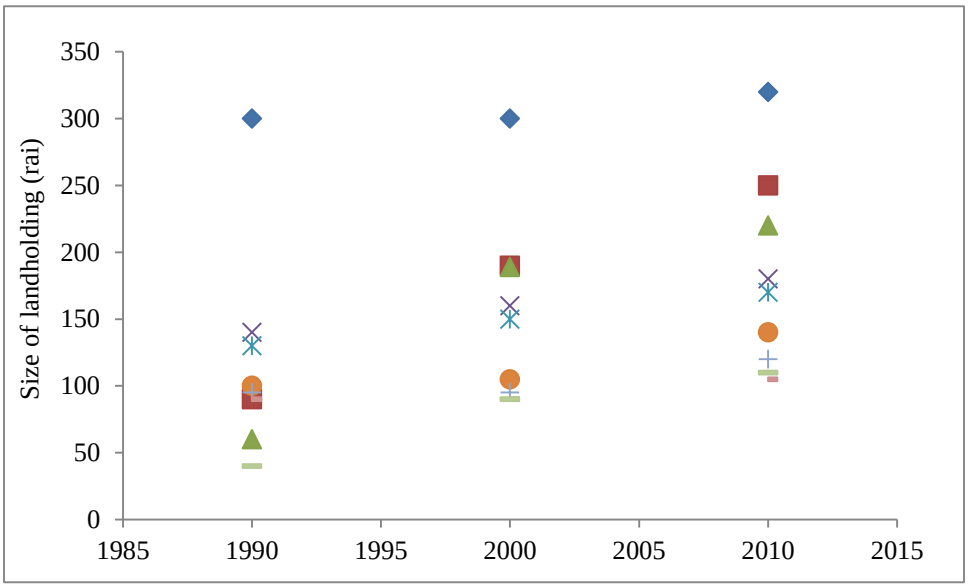

Figure 2-17 Landholding changes in each farm underwent trajectory of large family farm enterprise from 1990, 2000, and 2010

Case study 1 was a representative sample from ten cases. This case study traced back the origins to the settlements who had access to a large landholding and had already capital and technology for farm enterprise. There was an example of the growth of family farm enterprise that emerged from the ranks of Chinese capitalists as in the case study below.

Case study 1: Mr. Sin Lee

Mr Sin Lee, born in 1937, originated from a Chinese family that had strong links with farming and business. Mr. Lee's father was an immigrant worker who had built a small shop in the village. His father had also successfully engaged in the profitable rubber trades of which initially generated revenues for expansion of landholding and investment in plantations. His father was the largest rubber owner in the sub district. He managed a large scale plantation on the Kong-si system. Mr. Lee received about 150 rai of rubber plantation from his father, before setting up his own large scale farm in the late1960s. Mr. Lee got married and formed his own household and had four children. Generosity and success of the farm enterprise made his family renowned in the village. Today, he owns one of the largest farm enterprises in the Ban Mai/Sadoa area. He started with a large parcel of unoccupied land about 300 rai in new land and continued with a constant expansion of production scale with purchased land. He claimed that profit from his father's trade and plantation provided to accumulate capital for reinvestment in plantation and allowing him to expand his landholding. He was the first planter to invest in replanting since the late 1970s as the promotion of the replanting scheme. He had emphasized investment for improving productivity and applying new technology,

thereby his plantation had shown high yield and was a modern estate.

Like a large Chinese's plantation, he had invested to establish a rubber smoked factory in order to add value of large rubber output and more profit since the late 1960s. The Kong-si system was employed to manage his farm enterprise that allowed him to increase capability for enhancing business and to keep capital accumulation going. Expansion of landholding mostly accumulated through his investments in his plantation and his business in a small smoked factory. In the late 2000s, he decided to enter local politics that helped to accumulate political power. He thought that to play a role in local politics might have an effect on accumulations and economic opportunities.

In the early 2010s, his elder son became the farm manager of farm enterprise while other children got jobs in non-farm employments: government bureau and self-employment with a company. He had invested in the business as middlemen of fresh latex which could be consolidated into smoked rubber factory as a part of the farm enterprise. Middlemen of fresh latex and primary smoked factory became a highly profitable farm business that generated significant surplus of capital accumulation permitting a substantial expansion of landholding and reinvestment for improving productivity during the last decade. At the same time, modern management regarded to laborers, formal agreements of share-tapping, and financial systems were applied in the plantation and in the related farm business that helped to increase business performance and more profits. In fact, he had continued to acquire landholdings through purchased land during 1970-2000 and tended to decline land accumulation in the south region during 2001-2010. He became an advisor for his son to manage the farm enterprise.

Since the mid-2010s, he supervised his farm enterprise and started to expand with new planting in Chaing Rai and Phayoa which would invest for economic opportunities from low land price and potential growth of rubber in respect to the rubber boom and government policy. Mr Lee therefore became a large scale farm enterprise in new areas during the 2010s. Mr Sin started from a large area of unoccupied land for rubber plantation and managed to scale up his farm by the reliance on investment in the plantation and further diversification into related business.

Next, the study presents farm management and arrangements for farm enterprise. The rubber owners in this trajectory were characterized by intensive capital, specialization, and strongly oriented farm enterprise. The study found that new technology and the use of machines in plantations had been introduced by these large family farm enterprises and later extended to neighbors. As well as this they were the first farms to participate in re-plantation schemes. At the present, plantation was ongoing into 2 or 3 rotations. Farmers had commonly used technologies and plantation maintenance following RRIT's recommendation by use of high yield clones, intensive weeding control, high levels of fertilizer, and improvement of field conditions that had impacted on high yield and the improvement of productivity. Farmers' practices were characterized by a low intensive tapping system and good tapping skills that allowed high yields

and long economic life span compared with smallholdings. It appeared that the relations with rubber organizations and their staff including the network of farms enterprises contributed to good access to new technology and information both in plantations and markets.

Generally, farm management and administration are under the responsibility of farm managers. The farm manager is a key factor to determine farm performance and administrative farm enterprise. The farm manager is often the rubber owner or a family member. Farm managers have to manage all tasks in production, hired-tappers, processing, and marketing. They may do financial, accounts, and wage payments. They usually are trained by the rubber owners or family as assistant farm managers to gain expertise. They should inspire high trust, be hard working, and have a good personality to deal with controlling and monitoring hired tappers, coping with the uncertainty of production, and markets. On a tapping day, they have to control and monitor production that should be checked and verified for total quantity, pricing, and total gross sales in each plot. In most cases, the time of collecting latex was fixed to conveniently carry out latex to the point of marketing. For each plot, the farm manager records weight, dry rubber content (necessary to pay for the latex), and daily price before sending the production to the latex factory. In some cases, rubber farmers owned a small factory to produce rubber un-smoked sheets or smoked sheets. Latex is transformed into un-smoked rubber sheets that is later smoked in smoking house that can earn valuable product and high prices. Scrap rubber may be additional revenue for hired tappers except in rainy days when the quantity of scrap rubber is bigger, and so they will be shared equally with the owner.

The average, rubber pricing was tied to the local market price. Particularly if the rubber owners were middlemen or processing rubber, pricing would be set by the rubber owner depending on marketing price, price at factory gate, and market situations. The study found that 60:40 share-tapping ratio was commonly chosen for these farms. Remunerative payment is done through cash or bank transfer system every three days or weekly. In the past five years, modern financial transfers was applied to be comfortable and security of payment system.

Table 2-21 Estimated average costs of farm maintenances according to TR1, TR2 and TR3

	TR1	TR2	TR3
Yield (kg/ha)	2,230	2,150	1,810
Fertilizer cost (baht/ha)	14,100	12,900	10,600
Frequency of fertilizers application (time/yr)	2.5	2.3	2.0
Paid labor for fertilizer application (baht/ha)	625	625	625
Weeding cost (baht/ha)	2,200	2,100	2,100
Frequency of weeding (time/yr)	2	2	2
Total costs (baht/ha)	16,925	15,625	13,325

It can be observed in Table 2-21 that fertilizer applications were greater than that required by RRIT recommendations. Weeding is often done by machines or by applying herbicide with

more specific attention paid on large farms. The average of cost of farm maintenance was about 16,925 baht per ha. The average yield was 2, 2230 kg/ha, ranging from 1,625.0 to 2,500.0 kg per ha, which was higher than 1,750.0 kg/ha of the national average. This was only farms that had been progressive in their technological use. New clones from Malaysia were imported for new plots and might be planted for trial pilots. Stimulation technology was also applied under appropriate conditions. Then, specialization and intensification in production were high that led to high productivity and sustainable economic life span.

The study observed that the traditional agrarian contract, called "Tao-kea and Loo-kuli" was employed to manage hired tappers, contracts, and production. "Tao-kea" is simply the rubber owner and "Loo-kuli" is a share-tapper. "Tao-kea and Loo-kuli" could be considered as socio-economic interdependence that encouraged peaceful interrelationships between the parties. These are local institutions to embed the rights, obligations, and relationships between the rubber owners and hired-tappers under a share-tapping arrangement. "Tao-kea and Loo-kuli" also constituted what/how legitimacy and their functions accounting for the rubber owners and hired labor. In the 2010s, modern management was generally applied under share-tapping arrangements and gave priority to economic performance in plantations and farm business objectives. The study found that new farm managers tended to emphasize financial performance, profitability, and their related business. The strong ethical relation relying on *Tao-kea and Loo-kuli* has declined considerably. The important adaptations were formal agreements of share-tapping contracts, administrative production, modern payment systems, and related business. Share-tapping contracts developed into formal agreements facilitated to deal with problems and disputes of hired tappers including increases of working performances. Either middlemen or the factory of smoked rubber often established as a part of farm businesses that could increase profitability in their large volumes.

Moreover, interviews revealed that all the rubber owners had good attitudes to farm life and still put much more investment in plantations. They remained to be an inspiration and provide expertise in plantations that there were obviously a cause for the growth of farm structures and expansion of related business. The adaptation into new environments and the change of social and economic development were high and could maintain the growth of family farm enterprises. Expertise and business experiences had smoothly transferred into the next generation recognizing the family council system.

2.6.2 Growth of medium family farm enterprises

Figure 2-18 presents the farm pathway toward medium family farm enterprises: 2-2-2, 2-1-2, 4-4-2, and 4-2-2. The study found that fourth farm pathways could be grouped into two patterns of trajectory change: 1) the growing medium family farms enterprises (2-2-2 and 2-1-2) and 2) the growing small family farm toward medium family farm enterprise (4-4-2 and 4-2-2) as in Figure 2-18.

During the pathway of the growing medium family farms enterprises, interviews revealed that most of these farms settled and claimed unoccupied land in the villages during the 1960s and 1970s. Most of them had migrated from the paddy field area where they faced heavy land pressure in the Songkhla Lake area, Pattalung, and Nakorn Si Thammarat. There was a migration into the west side of Songkhla Lake attempting more landholding and accessing new land, which at that time was deforested due to forest concessions. Unlike Chinese migrants, these migrants came with low capital. This migration was associated with high rubber prices during the 1950s affecting growth of demand for new land for new plantings. High cash income that was observed from Chinese' plantations was highly incentive to move into new land. In some cases, the migration to new land was convinced by the first settlement. They began to mark unoccupied land in the next plot from the first settlements. Generally, big trees and canals were used to mark the size of occupied land and to own by whom with the acceptable of rights by people. Free land was given to induce newcomers who were relatives, friends, and new neighbors, of which households of friends and neighbors was highly valued in the difficult situations of settlement.

Respondents argued that size of unoccupied land depended on hard work for land clearing; if family members were available, they could claim a large size. The capability for land clearing varied about 10 to 15 rai per year depending on the available labor, location, and density of deforest. Initially, all plots did not have formal right of land, but it was accepted as the right to use by people. The first year was cultivated with food crops with shifting cultivation and then planted with an intercrop of rubber and fruit trees in the next year. Tree crops were further used to claim ownership of unoccupied land. Technological use in Chinese's plantations was observed and adapted into simple technology due to lack of capital. Rubber seedlings were freely collected from Chinese plantations. Moreover, the data showed that purchased land was historically high since the period 1960s-1970s was one of cheap land prices. Purchased land continued to increase during 1990-2010 in respect to accumulation of capital and attention to expansion for families.

In many cases, landholdings here were inherited from the former large farms. Families then had received a medium inheritance of land and managed its expansion. The number of medium family farms grew in the past 20 years where intergenerational land transfer was increasing. Marriage could increase size of land acquisition when a particular size of landholding was transferred to a wife and/or husband. In some cases, inheritance land dramatically increased

during the 2000s before it was sold, presenting a pathway of 2-1-2. During the 2000s-2010s, the establishment of business related with middlemen and processing rubber sheet substantially developed increasing profitability and taking advantage of a large volume of rubber output. The Kongsi system also was utilized the same as TR1.

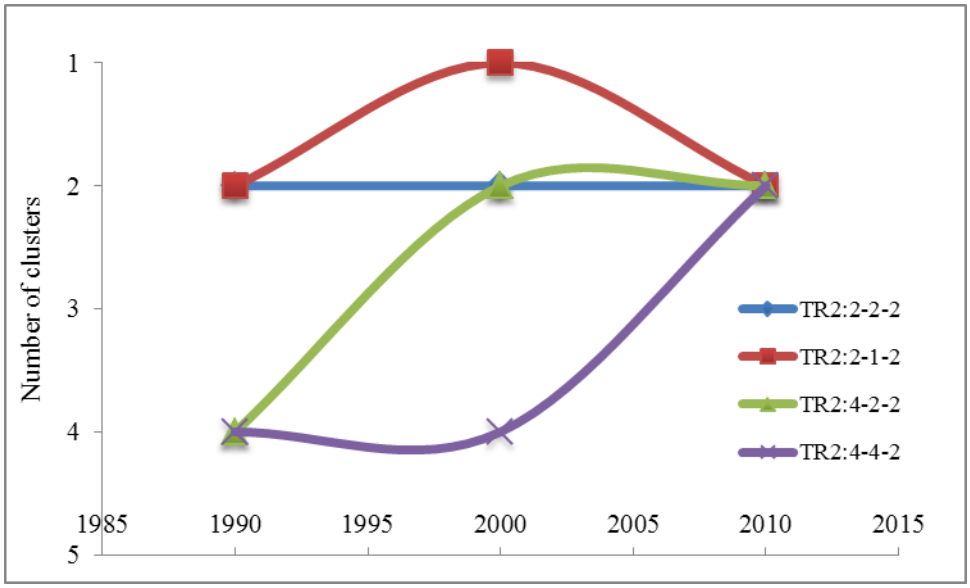

Figure 2-18 The 4 pathways for the trajectory "Growth medium family farm enterprise"

The second group of pathways 4-4-2 and 4-2-2 presented small family farms that evolved toward medium family farm enterprises. Respondents revealed that they were small family farms before they migrated to work as hired tappers or paid labor during the period 1980 to the end of the 1990s. Poor families and land pressure forced them to migrate into rubber intensive areas where remunerative work was high, compared with the falling earnings of rice. Interviews indicated that farmers in the paddy field areas had rapidly adopted off-farm work with rubber share-tapping after rice harvesting seasons. The extended family mostly encouraged family members to work as labor for other farmers so that they could increase household incomes and contribute to a better livelihood. Small holdings associated with low price of rice increased socioeconomic pressure and the need to have new sources of household income for sufficient family needs.

These workers were generally employed for the old plantations that could be trained in tapping skills and knowledge for growing rubber trees. Regarding profitability of rubber, most began to purchase small parcels of empty land with installment payments. In many cases, inherited land located in rice areas was sold for new planting where land was cheaper. For instance, our respondent said that a 10 rai of rice field was sold in Ranot district for approximately 100,000 baht which was enough to buy 20 rai in Paboon district in Pattalung. They preferred to buy empty land which was cheaper, and new planting could be established. During the immature stage of rubber plantations, they worked as hired laborers with share-

tapping agreements so that they could be saving money for more purchased land and production costs. In some cases, the head of household had migrated to be a tapper before marriage and got married in the village. Therefore, he could have inherited land. Generally, inherited land for rice was sold to purchase land in new areas as previously mentioned. Then the increment of landholding depended on the size of inherited land and purchased land. The experience with poor families and small holdings was a very important factor to induce attention to own rubber land, working hard and continue to expand. All of them presented the same world view of "No more for history of poor family, and it was only a time in life". These families were sufficient with living, working hard, saving money, and knowledge.

In the past 20 years, accessibility to credit was increased through the expansion of the Bank of Agriculture and Agricultural Cooperative (BAAC) that could access credit with low interest by offering a large loan for investment and purchasing land. It provided a chance of purchasing land in terms of size and price. Many farms argued that the first purchased land was empty land with small parcels about 5-10 rai per plot, and they appreciated the kindness of friends or neighbors to sell it. With regarding to saving money and loans with low interest from BAAC, they could access a large amount of rubber land which could have immediate returns. Because of the acquisition of rubber land, it was a good asset to the family in terms of income generation and the securities for future loans. Rubber land was used as security with banks or cooperatives. Farmers could have a large loan for the next land purchase. This process of land acquisition has been performed continuously for the past 30 years. As a result, they could have medium size of landholding, and the size continued to increase.

Furthermore, respondents stated that the size of landholding depended on the number of children and working capability to manage production. Landholding would increase until meeting the level of threshold of inherited land for their children. Primarily, they assumed that inheritance land of 20-30 rai per person were approximate to generate levels of income for adequate living and thereby total of landholding seemed to equate to an average of 2-3 children. It seemed that farmers who had more children would buy more land until they reached the expectation of inheritance land that would be sufficient for the number of children. Stopping land accumulation could be when working capability declined by family labor as well as levels of income generation maintained.

It meant that size of landholding tended to be maintained after the feeling of heavy work occurred or appropriate size of inheritance land existed. These reasons could explain why landholdings would be limited and did not reach large family farm enterprise. High prices and limited available land to market also caused difficulties to purchase large amounts of land. In 2012, these farmers preferred to buy small parcels in business locations for land speculation rather than farmland.

The attributions in this pathway was characterized by farmers who worked full-time in plantations, specialization, intensive capital and active learning for new technologies. Now, they were successful and had a quite higher social and economic status. They also became leaders or heads of groups in their community development, cooperatives, marketing farm groups, and local politics. Hired tappers claimed that they favored to have share-tapping contracts with these farms because generosity and understanding of a hired tappers in which expectations of tasks and behaviors were high. Pressure and restriction in work were lower than dealing with TR1. Similarly, in most cases of TR1, the establishment of merchants or processing unsmoked rubber factories has been developed in the past 20 years. The analysis revealed that the farms in this trajectory had balanced to optimize financial returns and social value.

Figure 2-19 shows the distribution of landholding size and a trend of increment of landholding out of which about 69% of total farms evolved under the cluster of medium family farm enterprises since 1990 while about 31.0% of total farms evolved from small family farms toward medium family farm enterprises in 2000 or 2010. The distribution of landholding varied during 1990 grouped into both medium farms and family farms. Landholding substantially increased during 1990 and 2000 and continued to increase in 2010 as in Figure 2-19.

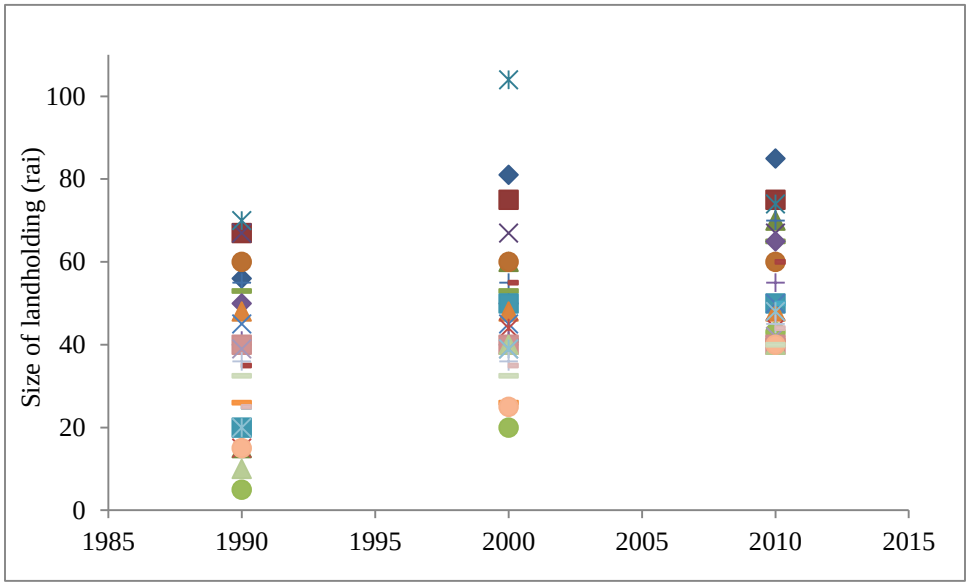

Figure 2-19 Landholding changes in each farm underwent trajectory of medium family farm enterprise from 1990, 2000, and 2010

In addition, our respondent argued that a high rubber price was a very important factor to determine land price for such during the 2010s when it was not a good time for expansion of farm size. They had accumulated money and waited until the period of low rubber price where land price would decline. And so they would purchase new farmland again, indicating attempting expansion in the size. Unlike farmers in TR1, they were not interested in expansion of plantation

in the north or north-east due to the difficulty in managing plantations, the high cost of production, unsuitable areas, and drought conditions.

This case study was a representative farm from ten cases. The case study had emerged from the ranks of family farms and had built up toward a medium family farm enterprise. There was a capitalist entrepreneur that traced back his origins of migrated labor, raised specialize, and managed to scale up his plantation.

Case study 2: Mr. Prasit Suwanprakarn

Mr Prasit Suwanprakarn was born in 1951, originating from a peasant family. His parents were rice farmers engaged in a small-scale in Kaunneang district, Pattalung was dominated by poor families of rice farmers. Because of poverty and small scale of paddy fields, he migrated following his relatives to be a hired tapper in Ban Mai/Sadoa in the mid-1970s. He was employed as a hired tapper in a jungle plantation of about 9.0 rai. This was the most important experience to learn that rubber was a more profitable crop than rice; this encouraged him in the need to have rubber land. In 1980, he had sold his inherited land of about 4 rai with the intention of buying land for rubber. He had purchased the first small parcel of about 5 rai from his friend at a low price in the following year. The earnings of off-farm work with share-tapping was divided for supporting his parents and for investment in the plantation.

In 1981, he got married and settled in Ban Mai. His family had received inherited land of about 22 rai from his wife's parents. This plantation was used as a source of capital accumulation to finance expansion of landholding of about 19 rai in 1992 and 18 rai in 1995. Gradually, he focused on farm management, share-tapping contracts, replanting, new technology, improving productivity, and the rubber market. He had established a small farm enterprise to facilitate his own effective management and used more hired tappers.

He explored marketing channels to sell at a better price through factories, exporters, and the central rubber market. He had invested in the purchase of a small car (pick up) for transporting his production to the central market in Hat Yai. He stated that he had explored the market in Hat Yai and local markets in order to get a better price. By the experiences in rubber market, he managed to accumulate money during this period and then in 1999, he had invested in a small smoked factory that allowed increasing profits and resilience to price change.

He also started to buy latex from other farmers for processing rubber smoked sheets. This business provided capital accumulation to reinvest for improving productivity, land accumulation, and the expansion of business.

In 2004, he had expanded his business as a middlemen of fresh latex which had been consolidated with the small smoked sheet factory. These activities were made to be more profitable and became a reliable source of income and helped to acquire a large number of landholdings in this period. He claimed that over 50 rai of landholdings were accumulated

during the 2010s coming from his involvement in the rubber trade and helped by returns from the plantation. In 2010, he had engaged his daughter to be a farm manager. He had provided to supervise farming operations and farm business. He stated that his daughter was a good farm manager and managed to carry out modern business management, which typically increased efficiency of contracts and more profits. These led him to concentrate more on the plantation. He also stated that his children went into higher education. He had reason to be proud when his daughter became a farm manager. His elder son has preferred to work as a lecturer in university, and his other son has worked as a professional in a big company in Bangkok.

Mr Prasit had become one of the most successful medium farm enterprises in 2012. He was a migrated laborer into rubber areas as a hired tapper and learned the value of rubber production and raised his specialization, and then created his own plantation and managed to scale up to a farm enterprise. When Mr Prasit had accumulated some initial capital from the plantation, he had reinvested to increase land accumulation and related business. He had developed behaviors of farm enterprise by experiences in a large landholding and new economic activities. He had taken advantage of economic opportunities for accumulation permitting a significant expansion of landholding and growing the related business.

Regarding farm management and performances, Table 2-21 shows that total costs and intensity of capital invested in the plantation were similar to TR1. The result was that the average yield was high to compare with the average yield of nation. "*Toa-kea and Loo-kuli system*" also employed to manage production and relations between the owner and hired tappers. Of course it was made by the experiences and local institutions in certain circumstances. Various types of share-tapping contracts were applied from 60:40, 55:45, and 50:50. Generally, local hired laborers and relatives were employed regarding to kinships, skill, high trust and confidence, and social institutions. Paid laborers were often used for weeding control in conditions of hard work. These farms might not have financial and accounting systems.

Like TR1, respondents argued that they had focused on productivity and cost reductions. Specialization derived from full-time work, extensive experience, and knowledge. High motivation to learn new knowledge and their relations with staff in rubber organizations and research centers allowed them to access new technology and the use of progressive technology in plantations, such as organic fertilizers, intercrops, the use of stimulation, and new clones. Farms in this trajectory had shown strong attention for expansion of farm enterprises so that capital accumulation was initially re-invested for expansion, productivity improvement and financial support for self-employment in non-farm sectors. Often children were employed in non-farm sectors or were self-employed in non-farm activities. There was a large impact on the transfer of farm enterprise and expertise to children. Most of them hoped their children would stay in their plantations and would continue to grow in farm enterprise. Simple living with the inspiration of farm life and feeling proud of landholding were observed by this trajectory.

2.6.3 Toward patron farms

This trajectory contained rubber farms who experienced the increment of landholding and dependent hired labor, which this study calls “Toward patron farms (TR3)”. Land holding size was smaller than TR2, but they only used hired tappers. Pathways could be grouped into: 1) stable patron farms (3-3-3), 2) the growth of medium family farms toward patron farms (2-3-3, 2-2-3), and 3) the growth of family farms toward patron farms (4-3-3, 4-2-3) as in Figure 2-20.

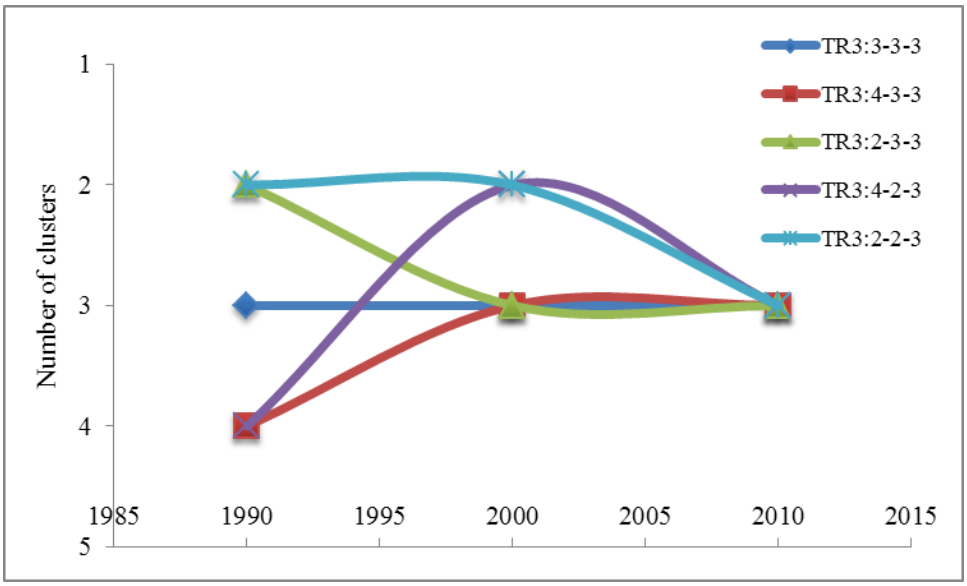

Figure 2-20 The 5 pathways for the trajectory “Toward patron farms”

The first pathway (3-3-3) accounted about 48.0% of total patron farms in which the head of household worked full-time with non-farm employment such as staff of company, governor, teachers, trade, and enterprisers. This pathway also included farms whose heads were merchants or self-employed in a shop, grocery, restaurant, garage, and so on in the village. Mostly they did not have tapping skills and had less specialized knowledge in plantations. Most landholdings were inherited from parents who owned medium size or large landholdings and thereafter landholding was steadily increased by purchasing lands and other inherited lands from parents.

Respondents stated that their parents had migrated into new areas of unoccupied land during the 1960s. Rubber was the main occupation of the family that led to gain experience in plantations. However, parents strongly encouraged them to attend higher education, and then they moved to study in town and Bangkok. Rubber income was the main source of household income and paid for the high expense of education. Higher education provided a good opportunity to enter a new career of non-farm employment. After marriage or starting their family, they moved back to their home town where they were able to have comfortable living with landholding and build a house. The landownership in the plantation was transferred to their family. Generally, landholding was sub-divided for each family member equally, and perhaps

were selection of larger plot for pure farmers or those of modest education. Since ownership transferred to them, rubber became a very important source of additional income that was marked increasing incentive for expansion continuously. Due to full-time non-farm work, holiday and free time were used for farm maintenance and arrangement of contracts. Qualified and honest laborers are important attributions for the tappers, which are then chosen among relatives, siblings, and social networks. These hired tappers were mostly introduced by parents, relatives, and friends. Paid laborers were employed for weeding control and herbicide. Fertilizer application was mostly done by hired tappers. Control and assessment of farm maintenance depended on characteristics of the rubber owners. In the past decade (2000s), many owners argued that rubber income was higher than their salary. Then their free time and holiday were usually used for controlling and monitoring of share-tapping and farm management.

Most rubber owners argued that rubber income was very important revenue to cope with the increasing cost of living and source of saving money for purchasing land. Accordingly, they paid much attention to seek opportunities for increasing the size. It was associated with high access to credit from banks and cooperatives that could offers a large loan for expansion. They often started with a small parcel of empty land or plantation. When they had become familiar with the process of land purchase, they preferred to purchase a relative large size of rubber land and business location because it could quickly give rubber income and had speculation of land price. The study found that even if these rubber owners had been familiar with the non-farm sector, they had a good attitude to farm life and farm experiences learned from parents. They also would have to increase landholding for financial return, creating a valuable asset for children, and preparing jobs for retirement.

The study reveals that the former generation (parents) was more likely to encourage their children to go into high education and enter non-farm employment that would uphold a family's honor. After they had received an inherited land and held with the property of family that had to be handed to the descendants, rubber would highlight additional income and would increase landholding consistent with a better financial position. A high earning plantation was likely to encourage them to improve productivity, to induce specialism and to have more time for arrangements of share-tapping contracts. However, in some cases, the study should note that farms had shown little experience, low specialization and struggling so that the plantation was limited to improve productivity and to be less efficient in share-tapping. Landholding would be expanded depending on saving money from outside farms.

The second pathway was characterized by medium farms moving toward patron farms (2-3-3 and 2-2-3). It constituted about 30.0% of total farms of TR3. In 1990, farms were structured and had the characteristics of medium family farm enterprises and the change of labor use that occurred led to be highly dependent on hired labor in 2000 or until 2010. The observation in family labor change was family laborers moved to work in non-farm activities such as factories

and trade. Landholding slightly increased over the study time. Out of which about 95 percent of total farms in this pathway were shop owners and merchants. The analysis revealed that households made the decision to extent non-farm activities depending on incentives, capacity, and individual preferences. Main incentives were the relative profitability, specialism, and risks of the farms that therefore caused diversity in favor of less risky income sources.

Household wealth, self-financing, and experiences were in a more favorable position and capacity to invest in non-farm activities. Some of them claimed that it was reasonable to concentrate on high-profit activities, i.e. a better return in non-farm activities relative to the rubber. Hired tappers who were relatives and local labor were employed to replace family labor. Rubber still generated a large proportion of household income which thereby encouraged expanding rubber landholding. Finances to invest in non-farm business mostly came from saving money generated by rubber income. Rubber lands were also securities for loans. In turn, the income earned from outside rubber also contributed highly to re-investment for improving productivity and expansion during 2000 and 2010. The study found that specialization was low compared with other pathways even if they had experience in plantation. In response to high rubber prices during the 2000s, respondents argued that share-tapping contracts were terminated in some plots to be replaced by family laborers. As well as investment to improve yield increased considerably. If rubber price regressed, these farms would be dependent on hired labor again.

The third pathway (4-3-3 and 4-2-3) accounted about 22.0 % of total farms in TR3. There was a change of small family farms toward patron farms. Farms experienced a change of labor use from family labor and would depend on hired labor and a steadily increase of landholding. Farms faced aging of the head of the household, lack of working capability, and low availability of family laborers would lead to employ hired-labor. In most cases, landholding substantially increased during 1990-2000 that led to growing structural farms from small family farms to medium farms or patron farms and therefore increased the proportion of hired tappers, accordingly. Historically, farms in this pathway were native villagers whose family had made a new settlement. In some cases, they migrated to follow their parents during the early 1960s. They received inherited land from the family which could generate enough income for living costs and education of the children. Higher education was a burden to families that limited the expansion of landholding before 1990. When their children graduated and got non-farm employment, savings gradually increased, allowing increment of landholding in 2000 and 2010. Then accessing credit from banks and cooperatives also facilitated to continue farm expansion.

At the current period, farmers are older ($\geq$ 60 years), have low working capacity and carry out less farm activities themselves. Landholding will be soon transferred to family members equally. Respondents stated that their children mostly worked outside the rubber sector in town or Bangkok. If they could not manage plantation, it would be sold. Farm worries are the loss of landholding and the difficulty to find solutions when their children preferred to work in

non-farm sectors. Hired laborers are employed with share-tapping. Respondents with hired laborers argued that generosity, kindness and encouragement to work were high so that they were willing to offer share-tapping contracts to them.

Figure 2-21 shows a trend of increment of landholding. The distribution of landholding varied during 1990, due to group of medium farms, patron farms and family farms. The average landholding slightly increased from 1990 to 2010 which size of scaling-up was varied. Farms in pathway of 3-3-3 and 2-3-3 appeared to outweigh capability and attempted expansion in size of purchased land.

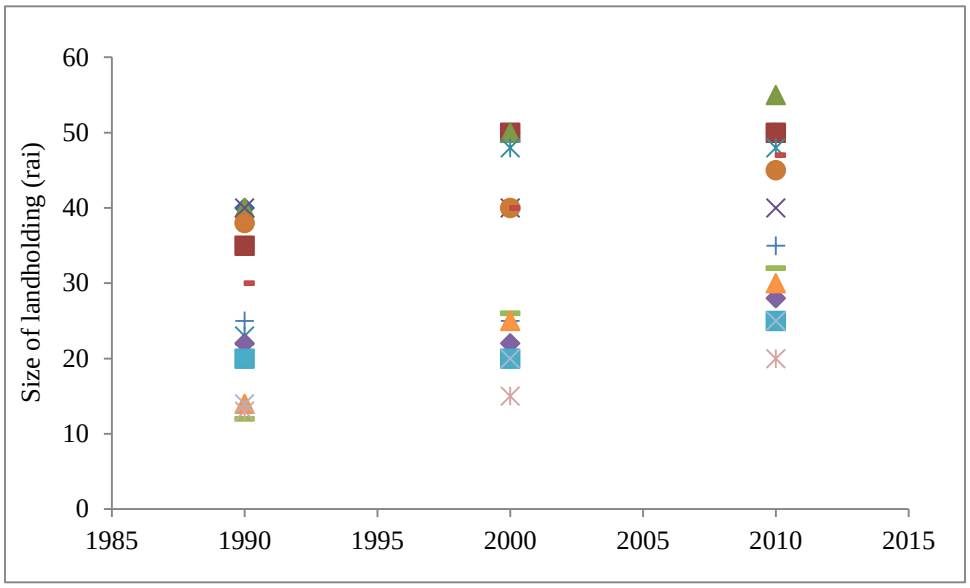

Figure 2-21 Landholding changes in each farm underwent trajectory of toward patron farms from 1990, 2000, and 2010

Figure 2-22 shows the change of labor use in plantations, the average family tappers was about 1.9 persons in 1990, substantially decreased to below 0.73 persons in 2000 and was absent in 2010.On the other hand, the average of hired laborers increased from 2.2 in 1990 to about 3.4 persons in 2010. This reflected the change of labor use from family labor to dependent hired laborers in 2010 while some farms have depended on hired laborers since 1990.

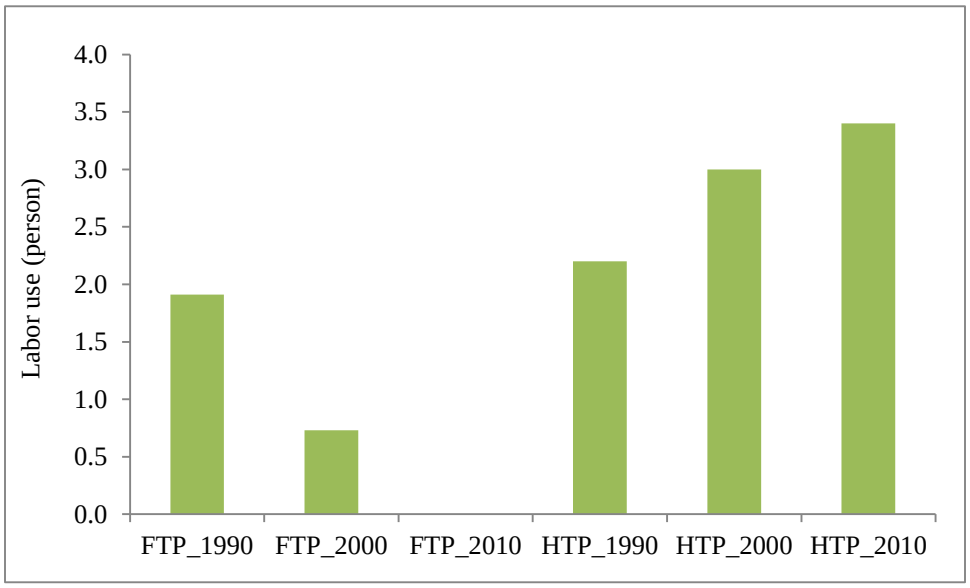

Figure 2-22 The average number of family tappers (FTP) and hired tappers (HTP) according to trajectory toward patron farms in 1990, 2000, and 2010

This trajectory shows remarkable diversity of farm pathways. The case study below was a representative case from fourteen respondents. This case study was a non-farm household and had initially accessed rubber land by inherited land. The case study had emerged from the ranks of family farms and managed to scale up his plantation through taking advantage from non-farm employment.

Case study 3: Mr. Prakob Thongkrai

Mr Prakop Thongkrai was born in 1964. His father was a rubber farmer holding about 60 rai. He was used to working on the planation since he was a child. Because of encouragement of family to take higher education, he had graduated from Rajabhat University which allowed him to be qualified as a teacher. He got a job as a teacher in Surattani high school in 1987 and moved to another high school in Rattaphoom district after his marriage in 1990. He received about 27 rai of inherited rubber land that he started to learn value of rubber in terms of additional income and wealth assets. He gradually changed his attitude to farm life positively for economic opportunities and family's wealth. Initially, he managed the plantation as a secondary occupation and still kept his salary from being a teacher. He started to expand his landholding with purchased land of about 13 rai in 1994 thanks to saving money from rubber income, and what he had saved from his salary. The second plot of 18 rai in 1997 was initially supported by his accessibility to credit and capital accumulated. Thereafter, he had invested much more in replanting in order to improve productivity.

Because the plantation became dependent on hired laborers, he had always emphasized social networks and employment of kin or persons in social ties that allowed him to access

labor availability, efficiency of contracts, and profitability. He went out for field trips every week to establish relations with middlemen and people in the village. These provided an effective strategy when middlemen, relatives, and people helped him to monitor, supervise, and control hired laborers. In this period, he not only learned a lot about farm management, technology, and contracts, but he also made the connection for land accumulation. He also received substantial training and knowledge from his participation with the Rubber Research Center and ORRAF. He also had learned how to manage his plantation when most of his time was spent at high school. He was one of the few farmers in the studied area who was willing to experiment with gas stimulation and new clones.

He had continued to manage capital accumulated landholding during the 2010s that he had took advantage of capital accumulation and more accessibility to credit. He also began to look for additional landholding in business areas or even in the town, which he purchased for building rental houses or for speculating land price. This activity also generated significant income which he reinvested in the plantation and land accumulation. Over 60 rai of landholding implied that he gradually become one of the successful patron farms among studied samples in several respects of farm management, improving productivity, and contract arrangement relying patron farm. He claimed that his attention to land accumulation and farm business did not affect his teacher's duties and responsibility, but he further was able to enhance functionality of teacher when his students mostly came from families of rubber farms.

Mr Prapob stated that he projected himself as a rubber farmer, indicating mobility toward farm enterprise which had contributed significantly to his success in land accumulation and the rising farm enterprise. This case study fully reflected the emergence of new farmers and their interrelations between farm and non-farm activities. There is no doubt that he used his position of teacher for increasing credit accessibility and to manage acquisition of landholding.

Concerning farm management in this trajectory, Table 2-21 shows compositions of costs and level of intensive capital invested in farm maintenances. The average of yield was about 1,806 kg/ha, ranging from 1,531 to 2,156 kg/ha. The variation of yield depended on the level of farm maintenance, biophysical of the plantation, and attention to improve yield which was lower than the results of TR1 and TR2. Our respondents argued that full-time work in non-farm employment had negatively impacted on low specialization and limited to improve productivity. In order to improve productivity and to cope with less specialization in the plantation, relatives and local tappers were employed to work all tasks in their contracts. Social networks through parents and siblings helped to prevent shrinking behavior, cheating, and disputes. Due to limited visits to plantations, social networks had created an effective means for controlling and monitoring production and working behavior of hired laborers. Indeed, cooperative members were joined because regulations and restrictions often could help to check and to verify both production and working behavior. In some areas, good relations with merchants and middlemen

helped them to arrange and to monitor share-tapping arrangements. All products had to be sold to specific merchants. While selling the products, the selected merchants would be informed about working behaviors, tapping days, sale records, bills and marketing situations in a week or month when the owners came to get their share. This was an effective tool to cross check quantity, price, and behaviors of hired laborers. Lastly, relatives or kin in the villages also could help to evaluate contract arrangements, to check quantity and price, and to monitor working behaviors of hired laborers and production for making a sustainable solution. At the present, the study found that farms in this trajectory had progressed to use new technologies such as stimulation, gas stimulation, and new clones. Regarded to higher education, active learning, and capital, the farms were able to understand in detailed use of technology and invested in new technology for profitability. They could have access to knowledge and information from rubber markets and research center that would have advantages for adoption of new technology and profits.

2.6.4 High structural change of farms

This trajectory presents the rapid change of large or medium family farms downsizing into small patron farms or family farms as in Figure 2-23. These pathways can be grouped into two farm pathways: 1) the change of farm life cycle becoming small family farms or patron farms and 2) the impact of sold land in the farm. The data showed that 74.0% of total farms in this trajectory had a large amount of sold land and 26.0% of the transferred land out of which changed into 65.0% of family farms and 35.0% of small patron farms.

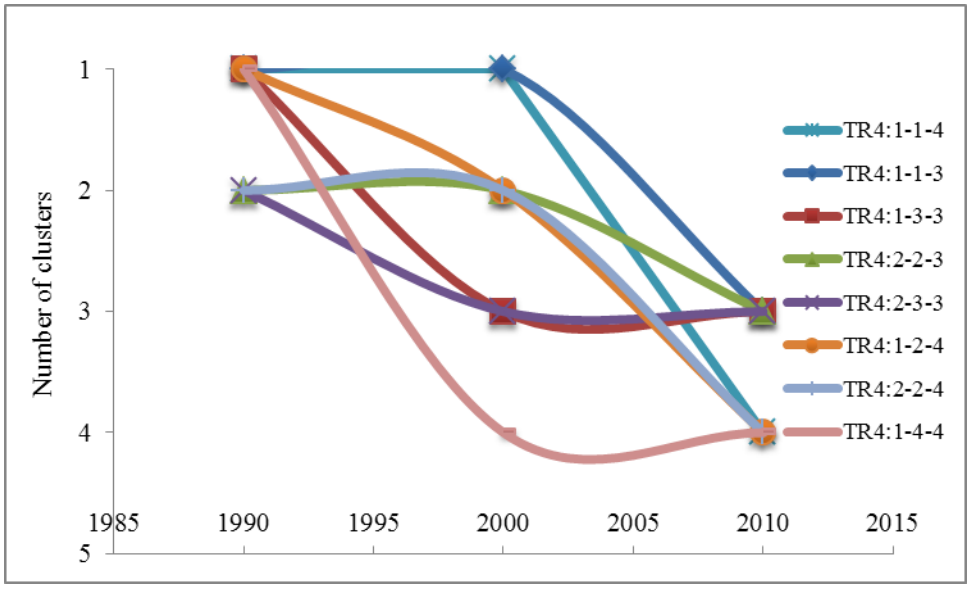

Figure 2-23 The 8 pathways for the trajectory "High structural change of farms"

The first pathway was characterized by farms that experienced both a large decrease of landholding and change of labor use. Before 1990, farms had shown structural characteristics of medium or large family farms. The average landholding size was over 120.0 rai, and employed

many hired laborers in plantations. A large decrease in landholding was mainly due to inheritance and partly sale of land. Figure 2-24 shows the trend of a large decrease of landholding size in this pathway. The average landholding in 1990 was about 114 rai per household, decreased to 47 rai in 2000 and declined to 19.0 rai in 2010. The largest decrease of landholding occurred in 1990-2000 and still held "ghost land" of about 19.0 rai.

Historically, these farmers came to the village for unoccupied land. Migration and means of access to land were similar with the second pathway of TR1 and TR2. A large amount of new land reflected diligence and hard working during the settlement time. Some farmers came to new settlements with their parents and had claimed a large landholding of unoccupied land. In response to high rubber prices during the 1950s, all lands excepted in wet areas were devoted for new planting. Typically, a family in rural society was an extended family. There were many family members per household to be available for cultivating rice and rubber. The data showed that the average number of children was about 6.5 persons per household. After his son or daughter's marriage, the new family might either come to be an extend family or build a new house near the old home in neighboring areas or in lands that would be transferred. Before land was transferred, the new family was permitted to tap rubber land in appropriate size under 50:50 share-tapping. There was verbal agreements to obtain landownership and also what obtained was security of their ownership. This process occurred continually from the first child to the last one except some sons or daughters who might move out the village or to town.

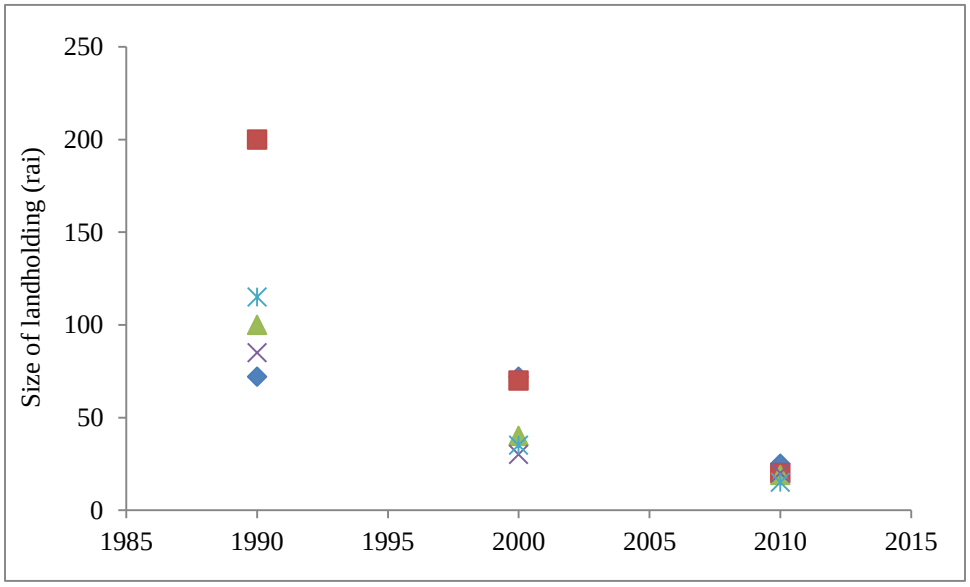

Figure 2-24 Landholding changes in case of transferred land underwent trajectory of high structural change of farms from 1990, 2000, and 2010

By 1990, the landowners were getting older that was an important reason to begin transferring land to their family members. Following customary rules for inheritance, all lands were divided equally and transferred in legal possession. The former rubber owners might leave

a small plot which was called *"ghost's plantation".* The role of this plantation was to generate revenue for retirement. Upon his death, ghost land would be inherited by the family member who took care of the farmer during retirement. Therefore, landholding size rapidly decreased in this farm and the use of labor also changed considerably.

The second pathway was characterized by downsizing of medium or large family farms into patron farms or family farms. This pathway included farms that had largely sold land. Farms were medium or large farms in 1990 and downsized to patron farms or family farms in 2000 or until 2010. Typically, a large decrease of landholding size was marked by land sold. It was complicated to explain the decision of selling land by only one reason. Indeed, the study found that socioeconomic pressure, attitude of family, vulnerable livelihood, and land price had influenced the decision to sell land. Farms were often exposed to high change of socioeconomic conditions and more materialism of living. Interviews revealed finding that personal consumption expenditure was made serious by extravagant lifestyles that had impacted on financial stress. Furthermore, a head of household with a gambling addiction often ended up deep in debt. This was a way to lose landholding and sell land. These behaviors brought their family into great debt and much difficulty in holding large landholdings. Borrowing money was easy as rubber land was a guarantee. In most cases, it seemed that total debt increased according to the need for electronic devices, cars, new house, and investment for new business. Unfortunately, accidents and special events had high debt for payback. Often these problems were never solved and then land was sold plot by plot a long life cycle. Perhaps they had been limited accessibility to capital market and limited education all together contributing to lost landholdings. Some farmers argued that the higher education of children was very important to their family and to guarantee his/her occupation in the future. Land had to be sold to fund children's education. Higher education appeared as a priority investment. About 10-20 rai of land was sold per transaction.

Respondents argued that high land price also influenced the decision to sell their landholdings. The price of land rapidly increased over twenty times in 20 years that caused itself more incentive to sell land. However, size of land sold usually depended on amount of debt and land price. Price of rubber land was higher than empty land. Interviews revealed that since farmers started to sell land, financial stresses did not leave but tended to increase according to vulnerable livelihood and socioeconomic pressure which rapidly grew. In particular, farmers had sold land where they had no documents of land right, or the landholding was located in a forest zone or had difficulties to get land rights. This pattern generally occurred on overlap zones between forest or conservation areas and cultivation areas. A few farmers had sold land due to lack of confidence in government policy for land rights.

Figure 2-25 shows the samples of those experienced a large decrease of landholding by land sales and their distributions. The average landholding was about 70 rai per household in

1990 that decreased to 55 rai in 2000 and fell to 28 rai in 2010. A large decline in the size occurred during 1990-2000 and continued to downsize in the current period. Five farms owned landholding below 10.0 rai grouped into small family farms in 2010.

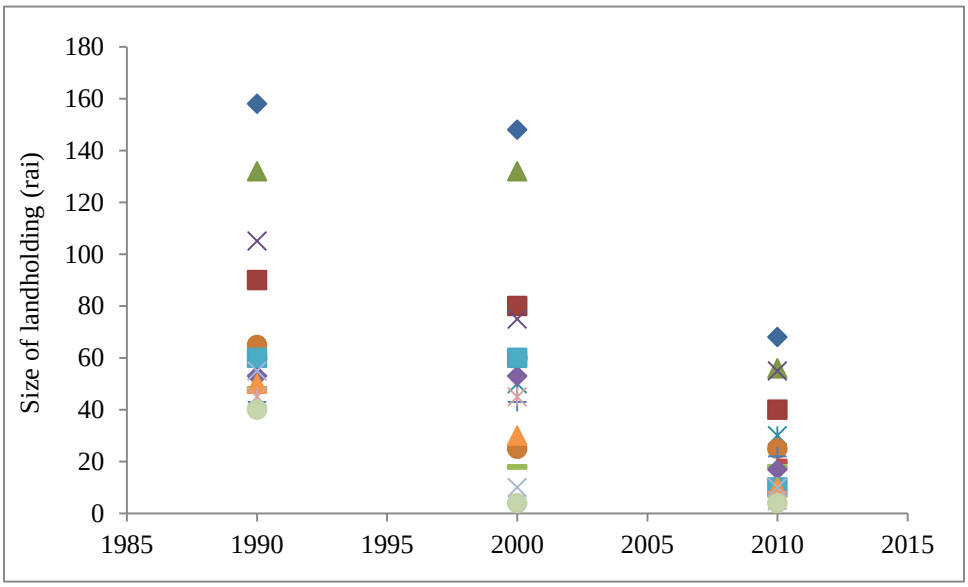

Figure 2-25 Landholding changes in case of the sold land underwent trajectory of high structural change of farms from 1990, 2000, and 2010

The case study below was a representative from ten respondents. The case study traced back his origins to a large farm who had access to a large amount of land during settlement, but it continuously declined in size into family farms. This case illustrates that farms had been compounded by socio-economic pressures and external shocks. In order to maintain consumption and improve livelihood, the sold land was adopted.

Case study 4: Mr. Loy Bunmee

Mr Loy Bunmee, born in 1945, originated from a peasant family. His father was a poor farmer who owned a small rice farm in the rural area around Muang district, Pattalung. Because of poverty and the need to have more cultivation land, his father had migrated into a new settlement in Koa Phra. His father and Mr. Loy began to claim a large new area of land when rubber was a profitable crop and dominated to expand in the areas. A large amount of new land was claimed for new planting (seedling rubber) and to cultivate food crops familiar with shifting cultivation. In 1967, Mr. Loy got married and formed his household in this village. He received about 40 rai of inherited land from parent's wife. His father died in late 1970, when he consequently received a large amount of landholding. At that time, he owned roughly over 147 rai of landholding mostly devoted for rubber plantation and some part to

fruits. He always farmed on the basis of rubber jungle and started to participate in replanting in 1988. The first land to be sold was about 28 rai in the early 1990s that generated enough money for building a new house, supporting the education of children, and daily living expenditures.

Five years later, he sold about 23 rai to cover some of his daughter's tuition and to buy a new car (pick up). He argued that the existing size of landholding was difficult to carry on by himself. He thought that revenue generated from selling the land could be used to purchase land in other areas where land still was low price but he had never done this. Then again, about 17 rai was sold to pay the cost of his son's marriage in 1995. He claimed that after the mid-1990s, he had fallen in much more debt and was unable to meet loan payments. He had borrowed much more money to cover his children's education and cost of his health treatments. He also had offered to pay for debts of his son and daughter, and eventually they had formed their households. These debts mostly came from unforeseen expenditures which mostly came from illnesses and accidents in the family and the need for money to improve their livelihood. This included the difficulty to access credit with lowest interest rates. He had also faced rising socio-economic pressures and disability to counter them along his pathway. Consequently, land was sold when they wanted to have money in order to repay the debts. Several plots therefore were sold during the 2000s.

He had failed to improve the farm enterprise because of the financial constraints and lack of capability to manage business. A half of total landholding was still replanted during the 2000s while the rest of rubber land had shown diminished yield with the old plantation. The delay of replanting described that rubber had not generated sufficient income for overall costs that he faced. Unfortunately, he had fallen to more socio-economic pressure that led to the lowest investment in production and never planned for expansion of landholding.

About 32 rai of landholding in 2012 indicated that his family had rapid changed downward from large farm enterprise to family farm. His life history revealed aspects of social differentiation and change of farm pathway where the increasing socioeconomic pressures forced his family to search for alternatives to maintain livelihood. However, it was difficult to say that land sale depended on livelihood adoption. Mr Loy had failed to set up farm enterprise and lacked the means of improving productivity that caused no options to cope the raising socio-economic pressure when prices fell. However, in the last decade, as Mr Loy remarked, he learned to value the plantation and the importance of landholding himself more that persuaded him to adopt livelihood and to invest for improving productivity.

Regarding farm management, Table 2-22 shows that the average of total cost was about 9,960 baht per ha. Fertilizers applied about 1.5 times per year or 1.0 kg per tree. Weeding control was done about 1.0 time a year. Weeding and fertilizer application were done by family labor. The average yield was about 1,750 kg/ha. Level of yield was similar by TR5 and TR6. The study

observed that farms belonging to the first pathway had more experience and specialization in plantations rather then the second pathway.

Table 2-22 Estimated average costs of farm maintenances according to TR4, TR5 and TR6

	TR4	TR5	TR6
Yield (kg/ha)	1,750	1,730	1,718
Fertilizer cost (baht/ha)	8,400	7,200	7,180
Frequency of fertilizer application (time/yr)	1.5	1.2	1.2
Paid labor for fertilizer application (baht/ha)	n/a	n/a	n/a
Weeding cost (baht/ha)	1,560	1,560	1,560
Frequency of weeding (time/yr)	1	1	1
Total costs (baht/ha)	9,960	8,760	8,740

Remark: the survey in 2011; fertilizer application were applied by family laborers

2.6.5 Stability of family farms

This trajectory belonged to the cluster of small family farms from 1990 to 2010. Farms were characterized by the pathway of 4-4-4 which were stable small holdings and the use of family labor. In order to understand the farm trajectory, the study will explain the history of settlement by smallholdings and the establishment of family farms that could explain why smallholding persisted and was limited in growth.

Our respondent stated that his family could be tracked back to the pioneer settlers who accessed new land through deforestation. Density of population and cultivation areas under paddy fields up to the border enforced the decision to migrate for more available cultivation area to produce food and soon to plant rubber for cash income. Settlers usually started to claim new land in an uphill area and deforestation zone, which mostly lay on long central regions belonging to the ridges of the Royal Mountain, Tanaaw Si Mountain including the west zone of Songkhla Lake. Large forests exploited by commercial logging companies that made deforest construction and extract timber in the area. During that time, the early development of roads and sawmills took place. The first group to the new area were sawmilling workers who came from neighboring villages and other provinces. Perhaps they were the pioneer settlers in some areas. The settlers established a new home either temporarily or permanently. Land clearing and shifting cultivation were made by family labor that could occupy about 5-10 rai per year. Considering high rubber prices and achievements of Chinese plantations in terms of cash income and long term economic prospects, they started to plant rubber together to cultivate field rice, peppers, and annual crops that could supply food and their surpluses to sell for cash income. In parallel, rubber and fruit trees had been planted. Seedlings of rubber trees could be collected from plantations of neighbors or Chinese. Simple technology was adopted for planting and growing rubber trees that might be copied from Chinese plantations. Wetland was used for paddy fields, but it mostly could cultivate rice the next year. Those cultivations also were marks of ownership and right to use by people. The pioneer settlers might have a large landholding size and soon gave free land

or sold it with the lowest price to new settlers in order to motivate migration of new families. Also, they could have more available labor by cooperative labor exchange and security in times of hardship conditions of settlement.

Our respondents stated that they began to have boundaries of land through marking big trees, canals, or gorges. Occupied land increased until they reached boundaries of each other. The estimation of occupied land was about 20-50 rai per household depending on available labor and location. The main reason was for acquiring cultivation areas to produce food in the first period and later for rubber plantation. From a few families to many, the community had developed into a functioning village across the studied area. Each community mostly started to extend by one or three family names. Typically, road network links between southern provinces from Suratani, Nakorn Si Thamarat, Patthalung, Songkhla, and west coast provinces that had been opened up to deforestation and reserved forest areas and thus settlements had increased considerably. More migrated families that moved into the new land in later years began to settle in small groups lining the road along the mountain ridges. During the 1970s and 1980s, the cultivated area expanded into the hinterland and further expanded into green forest zones. This process was accelerated in this period when tractors were introduced. The settlers who moved to new land in the later years gradually extended their lands through deforest beyond conserved forest areas and the mountain ridge bordering the west coast. Spontaneous settlements had been recorded for the studied area at least before the 1980s when the government reserve areas Act was effective, affecting recession of migration and expansion of new land.

The data showed that size of landholding rapidly decreased when this landholding was given to the second generation (family of sons/daughters; studied samples). 84.2% of households in this trajectory was divided equally landholding and passed down to family members and 15.8% for large share by elder brothers or young sisters. The average number of children who had rights to have inherited land was about 5.03 persons per household. The estimation of landholding by settlers was about 50.9 rai per household. Thus, land transferred was about 12.0 rai per households as in Figure 2-26. Figure 2-26 shows that size of landholding from the former (parent 1st generation) sharply decreased about five times that was passed down to the second generation (Children 2nd generation). It is remarkable that numbers of family members and size of holding by the former owner are important factors to determine landholding size of the samples. Landholding is increased through marriage and purchased land. The hidden reason is that parents do not leave different landholdings for anyone else. A large plot may be easily divided equally but if there are the different plots in size, the selection of plot for whom is done by parents. To embed by local customary rule, in such case will be affected by religion and ethnics, elder brothers/sisters might get a larger size than other young sons/daughters. This is because they are often available as laborers to work in plantations and perhaps do not get higher education.

Moreover, education levels and non-farm employment have influenced the different size of inherited land as well. Extension of higher education has been greater since the 1960s providing the opportunities to enter non-farm employment. Sons or daughters who graduate from higher education and work in non-farming jobs will receive smaller inheritance. The reason is that the family spent a lot of money on education generated from rubber income and previous hard work of family.

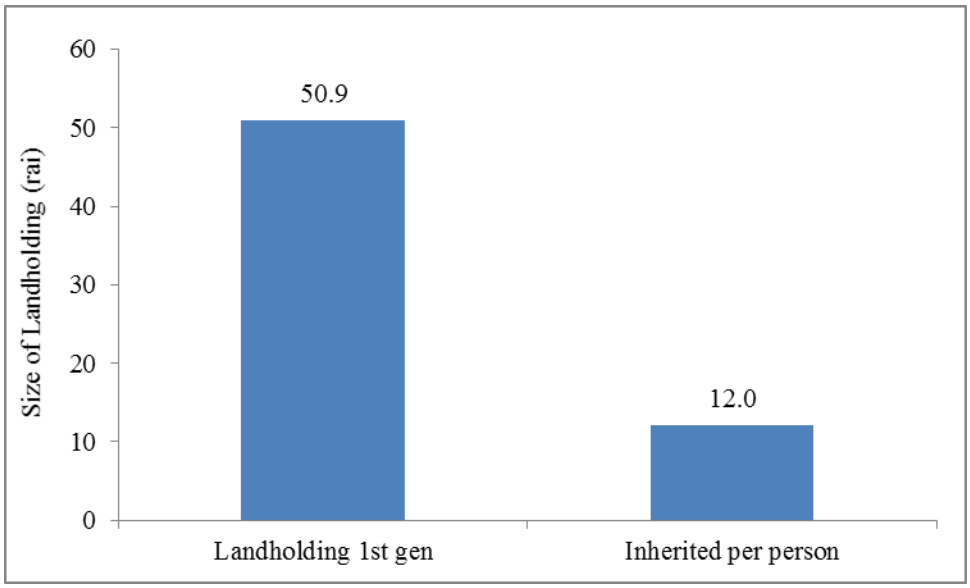

Figure 2-26 The average landholding by the first generation and inherited land for the next generation according to the trajectory of stable family farms

The study found that one of the important factors affecting farm size in the current household was the customary rule to embed landownership and right to use land. After the sons or daughters marriage, the new family would move into the household of parents to form an extended family or split the household to build a home in the village, it would mostly be built near the parent's home or on possibly inherited land. Parents would employ them to tap in the plantation or to cultivate rice. In this case, 50:50 share-tapping was applied. There was important available labor for re-plantation, new planting, and cultivation of rice. This enabled supporting social and economic status of new family by parents, which the study considered as further promoting values and sustainability of the family. When the new family had 1-2 children, verbal agreements to obtain landownership would give them over a particular plot, reflecting the right to use and ownership by family. The husband and wife might receive more inherited land from his family that could increase landholding. Fortunately, following local customary rules, if a son got married and moved into his wife's family in another village, he could have just a small or even no inherited land from his parents because he received a grant of land from wife's family. This could explain variations of landholding after marriage. For Muslims and ethnic Chinese, the wife should move to work under her husband's family. It seemed that this process gained to

possess more available laborers to work in plantations and field crops. The split to new household occurred after they had 1-2 children.

All of landholding was generally transferred as legal landownership when parents were very old aged. This could explain why increment of landholding occurred for middle aged families. As result, these families might get landownership during the period of 1980s to the 2000s. Rubber was the main source of household income that paid for living costs, facilitation of equipment, and education of children, which had been inflating according to social and economic growth. The results were low savings for re-investment and a trend to increase amount of debts borrowing from banks, cooperatives, saving groups, and private sources. Starting debt was the creating of intentionally or inadvertently matter that would lead to serious payment of debt affecting high tapping frequency to get daily rubber income. This was a paradox when the main revenue was generated by rubber with low diversification in household income, so those farms would be tapped to maximize short term production without trying to improve yield and extend economic life span. The farmers often said that "*if we do not tap, there is nothing to eat*". This indicated that rubber income was spent for everything in households.

The study also found that purchased land was low due to lack of capital, low access to credit, and attitude to threatening debt. The decision to purchase landholding was a very important event. Saving money and loans from cooperatives were sources of finance to purchase land. Due to high land price, farmers preferred buying very small parcels of about 6x6 m. per parcel for constructing houses along the road line. Often purchased land was bought from brothers or relatives, which showed the desire to keep original property of family name and contribute a valuable asset for his children. Land prices might be lower than market price.

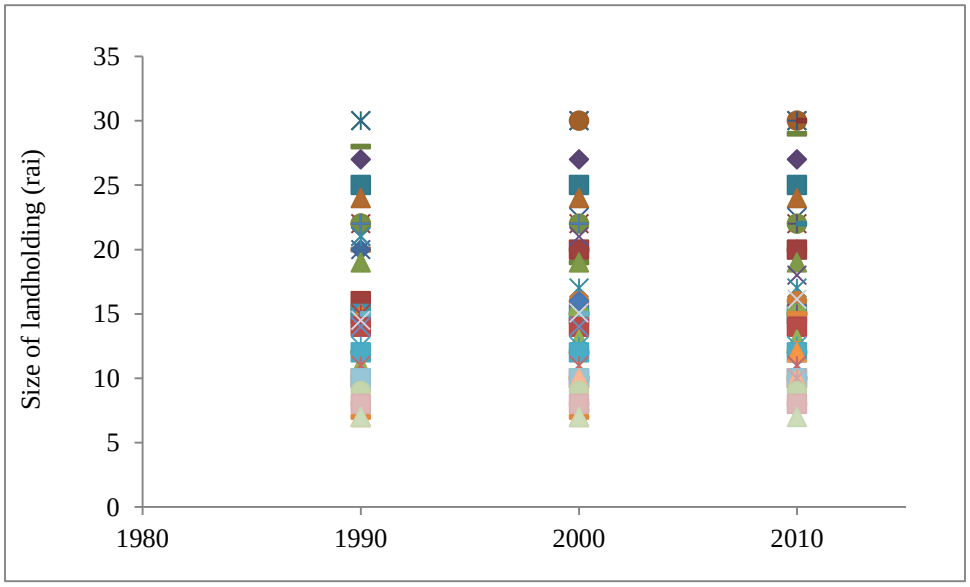

Figure 2-27 Landholding changes in each farm underwent trajectory of stability of family farms from 1990, 2000, and 2010

Figure 2-27 presents that the average landholding size was stable even if in some cases size of landholding steadily increased by a small amount of purchased land or inherited land after 2000. The average landholding size in 1990 was about 14.10 rai per household, and little changed to 14.60 rai in 2010. Similarly, the average family labor was about 2.1 persons per household over the study time reflecting a full-time involvement of husband and his wife in the plantation.

The study also found that the conversion of rice fields to rubber plantation or oil palm substantially increased in this trajectory since the early 2000s even though farmers always argued that this area was unsuitable land, low yield, and with high production cost. Our respondents argued that rice was difficult to grow due to high cost, low yield, and no irrigation system. Indeed, expansion of plantation areas was made to reach boundary lines to default growing rice. They thought that empty lands did not meet requirements of increasing revenue. It appeared that land was used in advantage from specialization in plantations. In some cases, in order to compensate the small size of holding and increase diversifications, intercrops were adopted under inter space among rubber trees during the immature stage. Since 1960, regulations of ORRAF restricted intercropping in mature rubber plantations, but later in the early 2000s it was permitted to have intercrops in some proportion. Traditional vegetables, sala, and timber were planted as intercrops among standing trees. These were already developed during the period of jungle rubber. They could help to increase farming diversification, food security, and additional income in case the rubber price fell and regressed yield. However, many areas had been limited to adopt intercropping due to restrict topography, weather, location, capital, and individual behaviors.

In addition to this farm pathway, the study found that after the 2000s, young laborers were likely engaged in non-farm activities or self-employment that could earn non-farm income and improve livelihood. One of the highest growths of industry and commercial trade in the studied areas created opportunities to enter non-farm employment such as in diverse companies and manufacturing. As well as this it encouraged some farmers to establish self-employment such as selling groceries, middlemen, traders, and variety shops. In such cases, labor use was changed corresponding to work on-farm and non-farm activities. For instance, in the early morning, tapping tasks were done by the head of household before going to the office. Collecting latex and selling were done by his wife or family members. The combination of working on-farm and non-farm duties was high for young families who had higher education and working capability. In response to the high rubber price in the 2000s, young labor tended to come back to work on the farm again in response to high remunerative work compared with daily wages in factories. Then, even if farms presented a stable structure, it appeared to have diversified use of family labor especially young labor.

Generally, children are encouraged to enter high education to get a chance to be employed in higher status jobs. The study found that most parents did not like to engage their children in farm or self-employment. Perhaps this was accordance to what this family perceived on limits to growth and land pressure. The inherited land they received was probably low and not enough to gain enough income. Then they emphasized higher education that would cope with land pressure and accorded to a negative attitude to farm life by young labor. They also stated that if their children did not graduate, they could work on the farm in their owned plantation or share-tapping. Since their children worked in non-farm activities, most families would receive income from their children monthly. There was a customary rule that children would donate to parents. In these cases, the study found that landholding would possibly increase reflecting the combination of incomes from rubber income and non-farm income allowing the purchase of small parcels of land. This also characterized the relationship between farm and non-farm. In such cases, the head of household had a positive attitude to farm life and attended to have more landholding. Purchasing land tended to increase through his efforts even they had less savings. The point of view was that parents should prepare assets for their children. The absolute landholding to transfer to their children of 10.0-15.0 rai was an appropriate size to earn income for their own living. It was a great positive attitude of having farm life that was observed by young households with high working capability.

As Table 2-22 explains, this trajectory was characterized by farms with low yield, use of intensive tapping, and low re-investment in plantations. The average of applying fertilizers was about 1.5 times per year or 0.75 kg per tree. Weeding control was done about 1.0 time a year. Weeding control and application of fertilizer often were done by family labor. The average cost was about 8,760 baht per ha. The average yield was about 1,730 kg/ha. In some cases, farmers did not apply fertilizer and made no weeding for a long time. Our respondents also claimed that they would apply organic fertilizer due to high cost of chemical fertilizer. This could reduce the cost of production. A high intensive tapping system was widely applied such as S/3 3d4 and S/2 3d4 while S/3 d1 might be used in some farms reflecting the need of a high rubber income and less sufficient size of rubber land. High tapping frequency would generate a maximum output per annum, but it had impacts on the lowest labor productivity and shortened the productive year. This consisted of general characteristics of small family farms who gave importance to cash income rather than productivity. Furthermore, a problem was inconsistency in tapping skills and relevant skills in plantation. These had effect on damage of tapping panels and low renewable bark that would lose economic performance in second bark as well as high bark consumption would reduce productive years. These serious issues had been perceived by farmers and would be more constraint in unsuitable areas of interrupted biophysical of rubber tree and low yield.

Concerning labor use, family laborers consisted of husband and his wife. Often if children were not in education, they would help to work the farms. Paid labor also was hired to carry out hard work such as weeding control and herbicide. In the past 10 years, marketing

system was gradually developed that had impacted on production forms to dominate by the sale of fresh latex and marketing function by cooperative and farm groups. Latex would be transformed to rubber sheets or smoked sheets by cooperatives that provided a way of helping to increase marketing efficiency and price at farm gate. These changes allowed them to reduce working time about 2.0 hours and earned cash income daily. More available working time could be used either for leisure or for off-farm or non-farm activities. Typically, engagement in non-farm activities was able to increase additional income and diversification.

It was obvious that small holdings and no change of technology were important factors affecting accumulation of money to expand farm size and investment in plantations. One of the important factors influencing limitation of growth was extravagant behavior and materialism in theses households. Many respondents argued that much of the money had been spent on facilitation equipment and unreasonable devices, such as a lot of electric equipment, new cars, and unnecessary goods. This life style was the consequence of the facts that most of revenue would pay back those debts and low savings for investment and improving productivity in plantations. Then many farmers claimed that cost of farm maintenance was incurred to them affecting less to farm maintenance. It seemed that everything needed to spend from daily food to facilitation equipment. A traditional rural life style was left to be replaced with urban behavior. For example, the cultivation of food and vegetables for daily consumption could be done traditionally. There was a certain amount of self-cultivation for food in households. Now, those needs had be purchased from market. From the views of key informants in the studied area, these changes led to raising cost of living. They also stated that cost of fertilizers could be reduced through mixed fertilizers between organic and chemical fertilizer which was promoted by the agricultural extension department. Each farmer could produce and make choices himself, if a farmer wanted the cheapest and acceptable performance. But most farmers seemed to prefer comfortable reasons to purchase everything as they needed.

Due to rubber income that farms could generate every tapping day, they did not emphasize saving money and life security in respect to price fluctuation and declined yield. Some farmers thought that income could be generated as soon as they tapped, and then tapping every day could generate income as they needed. They preferred to work every day if rubber trees could be tapped, reflecting high pressure of landholding and socioeconomic situations. The data showed that the number of farms in this trajectory decreased as Table 2-16, 2-17 and 2-18. Farmers still dealt with small farm size, no change of technology in plantation, and struggling for survival of the family. Farm size would increase through income of non-farm activities, but this option was available for some farms, often in highly educated families.

As below, the case study was a representative family farm from seventeen respondents. The case study, originated from family rubber farms, received a small amount of an inherited land and raised specialization in plantation. Small scale farm operated with family labor and

managed diversification in farming in order to sustain livelihood. The case study therefore achieved to improve and sustain livelihood through adopted farm strategy emphasizing diversified incomes and diversifications of farm activities.

Case study 5: Mr. Prokob Boonpet

Mr. Prabon was born in a rubber farming family in 1961. His father was a poor farmer with small scale activity in Muang District, Pattalung. This forced him to leave rice areas to a new settlements in the uphill zone. About 46 rai had been claimed by his father to plant rubber and to cultivate rice and food crops. He was used to working on the farm since he was a child that helped him to develop skill and specialization in plantation.

In 1985, he got married and built his household. His wife came from another village who originated from rice family. He and his wife worked as hired tappers in his father's plantation and cultivated rice about 4 rai for family consumption. In 1989, he received inherited land about 13 rai where had just been replanted, and so he became to be a hired tapper again. Because of falling rubber income and increase of family expenditure, he had become a worker in construction periodically during the early 1990s. This was a difficult period when rubber price was low that increased more debt with not enough expense to cover improving livelihood, children's education fees, and investment to transplant rice areas about 4 rai into rubber. He decided to encroach rice areas into rubber because of high cost of rice production and the difficulty to manage rice cultivation. He thought that increasing the rubber land could help to increase household income considerably. At the same time, he received ORRAF's training in rubber technology and intercropping, especially rubber associated with sala, traditional vegetables, and livestock. He eventually found the best practices and more information from sala farmers in Songkhla and Yala that had led to invest sala in rubber plantation in 2004. He also managed to intercrop traditional vegetables (Hreang) and turned to invest for improving productivity in plantation. He stated that when he relied on rubber income, he suffered from debt and faced vulnerability in his livelihood. This was because price fluctuations, small production, and imperfection of rubber market. Farm life was never happy or had freedom from debt. In order to cope with small scale and to sustain livelihood, he decided to invest in intercropping and emphasized improving productivity, which gradually transformed into progressive farming. Diversification of production allowed him to have varied income and increase resilience to market and price.

He also stated that he emphasized education of their children. Two sons and a daughter had gone into higher education. Household income mostly was invested in children's education. Higher education could be considered as possibility to ensure the future of his children. The elder son had graduated in 2009 and was employed by a government bureau in Bangkok. Two children were still being educated at university. He invested much more on children's education as he was not sure that his own landholding might not be able to support

them at the time of his death. Fortunately, the elder son remained to donate income that helped to manage capital accumulation for purchasing land about 100 square meters in 2010.

During the period of price boom, extra income gradually provided for the improving of livelihood and saving money. He recently decided to invest a lot of money in sala production and new intercrops even though production and market were severely constrained. He also played an important role to establish and managed the rubber cooperative in the village that allowed him to increase profit from accessibility to modern markets and better price from a price support program. Together with his role in the cooperative and with progressive farmers, he built up a considerable reputation in the village which he was selected by rubber farmers in the village as president of the rubber cooperative. Thus, during the 2010s, Mr. Prakob became a successful family farmer to be recognized as a progressive rubber farmer. According to his account, he initiated to achieve diversification of production and also emphasized the cooperative in production and markets. His plantation became the center of agricultural learning and extension.

Mr. Prakob started his family with small scale of which the replanting with high yield helped to increase profit and perhaps to cope with the period of falling prices. Increasing family socio-economic pressure and expenditure forced him to find alternative farm adoptions of intercropping. These farming systems enabled him to generate a reliable source of revenue which had been sufficient for improving livelihood, but his capital accumulation was made difficult to expand landholding.

2.6.6 Declining very small farms

This trajectory was characterized by very small family farms who owned very small landholding and used family labor on-farm and off-farm. Patterns of clustered farm pathway consisted of 5-5-5, 4-4-5 and 4-5-5, as Figure 2-28 shows. 48.3% of total samples of this trajectory were already very small farms since 1990 (pathway of 5-5-5), but they continued to decline. 51.7% of total samples of this trajectory had evolved from cluster of small family farms fallen into cluster of very small family farms in 2000 or 2010, presenting by 4-4-5 or 4-5-5.

Undergoing pathway of 5-5-5, our respondents stated that the family could be traced to the period of settlements when parents had migrated into the village during the 1960s-1970s. They could access new land or purchase cheap land from the pioneer settlers. This deforested land was cleared to plant rubber to generate cash income and also to cultivate food crops for home consumption with similar patterns of occupied land of small family farms. They also exploited jungle resources for cash income such as honey meal, wild animals, and timber. Interviews revealed that once they were married (studied sample), a new family was established under the traditional extended family or built on split household in parents' landholding. They were employed to work as hired laborers by parents or worked off-farm with share-tapping in the

rubber land of relatives, which became an important source of income to households today. Skills, qualified labor and expertise were important attributions to deal with a better condition of share-tapping. Social networks and high participation in social activities also contributed to get share-tapping and to sustain reputations in share-tapping. As a result, they could have a large off-farm area and dealt better conditions of share-tapping with medium or large family farm enterprises in the village. Household income depended on off-farm income which was higher than on-farm income.

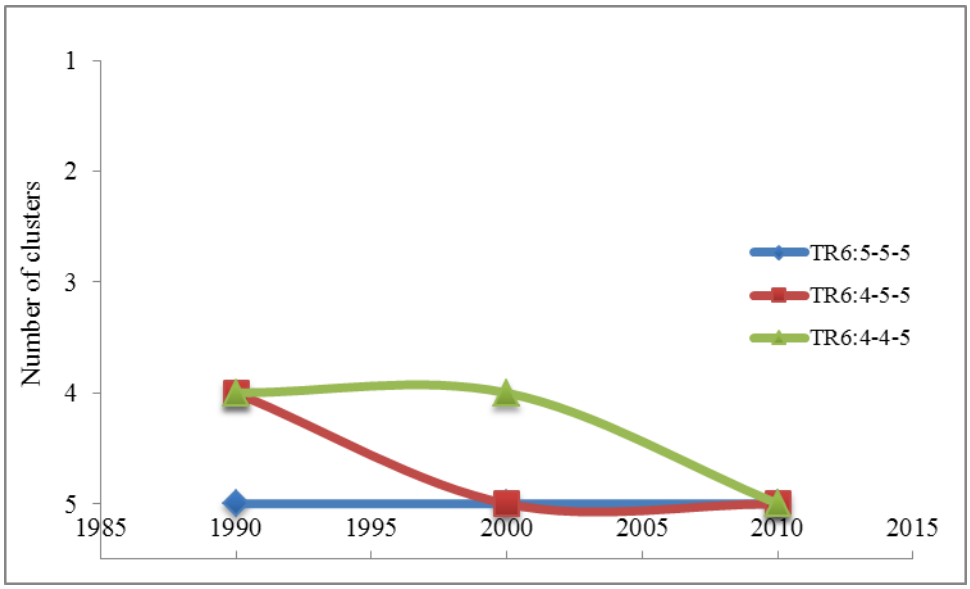

Figure 2-28 The 3 pathways for the trajectory "Declining very small farms"

The study found a few cases in the pathway of 5-5-5 that there were migrants who had moved to find share-tapping employment before 1990. Most of them came either from the area around studied areas or other provinces in the southern region such as Nakorn Si Thammart, Satoon, and Trang. The reason for migration was that the farms at home were too small, and they were looking for an opportunity in occupation. Relatives and social networks encouraged them to move to this village and also helped to deal with share-tapping. These families were employed in share-tapping. The rising tapping skill, qualified labor, and familiarity to people contributed to deal better conditions of share-tapping with medium and large family farm enterprises. Since low price land was available during 1970s-1980s, they had a small parcel of purchased land and later purchased small empty land for new planting. These purchased lands were recognized as generosity of the former landowners for helping them to have landownership. Farmers mentioned that landownership represented a family's achievement and a necessity to have security of homeland and farmland. After that, it was difficult to have more purchased lands because all incomes went to living cost and education of children. Interviews found that parents were still working on owned farms and off-farms. Young laborers mostly were engaged to work in non-farm or self-employment regarding growth of industry and level of education. Often additional incomes for households tended to increase through donated money received from

working young laborers, monthly. They claimed that a better living standard was the result of hard work and qualified labor in off-farm with share-tapping.

Second, the pathways of 4-4-5 and 4-5-5 were small family farms declining to cluster of very small farms. The data showed that farms were family owned in 1990 or until 2000 and declined in landholding into cluster of very small farms in 2000 or until 2010. The small size of rubber land made it difficult to generate income for livelihood that caused to adopt off-farm activities with share-tapping land. They became to be hired tappers in other rubber owners such as parents, relatives, friends, and neighbors. Respondents stated that they had received small amounts through inherited land before 1990, which generated the main source of household income. Size of inherited land depended on the number of family members and the former size of landholding. The parent's generation or the former had settled small unoccupied land in the village; a similar process of colonization as observed in the family farms. Respondents claimed that the existed holding could generate sufficient income for living cost in the past, but today it was necessary to increase income from working off-farm. They also argued that the plantation life span should be extend as long as possible to about 40.0 years. Tapping skills, specialization, and their relations with the rubber owners highly contributed to deciding to work off-farm as share-tappers. In 2010, off-farm activity was an important job to generate income for livelihood and saving money for farm investment. All incomes were often paid for living cost and education of children similar to TR5.

The study found that even farms holding very small size, declined in landholding was observed a long trajectory. Small size of sold land passed to medium farms or patron farms in the village which hopefully coped with financial stress and high debt. Similar to TR4, various reasons were made for them to fall into too much debt and raised socioeconomic pressure. Also, price slowdown in 1990 to 2002 to follow along with high cost of living put pressure on very small farms, which had vulnerable livelihoods, thereby selling land could help to maintain family consumption.

Figure 2-29 shows that the estimation landholding of parents (or 1st generation) was about 25.3 rai per household. The average inherited land of 6.7 rai was the lowest compared with other trajectories. Their parents mostly settled in the village through purchased land which, had a low land price in the period of settlement. Land had been devoted to rubber and rice. Size of landholding by the parents, family members and local inherited system as mentioned above were important factors affecting the rapid decreasing size of landholding in next generation. Generally, land was equally divided for family members. Land acquisition could increase a little bit through marriage.

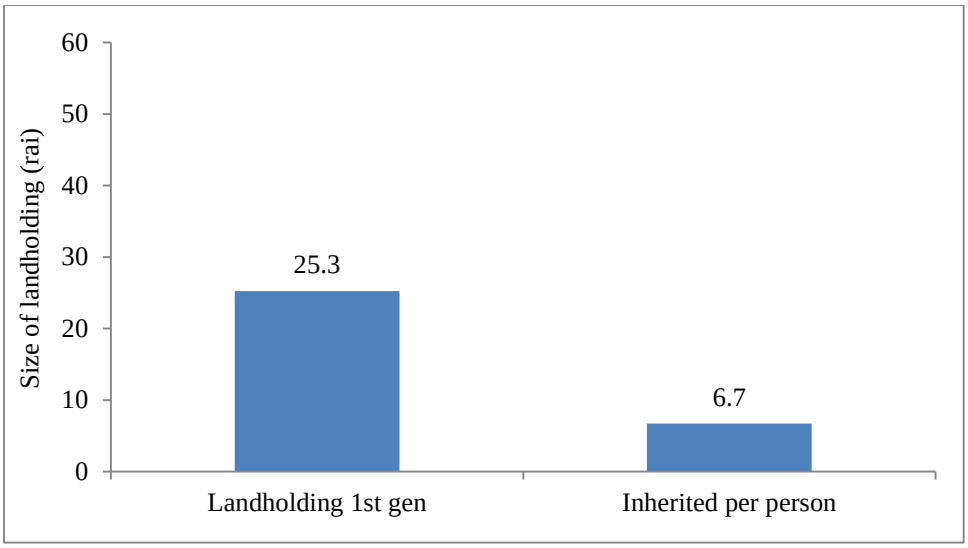

Figure 2-29 The average landholding by the first generation and inherited land for the next generation according to the trajectory of declining very small farms

To characterize the trajectory of declining very small farms, the case study as below was the representative sample from eighteen respondents. This case study originated from a family farm who had access to land during the settlement period. The case had received very small farm size and then off-farm activity with share-tapping well adopted regarded to skilled labor and availability of laborers. Income diversifications had long been promoted in the farms that allowed them to cope with very small scale and to improve livelihood.

Case study 6: Mr. Sophon Srijun

Mr. Sophon Srijun, born in 1966, originated from rubber farmers in Ban Koa Chaison. His father had owned landholding of about 22 rai (17 rai of rubber and 5 rai of rice). After he completed primary education, he spent most of his youth with hired tappers for another relative's plantation in Sadoa and paid labor in construction during the wintering period. This income was used to support his father's livelihood and to invest for replantation. In 1988, he married and then moved back to form his family in the village. He was employed in off-farm under share-tapping of about 14 rai. He also had rice cultivation about 5 rai by sharecropping with his father, which had ended five years later. He also raised a few cattle which could be sold for saving money every year. In 1991, he received about 5 rai of rubber land where labor use completely consolidated with off-farm activity of share-tapping. His own rubber land helped to increase household incomes.

Since that time, he remained to adopt share-tapping together to carry on his own plantation. In this decade, he managed to save enough money combined with a loan to purchase a small parcel of 48 square meters for house building. Regarding more debts, he

occasionally applied paid laborers as workers in construction business in order to increase income to meet repayment of loan and for improving livelihood. He stated that because of falling prices during 1991-2002, he had faced rapid rising socio-economic pressure. He also had invested in his own replanting in 1997. This implied that livelihood depended upon level of remuneration from adoption of share-tapping. This situation pushed him to manage saving money for cattle and chicken. He stated that cattle were wealth storage that could be occasional sold to cover part of debts every year. These activities could generate important additional incomes for saving money to pay children's education fees and cost of improving livelihood.

During the early 2010s, off-farm under share-tapping had changed into new rubber of 12 rai because of replanting of the previous plot. He claimed that this was because of his labor's attribution regarded skill and his reputation provided advantage to deal with a good condition of share-tapping and 55:45 share-tapping. In 2007, he also invested in a small village shop run by his wife. This activity helped to increase household income that mostly had been enough for costs of living. At the time, children's education fees was a major household expenditure and pushed him to have more debts to cover children tuition, especially for his son to enroll in higher education. He thought that children's education was the most important family investment. He also managed to accumulate some money for improving family livelihood in comparison with farm life. In 2010, the elder daughter had graduated and worked in a factory. Donated income from his daughter had brought improving livelihood enabling an increase in saving money to repayment of debts. Recently, he remained to manage saving money for small scale of the purchased land that would be able to increase inherited land for his children before his death.

Mr. Sophon started farming on a small scale and high adoption of off-farm in recognition of skill, specialization, and availability of laborers. Level of remuneration from off-farm and income generation from his small own farms were difficult to outweigh the cost in his family that had led to socio-economic pressures. Farm strategies therefore focused on income diversifications through adoptions of on-farms, non-farm activities and off-farm activities.

Like TR5, there was low improvement in productivity, often using a high frequency tapping system and was a burden in cost of production. Fertilizer application of 1.2 times per year was the lowest and perhaps was absent depending on financial situation and biophysical conditions in plantations. Weeding control also was done about 1.0 time per year. Total cost of input annum was about 8,740 baht per ha. The average yield was about 1,718 kg per ha. Farmers had been satisfied with levels of productivity that the rubber trees would bring. It was reflected that cost of farm maintenance was a burden in these farms. High frequency tapping systems were applied such as S/3 3d4, S/2 3d4, or S/3 d1.

As shown in Table 2-13, the availability of family laborers was high. It increased from 2.25 persons in 1990 to 3.05 persons in 2010. Family tappers of 2.27 persons in 2010 was higher than other trajectories, out of which 1.47 persons were available for off-farm and 0.8 persons for on-farm. There were several reasons given for deciding to rely on non-farm work of such importance as new morality of work depending on non-farm employment, lack of farm skills, and level of education as well as coexistence of growth of industry and commercial trade in the studied area. Price fluctuation and the difficulty to find share-tapping employment also increased pressure on household income, which would enable them to engage their family members in non-farm activities. Respondents stated that if children did not attend higher education or graduated only high school, the household would encourage them to work on-farm or off-farm with share-tapping. This was because remunerative work from share-tapping was higher than minimum wages in the factory in 2010.

In order to understand how to raise trust and confidence for the rubber owners when the farmers tapped both his owned plantation and off-farm, respondents stated that they efficiently emphasized all tasks belonged to share-tapping agreement. Perhaps this was due to high rubber income from off-farm and sustainability of his reputation. On tapping days, they began to tap rubber off-farm and later would tap their own trees as well as collecting latex. Off-farm usually consumed the most of the working time. In most cases, the husband who generally had high tapping skills, would tap off-farm while his wife tapped in their own plantation. The raised question by the owners regarding conflict of interest between off-farm and on-farm never occurred because of a given trust and confidence. The study found that because of the qualified labor, tapping skills, and expertise, they could deal with better conditions and terms of contract. The data showed that the number of farms in this trajectory tended to increase consistent with spilt down of family farms. Laborers from the non-farm sector moved back to off-farm in response to high rubber prices and high remunerative work under share-tapping during the end 2010s, especially mobility back to farm by young labor.

2.7 Relations Between Farm and Non-Farm Activities

In this section, the study aimed to analyze the relations between farm and non-farm activities in terms of availability of labor and income. The study will highlight the causes to promote non-farm activities in each of farm trajectories and their impacts on the farms.

In the farms, education is one of the important factors to determine non-farm activities. Interviews revealed that households mostly paid much attention to promote higher education to their children and encourage them to leave farms for non-farm employment. As the evidence shows, many households had sold land for educational funding in university or higher educational levels, especially in small family farms. High education was defined to present social status of household that had become more important in poor families and small family farms.

Expansion of education promoted through government programs probably helped them to access higher education. An important goal was to get jobs in government employment such as teachers, polices, governors, and staff in government organizations. Attitudes to compare success of education was widely accepted among the villagers. Probably, it was allowed to highlight social status and consequently from non-farm employment. The achievements to improve standard of living, economic status, and social status by the farmers also were enforced that each household had to have someone in government employment. This had deeply governed on parents that would teach their children to grow and to work for the state. Pride would be decreased if their children become workers in manufacturing and the least for the farmers.

If children did not attend higher education, most of them entered farms or become workers in manufacturing. As a result, it was obvious that many young laborers entered into non-farm employment and would generally move into industrial areas after the 2000s. For some cases, farmers had integrated the use of labor between plantation and jobs in manufacturing such as in cluster of small family farms and very small family farms. Heads of households would tap rubber trees in small holdings in the morning before going to jobs in manufacturing or non-farm activities. Collecting latex was done by his wife or parents. The sale of cup lump also helped to optimize time and available labor. The involvement of labor in both farm and non-farm activities was observed in suburban areas and areas served by manufacturing increased non-farm employment. Price booms had further increased incentives for engagement of farms. Indeed, young laborers who had experience in manufacturing or construction tended to move back to farms, regarding relative wages, which caused an increased supply of hired labor in the short run. Furthermore, large mobility back to farms also was observed in laborers or eventually new families that had experience in non-farm employment. They began to tap rubber in their own plantations and later some extended into off-farms with share-tapping.

Relations in the former with friends further helped to increase size of off-farm areas and to deal with better conditions of contracts. Due to experience in non-farm activity, self-employment was established in respect to experiences and business opportunities in merchants and middlemen. As a result, diversification of income was increased. High participation in non-farm activities probably came initially from increasing income and subsequently supposed to be more valuable free time after farm work. Some was observed a tendency increment of farm structure through purchased land.

As Figure 2-30 shows, in 2010, the number of family laborers in non-farm work were much different among trajectories. TR3 and TR1 had a large number of family laborers to work in non-farming because household heads in TR3 and most family laborers of TR1 engaged in their businesses. Young laborers tended to have a high proportion of non-farm activities in TR2, TR4, TR5, and TR6, but the number of non-farming family laborers was smaller than those of TR1 and TR3.

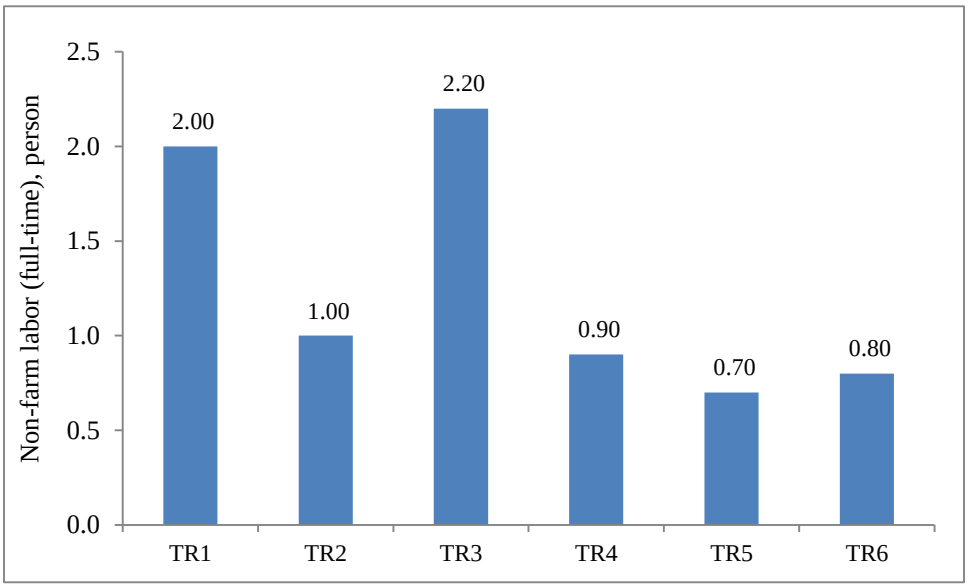

Figure 2-30 The average number of family laborers for non-farm activities by six farm trajectories

For pathway of TR1 and TR2, children mostly had been enrolled in higher education and would administer the family business or worked in the line of educational professions. Figure 2-30 shows that an average of 2.0 persons was higher than other trajectories except TR3. It was generally found that farms undergoing trajectory toward patron farms (TR3) were mainly rubber owners who engaged in non-farm employment. The first linkage between farm and non-farm employment was demonstrated through TR3 which were split households from parents before 1990 and received rubber land after they entered non-farm employment. Also, the need to own rubber land might have to be considered to secure income for the households. Rubber income was additional by considering total of working time. On such farms, rubber income was higher than salary. However, non-farm employment played an important role for potential increasing landholding, relevant investments, and increasing accessibility to credit. Moreover, they could have more opportunities to access new technologies, knowledge, and supply of hired-tappers. So, non-farm activities influenced the growth of farm structure in terms of capital and land acquisition. For small family farms and very small family farms, about 0.7-0.8 persons were engaged in non-farm activities as Figure 2-30.

Non-farm income constituted a significant portion of household income as Figure 2-31. On average, in small family farms, the total household income was about 532,560.0 baht per year constituting 76.3% of on-farm income and 23.7% of non-farm income. In very small farms, the average of household income was about 466,848.0 baht per year accounted by 22.3% of on-farm income, 46.3% of off-farm income, and 30.8% of non-farm income. Considering these facts, non-farm income had become increasingly recognized in improving livelihood and standard of living.

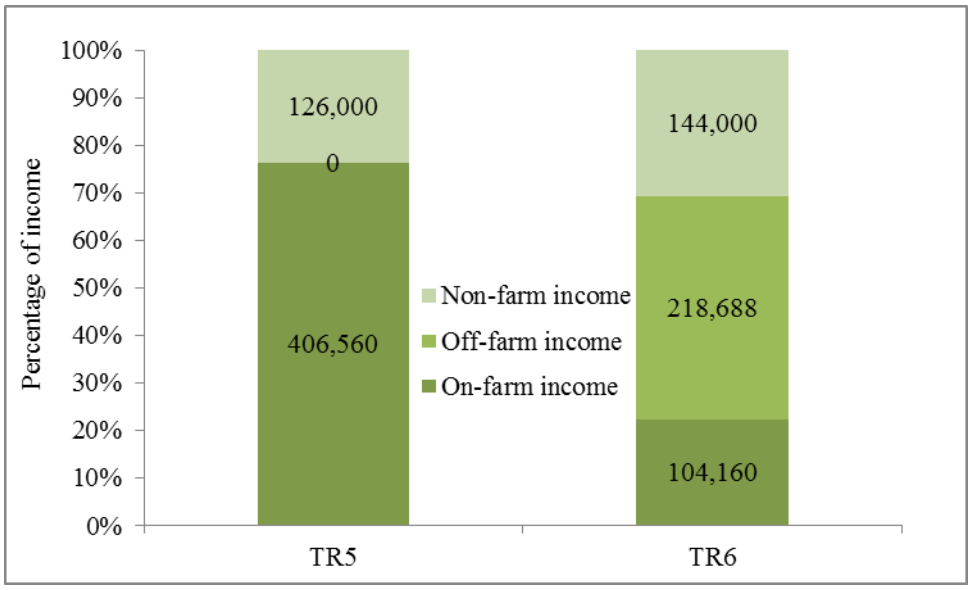

Figure 2-31 The average on-farm income, non-farm income, and off-farm income according to trajectories of stability of family farms and declining very small farms

Figure 2-31 also indicated a high portion of off-farm income and non-farm income contributed household income of very small family farms. Then off-farm income had become quite important, and these farms could be considered depending very much on off-farm activities. It was clear that non-farm income contributed considerably to improved livelihood and reduced financial stress. Apparently, this was the important source of capital accumulation for the purchased land and re-plantation. Based on the data obtained, it was obvious that households obtained a large proportion of cash income from non-farm and off-farm activities indicating diversified incomes was increasing.

2.8 Analyses of Farm Polarization

This section proposes to present the linkage between farm trajectory and polarization. First at all, the concept of polarization here is considered as a process of socio-economic changes dividing into two opposing sub-groups with fewer obtaining the agglomeration of socio-economic groups in the existence of poles. The study approached polarization proposed by Esteban & Ray (1994) that was mentioned that society was polarized when a population of individuals might be grouped accordingly to some vector of characteristics into clusters that each cluster were very similar, and different clusters were different relative to a given set of attributes or characteristics. Three features exhibited a high degree of homogeneity within each group and heterogeneity across groups, and the clusters were relatively uniform in size. According to this definition, the measurement of polarization accounted for the distance between clusters, homogeneity of clusters, and the relative size of the clusters.

The study revealed that the significant six farm trajectories were an identification and measurement of polarization. The results provided not only the level of polarization but also presented the evolution of polarization. The study therefore turns to discuss evolution of landholding (index of landholding), clustered pathways, income, and farm institutions in order to identify and measure polarization. There were multiple measurements for measuring polarization. Landholding and income captured good distances and the level extended polarization. Clustered pathways combined index landholding provided a mean to understand the evolution of polarization. Farm institutions were defined by farm strategy, goals, productivity, capability, and competitive advantage including local customs and circumstances of which were viewed as the most relevant sources affecting farm trajectories and more polarized with respect to the differences of farm institutions.

It could be observed in Figure 2-32 that polarization continually developed during 1990-2010. The level of polarization resulted from deterministic patterns of farm trajectories moving in opposite directions. Figure 2-32 presents a simplified polarization where the measurement of polarization depended on the relative landholding considering as an index of landholding. There was a rising polarization illustrated by the simplified representation of the relative distribution of landholding among farm trajectories. The increase in the distant index of landholding had been so important relative to the level of extended polarization.

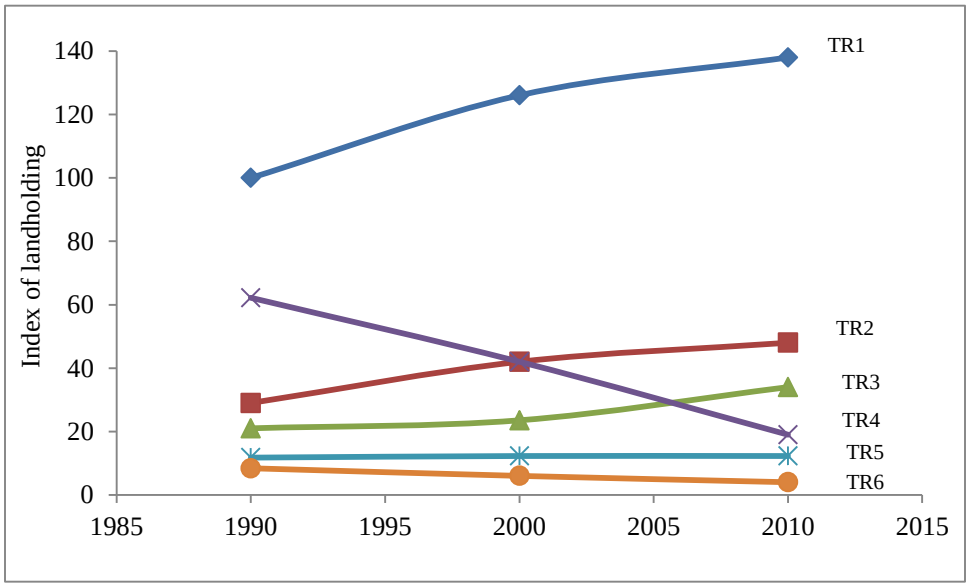

Figure 2-32 Index of landholding according to the six farm trajectories
Remark: the landholding of TR1 at 1990 used a base period (100) to calculate the index number

The first direction was the growth of land concentration where landholding was increasing presented by three trajectories of the growth of family farm enterprises, the growth of medium family farm enterprises, and toward patron farms. Index of landholding had been rising steadily over twenty years, indicating that extended polarization had been increasing throughout

the study time. The increase in index of landholding had been outweighed by trajectory of family farm enterprises (large and medium farms) reflecting an increasing land concentration. Toward patron farms also tended to steadily increase landholding that this rapid increase was recorded during 2000-2010 consistent with the evidence of the rapid growth of patron farms.

The second direction was the decline in landholding where landholding still decreased or tended to decrease according to three trajectories of high structural change of farms, stability of family farms, and declining very small farms. The continuing reduction of landholding was observed over 1990-2010. This decrease had varied greatly within and among trajectories. Index of landholding had been strongly decreased by the trajectory of high structural change of farms while it had been steadily decreased by trajectory of declining very small farms. Typically, the study had observed that some farms underwent trajectory of family farms could be grouped in this direction. Some had a similar deterministic patterns of very small farms regarded to have a potential reduction of landholding, farm objectives, socio-economic characteristics of the households, and relevant institutions. Thus, polarization had increased during 1990-2010. Index of landholding had been so important relative to the degree of polarization according to farm trajectories.

In order to analyze how polarizations occurred and their impacts, it can be observed at Figure 2-33 that each farm trajectory composed of various farm pathways presenting by patterns of clustered pathway changes. Polarization had derived by simply comparing relative clusters and their distributive changes. The distances of clustered groups or clustered pathways allowed us to capture polarization of which considered high levels of homogeneity within each group and high levels of heterogeneity between groups. This implied the simplified polarization to present through process of clustered pathways moving in opposite directions. The change in clustered pathways accompanied the evidence of index landholding according to farm trajectories could be traced to the evolution of polarization during 1990-2010. This also was made to observe the level of extended polarization measured by households from a given group or clusters toward/downward belonging to other clusters. Fortunately, by the first direction, farms experienced a relative growth of farm structures within or growing clustered pathways moving toward clusters of large family farm enterprises, medium family farm enterprises, and growth of patron farms. The relative growing farm structure within clusters, presenting no change of clustering pathway was always the dominant one.

Growing clustered pathways were observed by toward trends where the initial farm clusters of medium family farm enterprises grew to large family farm enterprises or the family farms evolved to medium family farm enterprises. The polarization followed a similar pattern of increment of landholding and the use of hired laborers in the different levels, but it was more likely lower than the first group. The study revealed that clustering pathways was less deterministic patterns in farm change. Large family farm enterprises commonly would grow

bigger overtime. Only medium family farm enterprises was made possible potential growing structure to be become large family farm enterprises. The evolution of family farms or patron farms toward large farm enterprises was not observed in this case study. The increases in levels of land concentration and farm capacity for improving productivity and profitability and enhancing farm business were measured the polarization in relations to the other direction.

Conversely, Figure 2-33 also depicts downward trends which could be seen as the decline in clustered pathways or no change to be clustered by family farms or very small farms at the present according to trajectory of high structural change, declining very small farms, and stability of family farms. Small landholding, the use of family laborers, and socio-economic characteristics regarded to smallholding households were key features to describe the relative positions to be polarized that opposed the previous one. The distance of polarization was presented by a decline in clustered pathways or no change of clusters belonged to family farms or very small farms. The study revealed that the decline in clustered pathways was observed by two deterministic patterns. The first was the prevailing clusters of large or medium family farm enterprises rapidly decreased into the uneven family farms or patron of retired farms. About 10.5 percent of households had been found to be declining clusters in which there had been a large reduction of landholding and labor use, indicating large farms getting smaller.

The variations of clustered pathways were estimated by determinants of changes in recognition of landholding, the use of laborers, and the different socio-economic characteristics of the households. About 13.6 percent of households steadily declined from the original cluster of family farms into cluster of very small farms, reflecting small farms getting smaller. The decline in landholding, rapid change in the use of family laborers, and socio-economic pressures had further polarized households. There followed a growing share of family farms and very small farms during 1990-2010.

Figure 2-33 also displays a large share of farms falling no change of clustered pathways over the study time. About 38.2 percent of households remained to be characterized by cluster of family farms and 10.9 percent of households had fallen to cluster of very small farms throughout the study time. No change in clustered pathways exhibited a similarity and cohesion of clusters of which limitations of growth had increased and could be seen the rising gap of landholding. This meant that landholding had decreased relative to the average landholding of the opposite direction. The distribution of landholding had been negative throughout which implied that no change of clustered pathway had served to increase polarization. No change of clustered pathway provided a large share of polarization.

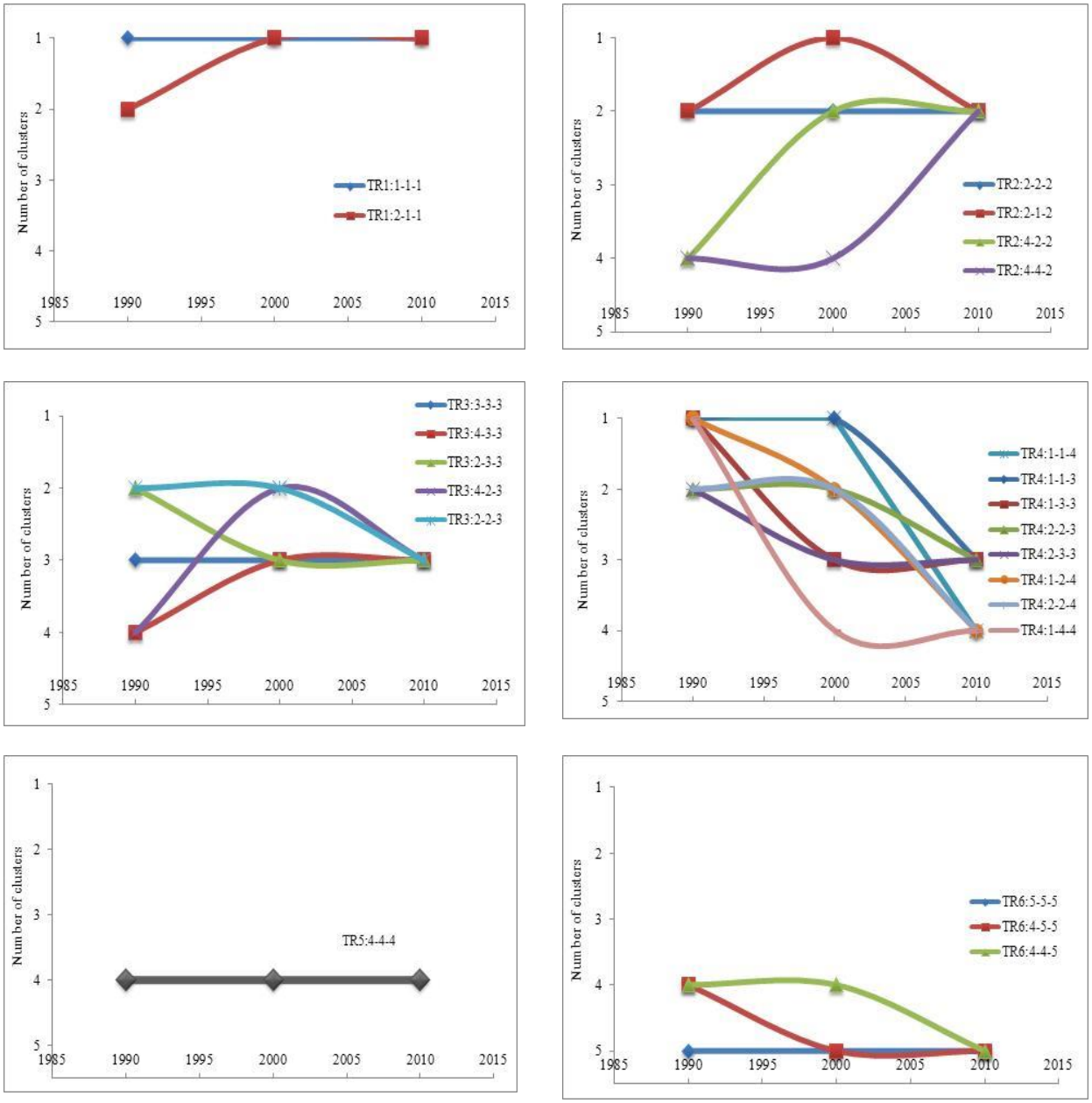

Figure 2-33 The pattern of clustered farm pathways for presenting compositions of the six-farm trajectories

The study also revealed that household incomes were estimated to reflect the degree of polarization. As in Table 2-23, rubber production provided an important share of household income. With regarding to no change technology, total farm income and the share of income derived from rubber production depended on farm size, available laborers, productivity, share-tapping contracts, and strategy adoption. Non-farm income accounted for various proportions from 11 percent to 44 percent of total household incomes. Off-farm income from share-tapping was very important for the trajectory of declining very small farms (TR6), which fell with farm

size. The average income of TR1 was 8.3 times larger than the average income of TR6. The gap of the average income estimated by the within direction was relatively low distance compared with the between directions.

It can be readily seen at Table 2-23 that household incomes were of unequal distribution and highlighted a large relative income distance among farm trajectories. This indicates that income inequality had been identified. The distribution of income could be extended to which income polarization had a similar pattern of land polarization according to the increased land polarization as in the above discussion. Therefore, income polarization also had been increasing over the last two decades. This increase had been essentially driven by land concentration.

Table 2-23 The mean composition of household incomes according to the six farm trajectories

	TR1	TR2	TR3	TR4	TR5	TR6
Farm Income (baht/yr)	3,420,504	972,000	532,200	568,000	406,560	104,160
Off-Farm Income (baht/yr)	-	-	-	-	-	218,688
Non-Farm Income (baht/yr)	460,000*	295,000*	420,000	159,000	126,000	144,000
Household Income (baht/yr)	3,880,504	1,267,000	952,200	727,000	532,560	466,848
Relative income (times)	8.3	2.5	1.9	1.3	1.1	1.0

Remark: * non-farm income excluded revenue from the related business (middlemen or processing smoked sheet)

Moreover, Table 2-24 shows that six farm trajectories had been categorized the differences in farm institutions regarding farm strategy, productivity, capability, competitive positions, and related business. The study revealed that society could be polarized according to the differences of farm institutions. These farm trajectories differentiated farm strategy to pursue two main strategies of farm business and living choice. These existing two defined that clusters generated a high degree of polarization in respect to the embedment of farm institutions.

The first two trajectories corresponded to business orientation of which farm strategies focused on the direction of the business in terms of expansion, management, and contraction that enabled to consistently generate a growing farm structure through creating and sustaining a competitive advantage defined by level of resource endowment, productivity, capability, and competitive positions. These resulted in agricultural extensification and intensification including more profitable enterprises, which allowed the continuation of upward mobility. Success in farm enterprises allowed investment for more land consolidation and the seeking of profitable activities through expansion of the related business. Toward patron farms also might correspond to small farm businesses with moderate resources and the capability for enhancing farm enterprise.

In opposite of this, the last three trajectories could be considered as pathways of smallholdings. Farm strategy carried out as a choice of living which there had been a growing interest in smallholding corresponding to less mechanized and capital intensive larger farms. A choice of living was characterized by farms operated on a small size and a major household income generation.

Table 2-24 Farm strategy, productivity, capability, competitive position, and related business for value added according to the six farm trajectories

	TR1	TR2	TR3	TR4	TR5	TR6
Farm strategy/goals	Farm business, financial return	Farm business, financial return	Small farm business, additional income	A choice of living, improving livelihood	A choice of living, improving livelihood	A choice of living, improving livelihood
Productivity	High intensive investment	High, intensive investment	Moderate	Vary	Vary	Low
Capability	High	High	Moderate	Vary	Vary	Vary
Competitive positions	Scale, Capital, Specialize, and Modern management	Scale, Capital, Specialize, and Modern management	Capital and Scale	Specialize, Available of family labor and Work effort	Specialize, Available of family labor and Work effort	Specialize, Available of family labor and Work effort
Related business to add value of output	High	High	Absence	Absence	Absence	Absence

These trajectories showed variations of productivity, capacity and competitive positions. These differences were rising pathways of downward mobility and through linkage effects to a large number of farms trapped in smallholdings. The trajectory of high structural change farms provided strong evidence that the failure to sustain the farm enterprise might be promoted to downward mobility. Family farms might become mired in situations of small farm size and radical farm strategy, which would gain the returns expected for improving standards of living. Then they failed attempts to accumulate for moving ahead. Very small farms that moved downwards since 1990 were likely structurally poor, with landholding below survival income, of which off-farm activities were highly adopted for improving livelihood. As well, the move by many farms to very small farms would reflect an income generation to the standard of living that would be expected from landholding basis and heavily depended on adoption of farm strategy for off-farm and non-farm activities.

Therefore, the study revealed that polarization had proved to be a relevant farm strategy, productivity, capability, and competitive positions of which the uniform farm attributions had been accompanied polarization defined by the index of landholding and level of income as in the previous discussion. The level extended polarization continued to increase in respect to the embedment of the set of rules that they adopted.

2.9 Summary: Farm Trajectories in the Rubber Economy

In this chapter, the study contributed to the improvement of methodological frameworks and formal procedures for analysis of farm trajectories. A multivariate statistic technique was selected to identify typology of farm trajectory with four stages of formal procedures: selection of variables, principal component analysis, cluster analysis, and validation. The study developed a systematic clustering technique to be a robust and reliable tool in assessing farm trajectories and accounting for changes in farm structures among the initial, intermediate, and the final year. Combining multivariate analysis and systematic clustering provided a mean to cross validate the farm trajectories of change. These methods were reliable tools for the study of farm trajectories and analysis of the drivers of change, particularly the impact of external drivers.

The study found that six farm trajectories highlighted that important farm transformation occurred during the period 1990 to 2010. 38.2% of farms were under the trajectory of stability of family farms. The other two important trajectories in terms for the number of farms were 10.5% of the rapid change of farm structures and 25% of declining very small farms that was characterized the limits to the growth, presenting “small getting smaller”. This trend was observed by the pathway of smallholding farms. On other hand, the study found other two trajectories that were observed for the growth of farm structures by 14.5% of growth of medium family farm enterprises and 4.1 % of growth of large family farm enterprises. This trend was presented the pathway of family farm enterprises by “bigger getting bigger”. The dominance of these opposing trajectories revealed a polarization of rubber farms since 1990.

Chapter 3

Analysis of Share-tapping Arrangements

In this chapter, share-tapping arrangements will first be analyzed by examining the history of share-tapping and the changes in contracts since the introduction of plantations. The conceptual framework of institutionalism is used to explain the structure and implementation of contracts. This conceptual framework allows this study to develop the idea of a set of rules for explaining share-tapping arrangements, and why share-tapping has persisted in the rubber economy. This study also examines the key factors used for determining share-tapping arrangements in particular, and their links with different share-tapping contracts, arrangements, tappers, economic performances, finalization, and the termination of share-tapping. This study defines a share-tapping contract as an "enforceable agreement as certain rights and obligations in the relationship between rubber owners and tappers regarding a set of functions related to rubber harvesting".

In the previous chapter, our study found that share-tapping is employed by three types of farms: large family farm enterprises, medium family farm enterprises, and patron farms. The specific hypothesis related to share-tapping is that there is no significant change in labor availability because institutional arrangements in share-tapping have never been challenged. For testing this hypothesis, this study emphasized the relationship between the typology of the rubber owners and the share-tapping arrangements that will allow us to analyze a set of rules according to typology of farms and trajectories.

This chapter is organized as follows. Section 3.1 presents the evolution of share tapping and tapping labor. Section 3.2 presents the characteristics of the actors engaged in share-tapping contracts. Section 3.3 presents an institutional analysis of share-tapping agreements. Section 3.4 presents the economic performance of share-tapping. Section 3.5 presents the factors determining share-tapping arrangements. Section 3.6 presents the duration of contracts and risk averse actors. Section 3.7 presents a set of rules for explaining share-tapping arrangements. Section 3.8 presents a contractual arrangement of share-tapping. Section 3.9 presents wage contacts challenging share-tapping, and the final section is a summary of analyses of share-tapping arrangements.

3.1 Evolution of Share-Tapping and Tapping Labor

Share-tapping has been the dominant labor contract in rubber production since the introduction of rubber plantations. Studies show no evidence that wage contracts or other payment systems are popularly applied. Understanding why owners opted for share-tapping

contracts, traditional sharecropping and the expansion of plantations during the 1900s explains the choice for share-tapping contractual arrangements and their extensive use.

3.1.1 Predominance of sharecropping and share cooperative labor

In the early twentieth century, the agrarian society in southern areas was based on traditional peasant communities. Agricultural production was produced to meet a household's consumption and the surpluses were firstly given to relatives and neighborhoods and then exchanged with other people in the villages or with others (Naksupark, 1984). Labor was the scarcest and most important resource during the season of cultivating and harvesting. Suitable land for rice cultivation was limited. Under such conditions, share cooperative labor and sharecropping were commonly observed in Thai agrarian society. Farms procured the labor that they needed from family members and outside the farms from kinships, friends, the neighborhood, and social networks. Relatives, friends, and neighborhoods were important sources of supply for specific tasks that needed temporary intensive labor during cultivating and harvesting. Laborers from outside the village also participated depending on social networks. The supplying of labor by share workers from outside occurred even on farms which had enough laborers for cultivating. This system also provided opportunities for socializing and feasting among people. Labor exchange in the form of *Khoreang* was commonly used during land preparation and transplanting, which is quite a balance of labor exchange. Another form is *So-reang* or *Oak-pak* which concerns the sharing of labor forces with maintaining a balance and sharing cooperative labor among the villagers. This form mostly occurred during cultivating and harvesting seasons. In one particular form of labor contract, when a day of rice harvesting was specified, farmers who were relatives, kin, and within neighborhoods could participate in harvesting, and they would then receive equally in the share of output. Therefore, share cooperative labor predominates in the traditional agrarian society. (Naksupark, 1984, Song-Maung, 2002).

Sharecropping was also prevalent in agrarian societies under the name of *Na-wah*. Because of the limits of appropriate land for rice cultivation, a shortage of rice land could be overcome both by sharecropping and renting, with very low cost. Most farmers held a small size farm or were landless. These farmers often had to cultivate with "*Na-Wah*". Na-Wah is considered sharecropping. Large farm owners permitted farmers to cultivate paddy fields with output sharing. They also supported all of, or shared in, the traditional inputs of production, such as cattle, plows, harrows, and varieties of rice. Sharecropping was high among farmers who owned small landholdings or were landless. Due to small landholdings, the surplus of laborers in these families offered opportunities to access agricultural production for subsistence and a cash income. Indeed, some farmers especially shared labor to carry out the rice harvesting period. The total rice was divided equally between the farmers and the landowner, or the share varied depending on kinship relationships and productivity. The agreement of "Na-Wah" was a share of

benefits between landowners and labor that was suitable for strong relationships within the peasant community. In fact, share outputs or renting land does not represent a response to economic return, so much as a way of taking social advantage by rich land owners. Sharing land provided the owners with outcomes in social relationships, political power, and prestige. It is likley that share-tapping presents similar characteristics, and can be derived from the earlier practice of the traditional sharecropping of "Na-Wah".

3.1.2 Evolution of share-tapping

The Chinese has had an important role by providing low cost labor and driving trade in the Thai economy since the mid eighteenth century (Ingram, 1971). This was due to a shortage of laborers and a low density of population in Thailand (at that time Thailand was called "*Siam*"). In the early nineteenth century, John Crawfurd (1960) assumed that Chinese laborers in southern Thailand numbered about 20,000 persons. Immigration of Chinese laborers increased to 1.5 million people in the mid nineteenth century, out of which 1.3 million people settled across the southern regions from Pattani to Surattani, and Phuket to Trang (Crawfurd, 1960). These laborers immigrated directly from the south of China and re-immigrated from British colonies, now Malaysia, and from Dutch colonies, now Indonesia. After the end of World War I, Chinese immigration sharply increased as they settled across the lower parts of the southern region. They supplied low cost labor for tin mines and the building of the train line during 1909-1918. Moreover, these laborers also played a role in the expansion of paddy fields on the eastern coast from Songkhla, Pattalung to Nakorn Si Thammarat, as well as the growing of chili crops in Phuket and Trang. These crops were mostly produced for export in response to growth in world demand (Ingram, 1971; Songprasert, 2005).

The first expansion of rubber plantations was largely attributed to these immigrated Chinese laborers. They also had started to invest and to get funding for estate plantations. These plantations were introduced and expanded along the train line from Hat Yai to the border area, and in Nabon, Nakorn Si Thammarat. In parallel, the immigrated Chinese laborers widely occupied new land to establish small rubber plantations near the train stations. The government of Siam during the monarchy of RAMA V (1853-1910) emphasized a policy for promoting the immigrated Chinese laborers and their settlements. Chinese laborers could have landholdings and free settlements with less tax. If a Chinese laborer occupied a landholding of less than 100 rai per person, the local office could authorize the holding registration within an office day, landholdings of more than 100 rai would be authorized by the local government within a month. These policies strongly encouraged large immigration within Chinese laborers and capitalists from British colonial areas to southern Thailand (Songprasert, 1993). Stefiel (1973) argued that these policies had more political than economic motivation, attempting to counterbalance the British colonial power in southern Thailand. Indeed, Chinese laborers massively migrated to southern regions, becoming tappers or farm managers in small and estate plantations. These

laborers had a complete knowledge of plantation technology and high capital for investment in new lands. These Chinese laborers also expanded rubber areas into eastern regions (Jiranakorn & Tipyakul, 1974a; Karrakarn, 1985; Songprasert, 1985). Chinese immigrants initially adopted rubber production as a full time occupation, whereas Thai citizens basically focused on subsistence crops (Stefiel, 1973). Many shareholder companies were established by Chinese capitalists for rubber plantations, such as the JengJeng Plantations Co, Lt. and the Wae Change Yen Plantations Co. Lt. These companies recruited immigrant laborers who had experience with tapping-skills and plantation technologies, mainly supplied by immigrant Chinese (Songprasert, 1993).

Regarding labor contracts in Malaysia during the early twentieth century, Barlow (1978) stated that share-tapping contracts called "*Pawah"* predominated in Chinese enterprises and Chinese smallholdings. The system of *Pawah* here was called the "*Bagi dua system*", where the production of rubber was shared equally between the rubber owner and share-tappers. This payment system has commonly been used by small rubber holdings in Malaysia since 1906 (Badriyah, 1985). The equal sharing of property among family members has also been used on plantations, consistent with Chinese tradition. Most estate plantations also applied the equal sharing of output between Chinese enterprises and tappers, which would be called "*share-tappers*" later. Since there are no official statistics for the use of share-tapping in Thailand during the introduction of plantations (1900-1910), this study postulates, based on the historical processes described above, that the share-tapping contracts which were employed on the original plantations (British Malaya) had been used in the new areas (southern Thailand). Ingram (1971), and Jiranakorn and Tipyakul (1974) stated that share-tapping was employed by the rubber owners across the southern regions since the introduction of plantations. This evidence has marked the acceptance of share-tapping on rubber plantations, and this study has no evidence that it changed to wage contracts.

Before WW II the local availability of tapping laborers was not enough to supply large farms. Large farm owners asked for permission to import tappers from British Malaysia, but the government wanted to promote the use of local laborers instead of immigrated laborers (RRC, 1975; Taanthai, 2002). Due to a lack of tapping skill and knowledge in plantation technology, local laborers were confined to clearing land, preparing land, and planting rubber. Immigrants were found to be more suitable for tapping, farm management, and processing of rubber sheets (RRC, 1968). However, because the local laborers were employed on the plantations, tapping skills started to diffuse from the Chinese tappers to the local laborers, which resulted in a greater supply of local tapping laborers after World War II. Hired tappers were responsible for tapping, collecting latex, and processing rubber sheets. Farm maintenance and annual variable costs were paid by the owners. Production costs were low due to high soil fertility, no need for weeding, and low use of chemicals. The owner could also provide some allowances under the forms of comfortable rooms and temporary housing, called "*Kok-sii*, กังสี", which was generally located on

the plantation or in the building for smoked rubber. On estates, the farm manager was responsible for managing contracts, controlling production, hiring tappers, and managing production functions. All hired tappers were lodged in the same area or building, enabling the control and management of daily production. Under this system, hired tappers were called "*Loo Ku-ri,* ลูกกุหลี". This system was commonly used on Chinese plantations at least until the 1980s.

Tapping skills were continuously transferred to Thai citizens after WW II (Thungwa, 1981; Taanthai, 2002; Song-maung, 2002). In Nakorn Si Tammarat and Songkla, paddy farmers worked as tappers on Chinese plantations after the rice was harvested. Moreover, local people were employed for clearing land, preparing land, planting and working in smoked rubber sheet factories (Phromman, 1996). Again, Thai people's tapping skills developed because Chinese tappers and Thai citizens worked together with close relations within all their social activities.

Chinese growers could increase the number of tappers while Thai laborers had increased incomes from new off-farm activities. During the 1950s-1960s, the level of remunerative work on plantations was higher than the rice income (Stefiel, 1973) which encouraged local people to increasingly become tappers on plantations. They began to tap on older plantations because this did not require skilled tappers. It seems that until the early 1960s, Thai people progressively replaced Chinese laborers in all tasks, from clearing land to the processing of smoked rubber sheets, while Chinese tappers worked as managers instead. As a result, Thai people became aware of the achievements of rubber cultivation in terms of cash income and economics in the long term. This further boosted the expansion of rubber through the migration of people from paddy fields to deforested areas. After 1960, rubber plantations were widely cultivated by Thai people who dominated small scale plantations across the region. Their farming systems were characterized by the complementary crops of rice and rubber, or fruit trees and rubber, whereas a large monoculture of rubber was observed on large Chinese farms.

Our interviews revealed that only 50:50 share-tapping was used for tapping contracts. The typical native rubber plantation was planted with low yield seedlings producing about 400 kg per ha. High intensive tapping was applied because the famers needed to increase their incomes, and also large girths of rubber could lead to tapping more than one tapping panel. Most plantations were located in upland or forest zones where working was difficult and they had to face dangerous wildlife. Due to the low density of rubber and wild conditions, a family of tappers (about 2 people) could tap about 10.0 rai each tapping day. The collecting and sheeting of rubber also consumed time and increased fatigue from working. Usually, the working time would start after midnight and finish in the afternoon. It lasted about 10.00-12.00 hours per day.

In the early 1960s, 60:40 share-tapping was established for modern plantations, which mostly started to be applied by the Chinese planters. High investment and new technology allowing high yields were very important factors to change share-tapping from 50:50 to 60:40.

The establishment of 60:40 share-tapping was acceptable to hired tappers because of highly remunerative work in the same unit, reflecting the impact of productivity and good working conditions in plains areas compared to jungle rubber. In this agreement, hired tappers were responsible for tapping, collecting, and sheeting rubber. Farm maintenance and costs were paid for by the owners. Hired tappers could have additional returns from scrap rubber. When the 50:50 share-tapping arrangement was applied on modern plantations, all costs were shared between the rubber owners and the share-tappers. If some hired tappers did not get involved in cost sharing and farm maintenance, this would result in the establishment of 55:45 share-tapping. The diversification of share-tapping agreements after the early 1970s corresponded to an adaptation to new working conditions and technology.

From the early 1990s to 2002, there was a recession period for commodity prices for more than ten years in response to a world economic slow down. Large plantations began to employ overseas tappers from Burma instead of locally hired tappers. Due to laws regulating illegal labor, the use of overseas tappers was limited to remote areas and mountain zones. In fact, overseas tappers were typically used in the border provinces such as Ranong and Phang-Nga.70:30 share-tapping was commonly used with overseas tappers, whereas the local tappers would get 60:40 share-tapping in the same conditions. This was because of lower trust, qualified labor, and higher risks. Under 70:30 share-tapping, the hired tappers were responsible for tapping, collecting, and transporting the rubber to the market place. Hired tappers did not participate in farm maintenance costs. The need to employ overseas tappers had been increasing with regards to their low cost and hard work, as compared to local tappers. In 2003, due to a large number of illegal immigrations from overseas to Thailand, the government implemented measures to recieve official registrations and working permits that would control the number and quality of immigrated laborers to fulfill the requirements. In turn, this encouraged an increase in the immigration of laborers into both farms and industry. In the late 2000s, there was a high proportion of overseas tappers on farms that required tappers who could work under the restrictions and regulations of business objectives. Cheap labor could be supplied in the short run. When the overseas tappers could adapt themselves into the new Thai society and had more skills as qualified laborers, they could deal with contracts similar to local people. On the other hand, a large supply of overseas tappers in the villages affected both tapping employment and social security, which we will discuss in the next section.

In 2003, rubber prices increased again in response to the growth of world demand and the rise of China's economy. Between 2003 and 2008, the average rubber price increased from about 28 to 78 bahts per kg. In 2009, it fell below 58 bahts per kg and then boomed to 130 bahts per kg in 2011, and fell slightly in 2012. The long rise of rubber prices influenced the arrangement of share-tapping contracts and the supply of labor to farms. The mobility of young laborers back to farms was high. The remunerative work in rubber was high compared with the average of wage labor. Our respondents also stated that 50:50 share-tapping was changed to 55:45 due to high

rubber prices and increasing costs of farm maintenance. As well, in a few cases, 65:35 share-tapping was applied to replace 60:40 share-tapping. Wage contract arrangements also were applied by some owners in Ban Kok-Maung and Ban Lo-han. That was a big challenge to the persistence of share-tapping. For the rubber owner, this system had relatively low costs and high profits compared to share-tapping. The cost of tapping was about 15-25 baht per rai and 10-15 baht for collecting latex. Collecting latex could be done using family labor. During the high prices from 2009 to 2011, this system was commonly used by patron and medium size family farm enterprises, but it was not observed in large family farm enterprises. Many paid tappers have argued that the level of wages was still higher compared to non-farm wages, even if income was lower than that of share-tapping. This was associated with difficult to find share-tapping contracts in the villages. They had only been involved in tapping tasks, but not in other tasks on the plantations that were reasonable for their level of wage. In most cases, paid laborers in the villages were employed for collecting latex. The owner generally worked with tappers in order to control production and the selling of latex. High returns and low costs of labor were important factors to promote the extensive application of wage contracts.

Our respondents of hired tappers stated that they were considering the potential for the negative effects of wage contracts, which illuminated the causes of the risks of share-tapping. As well, many rubber owners argued that wage contracts would be useful for evaluating the impacts on job quality, working efforts, productivity, profits, and so on. In 2012, all farms who had experience with paid tappers changed back to share-tapping again. The reasons were the low quality of work; i.e. variations of skill, less self supervision, high cost of monitoring, difficulty of recruiting hired tappers, and high labor costs when rubber prices had fallen, as compared with share-tapping. Also, it seems that social members tended to be against the extension of wage contracts due to declining social values and welfare. Consequently, share-tapping contracts have returned as the dominat form of harvesting arrangements on rubber plantations.

3.2 Characterization of the Actors Engaged in Share-Tapping Contracts

The aim of this section is to analyze the characteristics of the actors involved in share-tapping contracts, namely the rubber owners and tappers.

3.2.1) Rubber owners

It is obvious that large family farm enterprises have employed many hired tappers because of the scale of share-tapping areas and business objectives. Medium family farm enterprises were different because a particular plot was tapped by family tappers, and the rest tapped by hired tappers. While patron farms were characterized by dependence on hired tappers.

Table 3-1 shows farm characteristics according to three types of rubber owners. A total of 70 households owned 176 of the rubber plots included for this analysis. Age of the household

head varied from the youngest at 26 years old, to the oldest one at 84.0 years old. The average age denotes that most household heads are over 40.0 years old and are old aged farmers. This implies that owners have long experience on rubber farms. Table 3-1 also reveals the family nuclease, in which the average family size was about 3-6 people. Medium family farm enterprises tended to have more family members than other ones. The number of family tappers was low in all farm types and there was no family tapper on patron farms. As previously discussed, landholding size varied greatly between the three types of farms, and most devoted all landholding for rubber. The average of hire-tappers was varied. It is clear that landholding size, numbers of family tappers and farm demographics have influenced the decision to use share-tapping and the number of hire-tappers required. Next, this study will examine share-tapping agreements and distribution according to the typology of rubber owners as per the below discussion.

Table 3-1 Farm characteristics of the rubber owners

Farm characteristics	Large family farm enterprise				Medium family farm enterprise				Patron farm			
	Mean	S.D	Min.	Max.	Mean	S.D	Min.	Max.	Mean	S.D	Min.	Max.
Age of household head (yr)	58.7	10.7	42.0	75.0	49.5	12.7	26.0	78.0	64.4	11.9	43.0	84.0
Rubber experience (yr)	37.9	13.0	20.0	60.0	25.0	10.2	3.0	45.0	40.4	14.3	10.0	63.0
Family members (persons)	4.4	1.7	2.0	7.0	5.0	1.6	2.0	10.0	3.6	1.9	1.0	8.0
Family tappers (persons)	1.2	0.8	0	2.0	2.2	0.7	1.0	4.0	0	0	0	0
Landholding size (rai)	151.8	72.5	90.0	312.0	44.5	14.5	17.0	75.0	28.0	18.9	4.0	68.0
Rubber land (rai)	137.3	73.8	90.0	312.0	43.7	14.6	16.0	75.0	27.8	19.1	4.0	68.0
Plot of mature land (plot)	4.8	1.6	1.0	7.0	2.5	0.9	1.0	5.0	1.8	1.7	1.0	4.0
Share-tapping land (rai)	106.0	84.0	40.0	300.0	22.2	12.2	9.0	54.0	24.0	17.0	4.0	60.0
Number of hire-tappers (persons)	8.6	2.6	4.0	12.0	2.8	1.3	1.0	6.0	3.2	2.0	1.0	8.0
Number of farms	9				33				28			
Plots	43				82				51			

1) Large family farm enterprises

As discussed in the previous chapter, large family farm enterprises were strongly specialized on plantations and conducted share-tapping. The formality of contracts had increased, but had not claimed to be official or legal. Written agreements involved the ratio of

output/input sharing, obligations, daily practices, payment systems, and the actions in case of dispute. These agreements were based on customary rules written for formality agreements in order to ensure warrants and efficient contracts. Other attention proposed to clarify job descriptions and responsibilities on the plantations. Agreements also identified farming functions and main tasks to be done on tapping days and annual activities in farm maintenance. Contract agreements also included permissions and refused practices involving the tapping system, tapping-skill, marketing, and production. The termination or duration would be included. Agreement was administered by a farm manager who mostly had the power to validate or invalidate.

Table 3-2 The distribution of share-tapping contracts according to large family farm enterprises

Share-tapping contracts	Farms		Plot of share-tapping		Average of share-tapping area per plot
	Nb.	%	Nb.	%	
60:40	4	42.9	15	53.1	33.8
55:45	3	31.4	11	30.4	26.4
50:50	2	25.7	9	16.5	17.4
Total	9		35		27.3

Table 3-2 shows the distribution of the contracts for the 9 large family farm enterprises identified from the 220 farms sampled. 60:40 and 55:45 were the ratios mainly found. Under 60:40 share-tapping, the size of share-tapping per plot also was larger than that of 55:45 and 50:50 share-tapping, respectively.

2) Medium family farm enterprises

Medium family farm enterprises also specialized in plantations and sometimes tapped small parcels with family labor. The conditions and arrangement of contracts were all the same as contracts by large family farm enterprises. Informal agreements wer commonly performed by these farms, while in many cases, farmers tried to conduct business with formal agreements.

Table 3-3 The distribution of share-tapping contracts according to medium family farm enterprises

Share-tapping contracts	Farms		Plot of share-tapping		Average of share-tapping area per plot
	Nb.	%	Nb.	%	
60:40	13	39.4	23	48.9	17.3
55:45	14	42.4	17	36.2	13.1
50:50	6	18.2	7	14.9	13.6
Total	33		47		15.2

Table 3-3 shows that 33 out of 220 farms fell into the category of the medium family farm enterprise. 60:40 and 55:45 sharing dominated share-tapping contracts. Tapping size per plot was larger on farms with 60:40 share-tapping, while other contracts were comparable in tapping size.

3) Patron farms

On patron farms, all tapping areas were tapped by hired-tappers and owners were mostly dedicated to the farm as part-time farmers. Compared with the previous farm categories, specialization in this farming system was low. Our interviews reveal that informal agreements were commonly used to conduct share-tapping, while formal agreements were not observed during the study time. Table 3-4 shows that 28 out of 220 farms were included in this category of patron farm. It was obvious that more farmers chose 50:50 share-tapping than other methods, even if the proportion of plots tapped with 50:50 and 60:40 share-tapping were equal. 55:45 share-tapping was hardly ever used. This study found that this farm type relied on 50:50 share-tapping. In contrast, 60:40 share-tapping was selected if the tapping size per plot increased.

Table 3-4 The distribution of share-tapping contracts according to patron farms

Share-tapping contracts	Farms		Plot of share-tapping		Average of share-tapping area per plot
	Nb.	%	Nb.	%	
60:40	11	39.3	24	48.0	14.3
55:45	1	3.6	2	4.0	22.5
50:50	16	57.1	24	48.0	11.6
Total	28		50		13.3

The analysis reveals that three types of rubber owners presented two groups of production orientations. The first had an orientation of farm business attempting to maximize economic returns and intensify production in accordance with business objectives. The choice of contract emphasized a maximization of return and buniness strategy, including related business. Therefore, the selection of 60:40 was higher than the other share-tapping contracts. Contracts hardly regulated all practices and activities on plantations. Often contracts were performed by farm managers for regulation, management and administration of the plantation, and related business. All practices on the plantations were strongly controlled and verified, both in quantity and quality, by farm managers. Also, monitoring and control in production and marketing were high, closely checking every task and activity to cope with risks in production and risk aversion of hired laborers. In most cases, the rubber owners might focus on marketing, financial return and related business, which could involve increasing their value added and rubber production processes by managing their related businesses such as middlemen, primary processors, and factories.

The second group of owners balanced economic reasons and social values. Interviews reveal that generosity was involved in the experiences of poor families and their relationship with people during the settlement period. They had experienced a shift in the family from being a poor family to one of wealth in the present. All of them experienced settlement, and contributed highly to the development of the village. This virtue was to earn for them both social value and economic returns. It is similar to the patron-client relationship in a traditional agrarian society. At the persent, people respect them as leaders and local philosophers with high social status. Those who had high levels of generosity and kindness for relatives, kin, friends, and neighbors were to result in high relationships and exchange in terms of society, credit, labor, and culture among the families in the village since the start of the settlement period. There is a patron-client system in traditional agrarian societies in which people share and help each other among the wealthy and poor families. Social structure gives importance to land and labor sharing and strengthens social networks. In some cases, related business was observed on these farms similar to the previous one. Therefore, the agreement was likely to choose a wide range, from 60:40, 55:45, and 50:50 in the specific conditions of relevant factors. It appears that the proportion of 55:45 was high.

3.2.2) Tappers

Share-tappers are small holding farmers and landless hired laborers who are employed to tap on plantations under share-tapping contracts. Our collected samples were concentrated on very small farms who worked both on-farm and off-farm with share-tapping. The data presented that most share-tappers owned small landholdings and had high labor availability. 55 out of 220 farms were included in our households of share-tappers. 73 plots relied on off-farm with share-tapping in the 2010 data that were included for the analysis. Table 3-5 shows the farm characteristics of share-tappers. Average age of the household head was 50.6 years and most of the household heads were over 40.0 years old.

Rubber experience was about 25.4 years and indicates that farmers were highly skilled tappers and had long farm experience on plantations. The educational level of the heads of household was mostly limited to primary education. The analysis reveals that farm households were composed of a husband, wife, son, daughter, and other extended relatives. This constituted to the supply of tappers, so the higher the number of family laborers, the higher availability of farm labor, notably for tapping. Table 3-5 shows that the average size of family was 4.6 people. And the average for the available number of family tappers was about 2.3 people. The most common type of household structure is the nuclear family, comprising of a husband, his wife, and children. Extended families observed within the Islam ethnic were composed of the nuclear family and parent of either the head of household or his spouse. The available family labor for tappers was higher for extended families and families with young laborers working on farms. These farm laborers were allocated either for on-farm or for off-farm with share-tapping. Landholding size ranged from 1.0 to 21.0 rai, with the average being about 7.8 rai. Furthermore, the average area of off-farm land was 14.0 rai, ranging from 3.0 to 45.0 rai. Generally, the size

for off-farm was larger than for owned rubber land. Farms might have more than one plot of off-farm area. Share-tappers were employed by more than a single rubber owner for the different plots and with different contracts.

Table 3-5 Farm characteristics of share-tapper's households

Farm characteristics	Share-tappers			
	Mean	S.D	Min.	Max.
Age of household head (yr)	50.6	7.5	34.0	72.0
Rubber experience (yr)	25.4	8.7	6.0	45.0
Family members (persons)	4.6	1.4	2.0	8.0
Family tappers (persons)	2.3	0.7	1.0	4.0
Landholding size (rai)	7.8	5.5	1.0	21.0
Rubber land (rai)	7.1	5.3	1.0	21.0
Mature land (plot)	3.5	4.2	0.0	15.0
Off-farm land with share-tapping (rai)	14.0	8.0	3.0	45.0
Number of farms	55			
Plots	73			

Table 3-6 presents the distribution of share-tapper characteristics according to share-tapping contracts. The distribution of farms and plots in the different sharecropping contracts was different because a single farm might have more than one plot with different share-tapping. However, 50:50 was the most common sharecropping contract, both in terms of farms and plots. Farms commonly favored dealing with 50:50 share-tapping, with regards to its high output sharing. This study assumed a general rule that share-tappers preferred to deal with contracts of 50:50, 55:45, and 60:40 respectively. Respondents stated that a large tapping size and more productivity were important factors for determining their dealing with 60:40 share-tapping.

Moreover, our analysis found that there were inverse relationships between the size of landholdings and the size of off-farms. Very small holdings tended to have a large size of off-farm area. As Table 3-16 shows, the farms with 60:40 owned very small holdings compared with that of 55:45 and 50:50. The size of rubber land and mature rubber land changed in the same direction. According to the farms that underwent the trajectory of very small farms, our respondents stated that they had been well trained to become skilled-laborers either by family members or by themselves, and were long experienced on their own plantations. Because of very small landholdings and the availability of labor and skill, the adoption of off-farms with share-tapping was higher. They could be getting the deals for share-tapping contracts in the villages in which the rubber owners presented themselves with large farm sizes and more demand for hired tappers.

Our interviews revealed that these farmers could be classified into two groups by criteria of proportion of off-farm area, and size of their own rubber land. The first corresponded to farms

whose family tappers tapped both on-farm and off-farm. The second corresponded to farms whose households tapped only off-farm with share-tapping during the period of the 2010s. This was due to all rubber land growing at an immature stage. These farmers were from poor farm households and output sharing under off-farm was an important source of household income. Therefore, very small size, labor availability, and quality of family labor were critical factors in determining off-farm area and share-tapping contracts.

Table 3-6 Farm characteristics of share-tapper's households according to share-tapping contracts

Farm characteristics	60:40				55:45				50:50			
	Mean	S.D	Min.	Max.	Mean	S.D	Min.	Max.	Mean	S.D	Min.	Max.
Age of household head (yr)	48.9	9.5	34.0	65.0	52.0	8.4	43.0	72.0	50.0	5.6	35.0	60.0
Rubber experiences (yr)	24.8	9.9	10.0	40.0	22.6	8.1	6.0	36.0	26.6	9.3	10.0	45.0
Family members (persons)	5.4	1.6	3.0	8.0	4.2	1.4	2.0	7.0	4.2	1.2	2.0	6.0
Family tappers (persons)	2.7	0.9	2.0	4.0	2.2	0.6	1.0	3.0	2.2	.6	1.0	4.0
Landholding size (rai)	3.7	0.9	1.0	9.5	7.8	5.8	1.0	18.5	8.8	6.1	1.0	21.0
Rubber land (rai)	3.3	2.4	0	7.0	6.7	5.3	1.0	18.0	8.5	6.0	1.0	21.0
Mature rubber land (plot)	0.95	2.0	0	5.0	2.0	3.6	0	12.0	3.4	4.5	0	15.0
Off-farm land (rai)	20.5	10.7	6.0	45.0	14.2	6.3	6.0	28.0	12.2	6.2	3.0	26.0
Number of farms	13.0 (23.6%)				14.0 (25.5%)				28.0 (50.9%)			
Plots	20.0 (27.4%)				20.0 (27.4%)				33 (45.2%)			

Moreover, our data revealed some other sources of hired tappers, the first being hired tappers who migrated from other districts and provinces in the southern regions. This was due to small holdings and/or immature stages of planting associated with financial pressure. Perhaps it was difficult for them to find appropriate share-tapping employment in their home villages and they wanted to deal with large tapping sizes. This group could include very small farm households and landless farmers that included heads of households who presented tapping skills and qualified labor. In this family of hired laborers, the laborers were mainly husbands and their wives while they might drop their children off with grandparents for education. Our interviews found that relatives and friends in the village often helped them to find new share-tapping contracts and certified their labor quality. In some cases, heads of household had experience as workers or official staff in factories, commercial trade, and construction in the past ten years. The needed to improve family living standards associated with financial pressures that forced them to move back to their farms and adopt off-farm activities in order to keep up their financial position and meet their needs.

The second group is the migrated tapper family who has temporarily migrated from another region, such as the North-east region, to be a paid laborer in the village. Historically, they came to the village for paid labor in general jobs, such as collecting latex, weed control, etc. They would be trained to get tapping skills by friends and neighbors because the incentive for remunerative work was higher for tapping activities than for paid labor. These tappers generally are employed on older plantations or with highly exploited trees which can use un-skilled or low expertise tappers.

Regarding to attitude toward hired tappers, our respondents stated that share-tapping is a better job in terms of higher wages and better working conditions when compared with the situation of workers or paid laborers in construction and factories. However, most of the respondents did not prefer to engage their youngsters in the labor of share-tapping. They always encouraged their children to enter into non-farm employment. They said they would feel pleasure if their children could get job positions such as government officers, teachers, soldiers, and policemen. Many of these hired tappers argued that farm employment was hard work, a low class of job, low remunerative work, and with low sustainability when compared with being government officers. They hoped their children could get better jobs and had professional careers through higher education. If some children could not have any success in education, though, they could be trained to get tapping skills and expertise on a plantation that could be useful for finding share-tapping employment.

Concerning the relationship between the rubber owners and hired tappers, our interviews found that they usually had a good relationship and had long term relations. These therefore resulted in a high degree of confidence and trust, they followed supervision and recommendations, had high satisfaction with their tapping skill and qualified labor, and the desire to sustain the contracts. The respondents showed that the main characteristics and attributes of hired tappers were highlighted by honesty and trust, hard work, incentive driven and good work ethics, self supervising, obeyed the owner’s supervision, capability to work, availability of labor, consistency of work, performed farm maintenance, had appreciation towards their jobs, and a good personality in society and the economy. Working experience with others and a good reputation would be useful to certify an individual tapper's qualifications, and tended to get him better contracts. Working experience and a tapper's behavior were generally obtained through interviewing people and the last employer, in order to ensure qualified labor and to inspect for a personality that might negatively affect working performance and raise the possibility of disputes. It seems that locally hired tappers and persons included in social networks could give all the information that the owners need. The rubber owners could be offered up all the available locally hired tappers who were kin, relatives and within local social networks. This could explain the high proportion of locally hired tappers.

Some respondents argued that hired tappers from other provinces and other regions were characterized by high responsibility, hard work, and simple living compared to locally hired tappers. On the other hand, outside tappers often had problems with cheating and disputes. Those would then need close monitoring and tighter control, similar to overseas tappers. Cheating behavior was always a mystery and complicated to monitor. Through the experience of the rubber owners, cheating could be observed through the use of stimulation, increased rubber scraps and dropping collected latex in a particular tree. These dishonest behaviors could be very easy on farms that had low monitoring and control. Indeed, plantations in the remote areas and upland zones can be more affected by cheating and disputes. These problems could lead to immediate termination of the contract. In the case of goodwill, the rubber owner would mark them on parole for the first time. As well, most rubber owners argued that outside and overseas tappers had a high degree of cheating in many ways, and thereby they should have strong means to control and punish them by the law. Farm managers and job regulations should be allowed to control and monitor any possibility of loose behavior and disputes.

Our data shows that about 60.0% of total owners had experienced consistency with tapping skills and working competency. About 20.0% of the total owners had been faced with lack of responsibility, low working efforts, unceasing diligence, and rising dishonesty. Other problems involved the pausing of tapping day, moving back to the mother land of tappers from other regions, and uncertainty of weather. Maybe this is because hired tappers are often involved in many social activities and other productions, which can affect a lack of responsibility and performce at work. Hired tappers from other provinces often had problems of dishonesty and causing the pause of the tapping day due to frequently returning home.

Table 3-7 The average working times according to tasks and forms of product

Activities	Fresh Latex	Un Smoked Sheet Rubber (USS)
Tapping	00:00 – 06:00 (11:00 – 05:00)	00:00 – 06:00 (11:00 – 05:00)
Collecting latex	07:00 – 10:00	07:00 – 10:00
Sheeting	-	10:00 – 14:00
Sale of output	09:00 – 11:00	10:00 – 12:00*

Remark: survey data in 2011; time was the estimated working time by activity.

* 2 times per month or every week

Regarding working time, our respondents stated that tapping tasks generally would start after midnight depending on the size of the tapping area, available tappers, and distances to the plantation. Table 3-7 presents the average of working times according to activities and types of product forms. With regards to the sale of fresh latex, total working hours would be about 7.5 hours per 2.0 persons or 1.87 man-days. In the case of rubber sheeting, total working time would be about 10.0 hours per 2 tappers or 2.5 man-days. Sale of rubber sheets varied, about 2.0 times per month, and used about 1.0 hour per time, this would be hours working of both the rubber owners and the share-tappers, in general.

Immigrant tappers

Our collected samples, plus interviews, indicated that total overseas tappers were about 90.0% from Burma, 9.0% from Laos, and 1.0% from Cambodia. The average age was about 37.0 years, which was younger than those of total hired laborers. Male was predominant in all categories. About 50% of the foreign laborers were recruited by the rubber owner, 35% by an agency and 15% by the old foreign family. Accordingly, our respondents of immigrant tappers stated that they came to Thailand through direct contact with the rubber owners, old immigrated tappers and agents. After a few years, most immigrant laborers moved to intensive plantation areas through their networks. Since 2003, a registration of immigrant labor has been implemented to support the use of immigrant laborers. Registration cost was about 3,800 baht per year, which was a burden cost for immigrated laborers. Some rubber owners would pay this cost in allowance for a working permit, and those laborers would pay them back later. In 2010, immigrant labor in southern regions made up about 275,423 people (DOE, 2011). These laborers worked in both off-farm and non-farm sectors in Songkhla, Surattani, Chomphon, and Ranong. It was difficult to get a precise number of overseas laborers on plantations with the existing poor registration and statistical data available.

Our interveiws reveal that the arrival of immigrated tappers helped to supply the labor needed in particular conditions and contracts that did not need to be worked by local hired tappers. Often for the case of goodwill, overseas tappers had good relations with the rubber owners. They did not make any problems and worked intelligently at a satisfactory level. They had a willingness to work on the plantation and seemingly adapted into agrarian society as Thai people. They apparently understood how the culture works and what the importance of good working behavior was, which resulted in them being able to deal with contracts the same as Thai people. In farm enterprises, a head of workers was developed who could help to communicate, monitor, and control practices on the plantation. They also helped to certify labor quality and solve some cases of disputes. The rubber owner might facilitate accommodation, credit, health insurance, and additional income during the leaf fall season. Accommodation would be provided to promote work incentive. This study has found that regulations and restrictions were created to have the possibility for controling and monitoring the quantity and efficiency of contracts. These tappers were employed by 60:40, 65:35 and 70:30 share-tapping.

However, our respondents argued that problems and constraints to use overseas tappers were increasing. The important problems highlighted were dishonesty, cheating, lack of responsibility, escaping away from contracts and quarrelling among friends. The low cost of share-tapping relying on 70:30 seemed to earn short run. In Rattaphoom, Paboon, and Sa-doa, our study found that the immigrated laborers would cause rising conflicts among the people. The impact on tapping competition and social problems was concerned with social issues. It should

be noted that many criminal cases and drugs were caused by Burmese tappers. The conflicts among immigrated tappers and local people was reduced social security and living safety.

Therefore, people raised social orders and criminal sanctions on the farms which employed Burmese tappers, which was intended to punish or act against the contracts with foreign laborers. Pressure to the owners tended to increase, which could be observed through a lack of social cooperation and limit of any help from people in the village. People argued that the social sanctions were pursued to change the perceptions of the rubber owners over concern about the negative impacts of overseas tappers and required social responsibility. Those of measure were available to put pressure on the rubber owners, but these did not directly go against individual overseas tappers.

3.3 Institutional Analysis of the Share-Tapping Arrangement

A share-tapping contract is an agreement between rubber owners and share-tappers in which the owners allow share-tappers to tap rubber trees and subsequently pursue mutual benefits and values. The conceptual framework of a share-tapping contract was developed based on institutionalism. Figure 3-1 illustrates a general view of the concept of a share-tapping contract comprised of the rubber owner, share-tappers, contracts, institutions, and economic factors. According to our observations, the owners define the rights and obligations of share-tappers and their relationships with them. A share-tapper is hired to achieve the owner's objectives and in return receives a remuneration through sharing-outputs and other benefits.The rights that the rubber owners give to share-tappers could be only that of tapping the rubber trees and farm practices on the plantation. This right is a permission to generate income by getting a relative share of the output and requires maintaining the productivity of the plantation. On the other hand, the rubber owners could only have the right to use their labor and to change or terminate the contract. Owners still fully possess the right of landownership.

1) Rubber owners

The rubber owner is a contract maker who wants to employ the right skilled tappers to tap his rubber trees. Most owners prefer tappers who are high-quality laborers and available. Owners need to obtain complete information about the personal characteristics and working backgrounds that will affect the productivity of the work and efficiency of the contracts. Owners must deal with selection problems that arise when the labor market faces a limited supply of quality tappers, and has difficult access of full information. Typically, owners assume that they can have complete information on laborers who are kin, or persons with social ties in the village, and that these laborers have an average level of labor quality. Thus owners will generally make a contract with the same average rate as other owners in the village. However, owners can attract high-quality labor by offering better conditions such as higher share-output, lower share-input, or large tapping size. It appears that a prevalence of a set of arrangements is selected by the owners

based on their perceptual experiences, circumstances and the institutionalization of share-tapping.

2) Share-tappers

The share-tapper is a contract taker whose labour is hired to farm in return for a remuneration under the form of an output share. Share-tappers seek an appropriate contract corresponding to their farming experience, available labor, skill level and so on. Our interviews reveal that their most important attributes were tapping skill, honesty and trust, availability of labor, and efficient management to execute daily production and farm maintenance. Tappers who were specialized with tapping skills and management tended to deal with better conditions of contracts and longer term employment. Tapping skill and quality of labor warrants the reputation of share-tappers. Records of dispute and cheating have an impact on the possibility to find owners with whom to sign contracts in the future. The new-comers who have limited skills, tapping capacity, and farm maintenance experience have limited bargaining power with owners to negotiate for conditions and terms of their contracts. A prevalence of a set of agreements is perceived to be accepted by the share-tapper. They would normally obtain an agreement corresponding to their capacities and attributes among a set of agreements available.

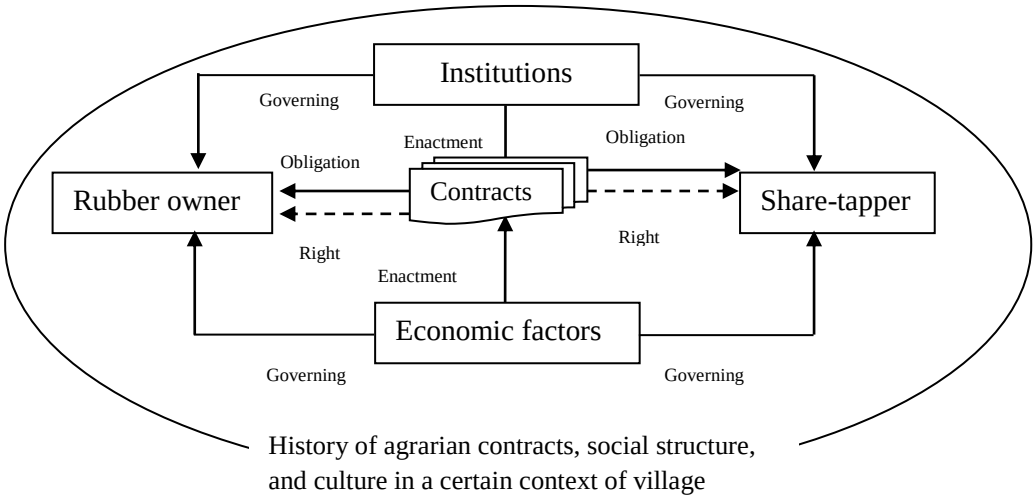

Figure 3-1 Conceptual framework of share-tapping contracts

3) Contracts

Both informal and formal arrangements exist in the study area, but informal arrangements are more popular and widely accepted. Formal arrangements are usually practiced in some farm enterprises. Informal agreements have no fixed duration and may last as long as the parties are willing. The contract comprises core agreements and task requirements. Core agreements concern output and input sharing, obligations, and duties on the plantation. Task requirements include a set of provisions and responsibilities for both parties in order to maintain

productivity, and optimal contracts include the means to handle cases of dispute (Figure 3-1). Share-output varies from 50% to 70% for the owners, with the share-tapper getting less than or equal to 50% of the output. The predominant share-tapping ratios comprise of (the owner:share-tapper) 70:30, 60:40, 65:35, 55:45, and 50:50. Owners always earn 50% of output or total gross sales or more. Cost sharing is flexible and relative to output sharing and other relevant factors. Cost is shared between the owners and share-tappers, either equally or as a proportion of the annual vailable cost. With high output sharing received by the rubber owner, all costs are paid by the owners. Obligations and duties involve the agreement of tasks and jobs on the plantation as to what will be done by the share-tapper are tapping, collecting latex, sheeting, transporting, storing, and partly selling the product.

Task requirements involve the agreement of practices or tasks in farm maintenance, such as weed control, applying fertilizer, the spraying of chemicals, and others. These tasks may be done either by paid labor or share-tappers, which are mostly flexible in the sharing of tasks and costs. These will have to perform for the improvement of productivity and maximizing efficient resources. Often share-tappers prefer to do these tasks because they need to maintain long-term employment and it gives them a good chance to present their labor quality and be appreciated by the owners.

Figure 3-1 shows the recognition that economic factors and institutions are also important factors to structure and enable the orderly thought, behavior, and practices of the actors for the arrangement of share-tapping contracts. Institutions here are the social norm, culture, convention, customary and social rules to embedded thought, behaviors and actions in human and collective actions. With regards to this, institutions have influenced the structure for organizing contracts, contractual arrangements and relationships between the rubber owner and hired laborers. Institutions further embed and constrain the choice of contracts, choice of labors, and contractual arrangements to pursue economic reasons, functionality and legitimacy. Institutions also enforce productivity improvement in order to determine the potential for the optimal efficiency of contracts and to order the execution of contracts. The important economic factors involved in contractual arrangement are farm size, return, cost and price, including physical conditions relevant to the biophysical health of the trees, yield, location, production forms, and marketing systems. These factors influence the potential level of profitability and also shape the farmer’s decisions for his choice and arrangement of contracts.

3.4 Economic Performance of Share-Tapping

1) Assumptions of analysis

This section aims at assessing the financial return of different share-tapping contracts using survey data from 2011. For rubber plantations, the cost of production can be classified into immature and mature periods. During the immature period, the first year (establishment of the plantation) includes the costs of land, land preparation, planting material (clones), chemicals or fertilizers used at planting, labor, and opportunity costs. During the years 2 to 6, there are maintenance costs comprised of fertilizer, chemicals, weeding, farm equipment, replacement clones, and labor costs. During the mature period our study focused on the cases where rubber was sold under the form of unsmoked rubber sheets. The expenses for the first year of tapping, or year 7, comprised of tapping equipment, collecting devices, sheet processing equipment and buildings, fertilizer, weeding, chemicals, and labor costs. For the farms with hired tappers, the cost of share-tapping was included. From years 8 to 35, the expenses were composed of costs for farm maintenance (fertilizer, weeding, chemicals, and labor cost), farm equipment replacement, and labor cost. The estimated average cost of the immature period was based on data presented by RRIT in 2011 to ensure reliability of the data. The 341 plots of our sample tapped by share-tapping labor were distributed in different share-tapping contracts, as showed in Table 3-8.

Table 3-8 The distribution of plots according to share-tapping contracts

share-tapping contracts	Number of plots	% of plot	Average of share-tapping areas (rai per household.)	Yield (kg/rai/year)
60:40	116	35.2	20.5	340.0
55:45	68	23.5	14.2	308.0
50:50	138	41.3	12.2	295.0
Total	341	100		

2) Estimated average economic performance to the rubber owners

Tapping cost, mainly consisting of tapping/collecting labor, is by far the highest cost of production for the rubber owners, ranging from 81.5% of total production cost for 60:40 share-tapping contracts to 90.9% for 50:50 share-tapping contracts (84.6% for 55:45 contracts). In line with the cost sharing ratio, total farm maintenance costs during the mature period represents 13.8 % of total production cost for 60:40 share-tapping contracts, which was higher than that of 55:45 and 50:50, which accounted for about 11.0 and 5.2 %, respectively. The lowest average yield was observed in farms using 50:50 share-tapping. This is not surprising, as old aged and low yield plantations are reasons to use this share-output for share-tapping contracts. With the highest yield and the lowest labor cost per unit, farms using a 60:40 ratio tended to give the highest net revenue (Table 3-9).

Table 3-9 The estimated average economic performance to the rubber owners

	60:40			55:45			50:50		
		Baht/kg	%		Baht/kg	%		Baht/kg	%
Production (kg)	340			308			295		
Price (baht)	120			120			120		
Gross revenue (baht/rai)	40,800			36,960			35,400		
Replanting /immature cost (baht/rai)	795.6	2.3	3.8	740.3	2.4	3.7	715.5	2.4	3.6
Operating cost (baht/rai)									
- Fertilizer (baht/rai)	2,250	6.6	10.8	1,660	5.4	8.2	720	2.4	3.6
- Weed control - (baht /rai)	350	1	1.7	300	1	1.5	175	0.6	0.9
- Maintenance labor (baht/rai)	272	0.8	1.3	269	0.9	1.3	130	0.4	0.7
Tapping cost									
- Tapping/collections (baht/rai)	16,320	48	78.3	16,632	54	82	17,700	60	88.7
- Management (baht/rai)	439	1.3	2.1	304	1	1.5	201	0.7	1
- Plantation equipment (baht/rai)	235	0.7	1.1	230	0.7	1.1	235	0.8	1.2
Land tax/opportunity cost									
- Land tax (baht/rai)	5	0	0	5	0	0	5	0	
- Opportunity cost (baht/rai)	173	0.5	0.8	138	0.4	0.7	71	0.2	0.4
Total cost (baht/rai)	20,839.6	61.3	100	20,278.3	65.8	100	19,952.5	67.6	100
Farm Return (baht/rai)	19,960.4	58.7	48.9	16,681.7		45.1	15,447.5		43.6

Remarks:

1) The average rubber price (baht/kg) by the survey in 2011
2) Yield (kg/rai/year) by the survey in 2011
3) Gross revenue = production per rai (yield) x price
4) Replanting and cost during the immature period = RRIT's survey in 2011
5) Land tax/opportunities cost came from RRIT's survey in 2011, opportunity cost is the income foregone by renting
6) Maintenance cost and tapping cost came from the survey data from 2011 (baht/rai/year)
7) Fertilizer = quantity (kg) per rai x price in 2011 (baht/kg)
8) Weed control = frequency x cost by machine (baht/rai)
9) Maintenance labor = paid labor for application of fertilizers or spray chemicals, etc (baht/rai)
10) Tapping/collections = sharing gross sales by hired tappers (baht)
11) Management cost = cost of monitoring, supervision and transportation (frequency x the estimated cost)

12) Total cost = replanting cost/immature cost + maintenance cost + tapping cost + land tax/opportunity cost
13) Farm return = gross revenue – total cost
14) Percentage of farm return = net farm return / gross revenue

3) Estimated average income and cost to share-tappers

It is also interesting to examine economic performance from the point of view of the hired tappers, as shown in Table 3-10. Logically, the total cost for 50:50 share-tapping contracts was the highest due to cost sharing. Net return per tapping area also was higher than the others. However, due to the small size of tapping areas per household, total return and return per labor were the lowest. Even though the share for the tapper is lower, 60:40 share-tapping is favorable to hired-labor because of high yields and a larger size of tapping areas per household.

Table 3-10 The estimated average income and cost of work for hired tappers

	60:40	Baht/kg	55:45	Baht/kg	50:50	Baht/kg
Production (kg)	340		308		295	
Price (baht)	120		120		120	
Return to share-tappers (baht/rai)	16,320	48	16,632	54	17,700	60
Tapping areas (baht/rai)	20.5		14.2		12.2	
No.-Tapper (man)	2.7		2.2		2.2	
Tapping Cost						
-tapping equipment (baht/rai)	278	0.8	190	0.6	182	0.6
-transportation (baht/rai)	172	0.5	155	0.5	129	0.4
Maintenance cost (baht/rai)	no	-	no	-	1,025.00	3.5
Total cost (baht/rai)	450	1.3	345	1.1	1336	4.5
Net return (baht/rai)	15,870	46.7	16,287	52.9	16,364	55.5
Total return (baht/yr)	325,335		231,275		199,641	
Return per labor (baht/yr)	120,494.4		105,125		90,745.8	

Remarks:

1) The average rubber price (baht/kg) by the survey in 2011
2) Yield (kg/rai/year) by the survey in 2011
3) Return to share-tappers = cost of tapping/collection in Table3-2 (baht/rai)
4) No.-tappers (persons) by the survey data in 2011
5) Tapping equipment came from RRIT's survey in 2011 (baht/rai)
6) Transportation by the survey data in 2011 (baht/rai)
7) Maintenance cost by the survey data in 2011 (baht/rai)
8) Total cost = tapping cost + maintenance cost (baht/rai)
9) Net return = return to share-tappers – total cost (baht/rai)
10) Total return = net return x tapping areas (baht/year)
11) Return per labor = total return / No.-tappers (baht/tapper/year)

Our analysis shows that revenue for the share-tappers depends on the size of the tapping areas, the yield and cost sharing. It should be noted that a direct comparison of economic

performance between types of share-tapping contracts must be carefully managed often when the data and information involved are based on practice experiences and may be an estimation. Our analysis is based on figures for the one year of 2011. This year encountered not only yield variation, weather uncertainty, and various conditions in the arrangement of contracts, but also fluctuations in rubber price, which affected the economic performance of share-tapping.

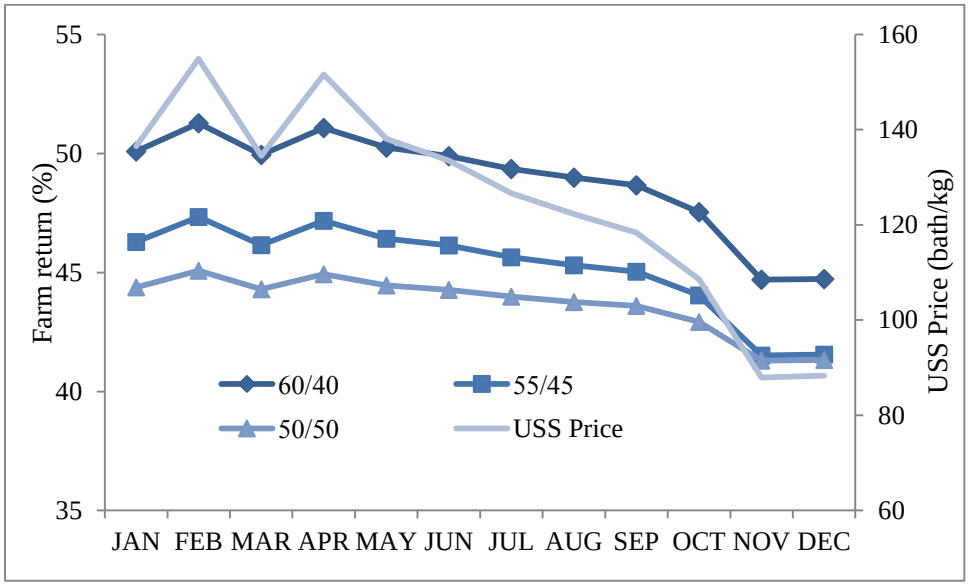

Figure 3-2 The change of farm returns according to rubber price in 2011

In 2011, the fluctuation of rubber price was high. Figure 3-2 shows a declining trend for farm returns in response to a price slowdown. 60:40 share-tapping continued to provide a higher return to the rubber owners than 55:45 and 50:50. The percentage of farm return for 55:45 share-tapping became relatively close to 50:50 share-tapping when the price dropped. Therefore, the net return naturally declined in accordance with price volatility. Past declines in price of 10.0 baht per kg had decreased farm returns by 1.0 percentage point, as shown in Figure 3-2.

Table 3-11 Return per unit and percentage of farm return according to the change of yield

Year of plantation	Tapping year	average yield (kg/rai)	60:40		55:45		50:50	
			Return per rai	Return per price (%)	Return per rai	Return per price (%)	Return per rai	Return per price (%)
1-6	-	-	-	-	-	-	-	-
7-9	1-3	260	14,200.4	45.5	13,513.0	43.3	13,347.5	42.8
10-18	4-12	360	21,400.4	49.5	20,113.7	46.6	19,347.5	44.8
19-28	13-22	320	18,520.4	48.2	17,473.7	45.5	16,947.5	44.1
29-38	23-34	240	12,760.4	44.3	12,193.7	42.3	12,147.5	42.2

Remark: Year of plantation, tapping year and average yield came from the survey data in 2011

Return per rai calculated from the survey data in 2011 as in Table 3-3, Return price = farm return / price

Table 3-11 shows that yield evolves along the productive period, affecting the average economic performance of the plantation. Under 60:40 share-tapping contracts, the estimated return per unit was always higher than that of 55:45 and 50:50, and the farm return was maintained above 40.0 percent throughout their economic life spans. Whatever the share-tapping contract, when the yield regressed, the level of return per unit declined considerably. Therefore, rubber yield directly affected the level of return, both for the owner and the hired tappers, and consequently affected the share-tapping arrangement. This could explain why after 22 years of tapping, 60:40 share-tapping often changed into 50:50 or 55:45.

3.5 Factors Determining Share-Tapping Arrangements

The purpose of this section is to identify the factors influencing share-tapping arrangements and identify the rules governing share-tapping. It also shows how these rules are embedded in the three types of rubber owners: large family farm enterprises, medium family farm enterprises, and patron farms.

1) Output sharing rules

The 50:50, 55:45 and 60:40 share-tapping schemes are the main patterns found in the collected samples in this study area, while some farms had experience with 65:35 and 70:30 share-tapping patterns. The rule limits the share so that not more than 50% and not less than 30% of output goes to the share-tapper, and more than 50% of output goes to the owners. Our interviews revealed that 50:50 was commonly used during the time of old clones, or at least before the time that new clones had been promoted. Thereafter, 60:40 and 55:45 were increasingly used. These new sharing patterns are due to higher yields and the rising cost of farm maintenance. Also, 70:30 was applied by some farmers in response to high risks from overseas tappers and the high cost of monitoring them. The sharing patterns include not only the main products (fresh latex, rubber sheets, and cup-lumps) but also the "by-products" or "scrap rubber". In some cases, only the main products will be shared between owners and share-tappers, while tappers who get whole scrap rubbers consider it as additional earnings. This study found that output sharing could be changed, and there were flexible rules in response to these changes, as well as a share in the inherent risks. For example, high output sharing to the owner will be observed if the tappers do not share in the cost.

2) Cost sharing rules

Cost sharing is generally related to the output sharing pattern. The principal rule is the higher the output sharing is to the share-tapper, the higher the cost sharing will be. The compensation of cost sharing could be observed by low output sharing. Cost sharing pays for farm maintenance and related costs of production, it needs to identify who will share, how much, and for what activities. All inputs and applications are paid for by the owners. This rule was observed in farms undertaking 60:40, 65:35, and 70:30 share-tapping. If a higher output sharing

is given to the tapper, cost sharing could be increased proportionally, or divided equally. Cost sharing appears to be raised with regards to output sharing. 50:50 share-tapping is embedded by this rule.

Our interviews revealed that the rising price of input tends to increase the proportion of cost sharing. The cost of farm maintenance is composed of fertilizer, weed control, disease control, and labor costs for the application of inputs. The attention is concentrated on improving productivity and maintaining rubber trees all along their economic life. Share-tappers somewhat relied on 60:40 and 55:45 share-tapping, they preferred to work on applying fertilizer and weed control, which would enable them to earn a greater value of share-tapping and long-term employment. In the study area, cost sharing and farm maintenance responsibilities can be grouped into three cost sharing schemes.

The first is that owners pay all costs in farm maintenance and then the share-tapper is responsible only for tasks in production. 60:40, 65:35 and 70:30 share-tapping mostly rely on this system.The second corresponds to a share of a particular proportion of costs between the owner and share-tapper. There are no fixed rules as to what extent, by who, how much, and what activities. The share in proportion of costs can be grouped into sub-systems. The first sub-system is where the owners pay the cost of material inputs such as fertilizer, chemicals, and fuel. These inputs are applied by share-tappers. Share-tappers will be responsible for the application of these inputs, or pay the labor costs if paid laborers are used. The second sub-system is where the costs of fertilizer and its application are paid for by the owners. Weed control is paid for by the share-tappers. These cost sharing systems are well employed by farms under 50:50 and 55:45 share-tapping. The third corresponds to equal cost sharing between the owners and tappers. The costs and farm maintenance responsibilities are shared between the owners and share-tappers equally. This cost sharing system is employed by farms under 50:50 share-tapping. This study revealed that even when farm maintenance costs were incurred by the share-tappers, they preferred to share all of the costs.

3) Sources of hired labor, kinships and labor institutions

Table 3-12 shows that sources of hired labor varies according to the type of farm employing share tappers. Large family farm enterprises rely more on local labor and present the highest rate of hired tappers from other provinces in southern regions such as Pattalung, Trang, and Nakornsithamarat. Medium family farm enterprises do not use labor from other provinces and rely equally on kinship, relatives and village people. Patron farms have a similar pattern related to local labor but also use more laborers from other provinces. This can be interpreted as the medium family farm enterprises being able to satisfy their needs locally through stronger linkages at the village level, while large farms and patron farms tend to have less capacity to connect with or a need for local skills.

Table 3-12 The distribution of sources of hired tappers according to types of rubber owners

Source of hired tapper	Large family farm enterprise		Medium family farm enterprise		Patron farms		Total	
	n	%	n	%	n	%	n	%
Kinship or relative	2	5.7	23	48.9	22	44.0	47	35.6
Local village	28	80.0	24	51.1	22	44.0	74	56.1
Other provinces	5	14.3	-	-	6	12.0	11	8.3
Total	35	100	47	100	50	100	132	100

Table 3-13 shows the distribution of share-tapping contracts according to the origin of the share-tappers. The data indicates that whatever the share-tapping contract, the major supply of share-tappers came from kinships and local tappers. The origin of share-tappers strongly influences the output sharing pattern. Kinship or strong social ties are related to higher output shares for the tappers or better terms and conditions on the contracts. Kinships or relatives have the best deal of 50:50 share-tapping, while 60:40 and 55:45 share-tapping were strongly applied for share-tappers who were local and from outside the village.

Table 3-13 The distribution of sources of hire-tappers according to share-tapping contracts

Source of hired tapper	60:40		55:45		50:50		Total	
Number of plots	n	%	n	%	n	%	n	%
Kinship or relative	13	23.2	10	33.3	25	54.3	48	36.4
Local village	39	69.6	20	66.7	14	30.4	73	55.3
Other provinces	4	7.1	-	-	7	15.2	11	8.3
Total	56		30		46	100	132	100

In this study, it should be noted that kinship is defined as persons in the extended family, for both the husband and wife. Kinships could be extended through formal kin (extended family) and informal kin by social ties. There is a common system to consolidate people into social ties or social networks. Traditionally, Thai villages are made up of people tightly bounded by a few extended families and are connected to other villages through marriage and immigration since the settlement period. Kinship usually extends across the entire village and also links to multiple villages, districts, and provinces. This includes close friends, indirect friends, and neighborhoods. Moreover, people are linked through prestige, credit, economy and history of exchanges in farm labor, social activities, and politics. For instance, farmers go to help relatives in the closer villages during rice harvesting or wedding ceremonies. In everyday life, culture, local festivals, and religion also enforce people within some certain relations and participations. Villagers are bound together through extended kinship relationships. Thus, kinships and social networks are important social institutions in Thai villages. These are valuable resources for taking advantage of for social and economic status.

In our period of study, most families in the villages were nuclear families comprised of a husband, wife and their children, which had split from the extended family. Houses were often built in the same village as their parents, as well as the families of siblings. There were also several close kinships that had the same family names of fathers or mothers and cousin relationships. To extend social networks, our study found that a great number of friends or high social networks relied on owners who had large landholdings or higher economic status, rather than those of low-status people. As well, villagers who had the same occupations within the villages mostly had relationships with friends or indirect friends. These relationships also extended to people outside the village who could trace their relatives from both the families of the father and the mother. This was a bilateral kinship pattern and it extended broadly to non-relatives. There were significant extended kinships and social networks.

By consequences of kinship and social ties, the extended kinships and people in social networks within and outside the village were important supplies of tappers regarding skill and labor quality requirements. This study found that owners were more likely to choose kin and people in social ties if the tapping's attributes were considerably the same or not too much different. There is prestige to poor families and the meaning of wealth transfers (gifts) within kinship structures and social networks corresponded to local institutions such that rich families should help or support the raising of economic status in the families of siblings and kinships. It seems that kinship relations could be expected to be greater when they induced altruism, working effort, trustworthiness, and contract security. Kinships were important to reduce conflicts of interest, and they also increased trust and confidence. Decreased moral hazard also provided a strong commitment to contracts.

Responsdents stated that trust and confidence from kinships and people in social networks were mostly derived from that which we call "*altruism effect*". Altruism effect is a key factor in conducting contracts and inducing efficient contracts. Altruism induces gains that were observed for such things as high working effort, tapping skill, self-supervision, and cooperative behavior. Farms dealing with kinships tended to have low monitoring and supervision, reduced moral hazard, and reduced conflicts of interest. Furthermore, in most cases, monitoring and supervision were performed by kinship networks, which resulted in low frequency of monitoring and lower cost. This gave credence to the fact that people in kinship networks who were rubber owners, share-tappers, and middlemen helped monitor working efforts, shrinking, and self-supervision, and offer protection from any disputes in production. This was the cooperative behavior among kinship networks that enabled the control and monitoring of contracts to be effective. Moreover, our study observed that labor mobility was the lowest among kinships and local laborers. Local tappers who had lived in the village for a long time ensured that people in the village were completely informed about their farm characteristics, skills, working attributes, and behavior in social and economic activities. Share-tapper candidates could be easily monitored and evaluated, especially their skill, quality and availability. Additionally, share-

tappers also obtained complete information on whether an owner, plantation, and share-tapping availability was useful to what mattered in their decisions.

In addition to share-tapping contracts, economic and social activities were also generally involved and exchanged between the owner and hired tappers. Accordingly, the relationship and a given prestige through share-tapping were highly important to maintain and strengthen their relationships. When an owner shares his wealth with people in the village, then prestige and high social status will be gained. Adversely, if many outside laborers or overseas tappers are employed, people will question the owner's decision and it marks them as a greedy man.

Our analyses also reveal that labor institutions were embedded in the behaviors and activities of hired tappers, both on the plantation and in their relations with people. According to traditional agrarian society, people had strong relationships, which was observed in the social and economic levels for everyone. Everyone could explain the personal characteristics for someone, who were qualified tappers or with high attributes, and this included who had kinship to whom. The complete information was an opportunity meant to get the right job with the right person, for the hired tappers and the owners. As with the consequences of Karma principles, there was diligence of work, faithfulness, and appreciation towards the owner's generosity. All of them had long experience with plantations and had trained to be skilled tappers. Cheating and dishonesty were considered blasphemous and evil, that it would be re-paid to the owner in the next life. If you have been declared a hired tapper, you need to be a qualified laborer and have tapping attributes yourself. People will often assess you both on the plantation and in your behavior in social and economic activities as a whole. Dishonesty and cheating behavior can be observed by everyone and it will be informed to the rubber owner in some way. This is the default in his occupation which makes for difficult situations when it's time to deal contracts with other owners. Our interviews revealed that hired tappers knew what the right thing to do was for sustaining his occupation. They declared their qualified labor and induced confidence and trust among the parties. Once a system of confidence and trust was established, owners would give a temporary right for all activities. Therefore, people understood the basic rule that what/how legitimacy should prevail in response to sustaining their employment and recognition for getting the job.

Our analyses revealed that a system of confidence and trust is an important rule governing share-tapping arrangements. This translates into a self awareness towards his work with honesty and appreciation toward the kindness of the owners, which could then be observed through his work effort, self supervision, and pride in his work. Honesty is a very important attribute which has been taught by parents in order to grow up and be a good person, as in the proverb *An honest man gets all the help he needs; a dishonest man gets help only once*. If you are working as a hired tapper, this is the rule to govern all activities and determine the primary characteristics of hired tappers. In order to verify honesty, a lot of experience on plantations and

good behavior in social cooperation should be verified. When hired tappers can prove their honesty, they can get special work conditions which belong within a system of confidence and trust. Personal characteristics, relationships, experience and farm objectives have influence in determining this level of confidence and trust. Under the inducement of confidence and trust, hired tappers have to keep it in mind to maintain a high degree of honesty towards the owners and themselves, and keep this resolution abundantly clear. Hired tappers will work like it's their own plantation, do all the farm activities that the owner usually does, and maybe manage the income sharing as well.

In this study, the level of monitoring, level of responsibility to the plantation, and the number of working years were the primary criterions used to assess a level of confidence and trust. Confidence and trust could be grouped into three levels, as follows. The first is when practices and tasks were frequently monitored and controlled by the owner. Higher monitoring would reflect low confidence and trust presented by the farm. It is likely that modern business management would be replaced. Job discriptions and regulations were created to regulate all practices and tasks in production, allowing the farm manager to control and monitor production and meet farm objectives. High monitoring and intensive control were applied by farm enterprises or farms using overseas tappers or new tappers. However, there were no absolute regulations to protect against cheating or disputes whenever a formal agreement was applied. Cheating and disputes tended to increase eventually. Overseas tappers were recorded as having higher rates of cheating compared to local tappers.

The second level is moderate confidence and trust. The rubber owners would visit their plantations about 24-60 times per year in order to monitor quality of work and verify quantity of production. Particular attention would be paid to keeping a routine for the assessment of farm maintenance, working conditions, and informal interviews with local people. Selling records or bill payments would be checked to verify quantity, price and gross sales, and he could further evaluate working performance and a tapper's behavior during production. Perhaps the rubber owners would walk around the plantation to assess variations of weed control, disease, and declining biophysical conditions. All hired tappers could be reached for an assessment of honesty and self supervision.

The third level is high confidence and trust, which is characterized by all activities on the plantation being done by the hired tappers. Plantation visits number about 6 – 10 times per year, or complete absence in some cases. This level had the lowest monitoring and control in production. Hired tappers who have good reputations, skill, long farm experience, kinships, and good personal characteristics will be expected to get more confidence and trust, earned from their individual behavior and their viability in the past. There is a belief in their competency and capability to work, that it will be accomplished on their own merit. When their labor attributes and working performances have been proven through direct investigation or social networks,

they do not raise any questions of shrinking, cheating, or disputes. There also needs to be a system to verify the quantity and price.. Respondents argued that "if you wanted to sustain yourself in this occupation with long employment, this means that you should do the job as if you owned the farm". In fact, the rubber owners would keep employment with good hired tappers. Even when plantations were to be re-planted, they would offer another plot for them. Therefore, the rule derived through this system of confidence and trust is one of the fundamental elements that govern the relationships and arrangements of share-tapping contracts.

4) Skill and rules of skilled labor to ensure longer rubber tree life spans

For rubber owners, tapping skill is an important attribute for increasing productivity, reducing cost, and guaranteeing a long economic span of the rubber trees. In theory, rubber trees start to be tapped in their seventh year on the first virgin panel. The first panel will be consumed within 6-7 years. A second half spiral cut is tapped on the other side of the tree as the virgin panel. After that, tapping returns to the first panel, where the renewed bark is thick enough to be tapped for another 5-6 years while the second panel grows its renewed bark. Thus, the virgin bark and the renewed bark are completed in about 20 years (Webster & Baulkwill, 1989). Skilled tappers associated with low tapping frequency systems and better farm maintenance can make it possible to tap the rubber tree for up to 35 years. This results in a sustained source of household income, with higher production and decreased costs of re-planting. Low skilled tappers can deteriorate rubber trees, in particular when the renewed bark becomes very thin and impossible for tapping. The results are shorter life span and early re-planting after about 15 years (RRIT, 2010). Thus, tapping skill is an important factor in the selection of labor and contract arrangements.

The level of tapping skill is verified through historical working records and the existing practices on the plantations. The owner's observations emphasize low bark consumption, high renewed bark, less damaged bark, and high yield as a function of the age of tree. Our study found that the element of tapping skill could be measured as follows. Firstly, the technique of rubber exploitation on the tree is observed: low bark consumption without any damage to the cambium, or, tapping with a uniform depth of the wounds (thickness) in accordance with the RRIT recommendation of 2.0 mm per cut. The first renewed bark is as acceptable as when tapping virgin bark (thick is possible to tap) which results in a high yield and long economic life. Second, adequate skill and consistency are required to have a sufficiently productive plantation. Temporary variations in tapping skills should be low or within an acceptable level. Finally, the tapping skill should guarantee a high yield even if several other factors have influenced the level of yield, such as the tapping system, age of the trees, biophysical health of the plantation, and the level of maintenance on the plantation.

Importantly, our study found that people in the villages knew who the skilled tappers were. Their tapping skill was observed by everyone and further assessed and compared with

everyone else. Tapping-skills could be raised through coaching, supervision, and interpersonal training; as well, long experience on plantations could develop skill, competency and consistency. All owners argued that a tight supply of skilled tappers had incraesed and low skilled tappers had to be recruited instead.

Unskilled and low skilled tappers are often employed for the exploitation of high tapping panels, or for slaughter tapping which consists of an intensive tapping system in order to extract as much latex as possible before the trees are felled (Webster & Baulkwill, 1989). It seems that everybody starts to learn tapping skills from slaughtered plantations. Thanks to learning by doing and supervision, tapping skills develop over time so that unskilled tappers can become skilled tappers.

Table 3-14 The distribution of farms according to tapping skill of the household head

Source of hired tapper	Large family farm enterprises		Medium family farm enterprises		Patron farms		Total	
	n	%	n	%	n	%	n	%
Unskilled tappers	4	44.4	9	27.3	9	32.2	22	31.4
Skilled tappers	5	55.6	24	72.7	19	67.8	48	68.6
Total	9	100	33	100	28	100	70	100

In Table 3-14, our study presents the percentage of skilled and unskilled tappers by household head according to types of rubber farms. This was a self-assessment of their tapping skill. Totally, 68.6% of the owners had tapping skill and 31.4% did not. It was not surprising that the percentage of skilled-tappers was higher than unskilled tappers for each farm type. This was because the owners had long experience on plantations and had learned how to measure skilled tappers. In most cases, low tapping skill was observed in large family farm enterprises and patron farms who worked as farm managers.

Table 3-15 The distribution of very small farms according to tapping skill and share-tapping contracts

Source of hired tapper	60:40		55:45		50:50	
	Un-skilled	Skilled	Un-skilled	Skilled	Un-skilled	Skilled
Number of farms	2	12	5	12	9	16
Percentage of farms in each category (%)	14.3	85.7	29.4	70.6	36.0	64.0
Number of plots	4	17	7	14	12	21
Percentage of plots in each category (%)	19.0	81.0	33.3	66.7	36.4	63.6
Number of tappers	2.0	2.8	2.0	2.3	2.3	2.0
Off-farm land with share-tapping (rai)	13.75	21.6	12.6	15.4	11.6	12.5

In Table 3-15 our study proposes to understand the relationship between tapping skill and off-farm with share-tapping. This was a self-evaluation of the tapper's skill, which might vary depending on farm characteristics and references compared with other share-tappers. Our data indicates that skilled tappers dominated in each type of contract. The proportion of skilled tappers under 60:40 share-tapping was higher than with 55:45 and 50:50 share-tapping. As with the analyses of remuneration to hired tappers in Table 3-10, the contract conditions of 60:40 sharetapping shows a double size of tapping and higher yield compared to that of 55:45 and 50:50. These resulted in highly remunerative hired tappers in the favorable 60:40 sharetapping plan. This could explain why skilled laborers preferred to deal with 60:40 sharetapping. This also reflects the tight supply of skilled tappers, and their selection may consider other factors. In brief, tapping skill is primarily a tapper's attribution for dealing with share-tapping contracts. The proportion of unskilled tappers is concerned with the impact of other factors to be considered in their selection.

5) Biophysical conditions of rubber trees and topography

Biophysical conditions and plantation topography are important factors when determining share-tapping arrangements and the selection of tappers. Here, biophysical conditions of the plantation are related to clones, age, tree physiology, plant location, and yield, which has a considerable bearing on the rubber tree. Once the tapping has begun, the biophysical conditions of the plantation strongly influence the potential yield and productivity over its productive years. On average, a low yield was observed in the initial tapping years from 1-3 years. The yield increased during the tapping years from 4-12 years. The yield slightly declined during the tapping years from 13-24 years, corresponding to tapping the renewed bark. After that, the high tapping panels of virgin bark were applied, which might be undertaken for 25-35 years before re-planting. This period had the lowest yield (Webster & Baulkwill, 1989; RRIT, 2010).

Table 3-16 The share-tapping arrangement changes regarding yield and tapping years

Year of plantation	Tapping year	Tapping panel	The average yield (kg/rai)*	Share-tapping (owner:tapper)
1-6	-	-	-	-
7-9	1-3	1st virgin bark	220	50:50
10-18	4-12	1st and 2nd virgin bark	320	60:40 or 55:45
19-28	13-22	3th and 4th renewed bark	280	60:40 or 55:45
29-38	23-34	Upper panels virgin bark	180	50:50

Remark: the average yield in each period was calculated from the survey data of 393 samples in 2011
Tapping system is 2S d/2, 2S 2d/3

Rubber presented increasing yields during the first and second virgin barks and then diminishing yields, however, the fast or low diminishing yields would depend on the types of clones and the level of farm maintenance. Table 3-16 shows the relationship between tapping

years, the average yield, and share-tapping. Share-tapping had been arranged according to changes of biophysical conditions on the plantation; with this, yield and location were important factors in determining share-tapping arrangements.

Our data reveals that 50:50 share-tapping was generally applied during the first tapping year or the period of the first virgin panel. This was because of low yield and the rubber trees needed to be tapped by highly skilled tappers to maximize yield potential. If the first panel could get good renewable bark, the productivity would be high in the repeat tap and this would extend its productive years. However, if high yield and large size of tapping area were the case, 55:45 or 60:40 share-tapping might be applied. These two systems may continue during the 4-12 tapping years in order to recognize increasing yields. It seems that the rubber trees generate maximimum yield in this period, consistent with the optimal maturity of rubber trees. The first and second virgin barks will be completely tapped in this period. In the third period, there is tapping of the renewed bark. The regeneration of bark would have enough thickness to allow tapping for 6-7 years (Webster & Baulkwill, 1989). 60:40 or 55:45 share-tapping would mostly be maintained. However, some farms might change from 60:40 to 55:45 share-tapping if the yield declined highly or if there was much difficulty in tapping the renewed bark. In the last stage before re-planting, yield was the lowest and rubber might be tapped with high frequency or stimulation. Tappers then are usually faced with upper tapped panels, hard work, increased working time, and tend to suffer fatigue. 50:50 share-tapping will usually be applied until the year of re-planting. In some cases, if gas stimulation or ethephon stimulation was applied, and therefore the yield was higher than average, 60:40 share-tapping would be maintained, or 70:30 share-tapping would be applied. In addition, many tappers who were un-skilled or low skilled would be employed in most of these cases.

This study found that topography and the location of the plantation also had an influence on the selection of tappers and contract arrangements. Southern region topography varies, ranging from coastal areas, basin areas, hilly land, uplands, and mountains. Rubber plantations are located across these regions, from basin areas closer to the mountainous areas, and are intensively planted in hilly land and upland areas. Based on our perception of the farms, the topography where plantations are located can be classified into three locations, namely; plains areas, rolling hill areas, and mountains. Share-tapping arrangements are also selected with regards to topography, distance, and location. Our interviews revealed that 50:50 and 55:45 share-tapping tended to be applied to farms located in rolling hill areas to mountains, which presents hard working conditions. Tappers certainly faced difficult tasks, high transportation costs, poor working conditions, living in remote areas, etc. Material allowances and living material provisions may be offered in order to increase working incentive. 60:40 share-tapping tended to be applied to farms in the plains areas and rolling hill areas, which present much easier working conditions, low working costs, and proximity to villages. Moreover, outside villages and

overseas tappers often were employed by plantations located in remote and mountain zones, which were highly undesirable to local tappers.

6) Monitoring and supervision

Monitoring and supervision are managerial functions that enable farm control and evaluation. Monitoring is generally used to cope with and prevent uncertainty, risks, shrinking and tappers' variances. Supervision is an attempt toward improving skill and working effort, and maintaining quality as per the owner's expectations. The frequency of monitoring and supervision may vary, from every tapping-day to none, or without any direct monitoring and supervision. Monitoring and supervision are costly to the rubber owners. Intensive supervision and monitoring are observed by large family farm enterprises and medium family farm enterprises. It seems that the higher the frequency of supervision and monitoring is, the higher the productivity and more efficient the contracts will be. Our analysis revealed that control and evaluation functions were essential subjects for monitoring and supervision, and were comprised of the following:

(1) Level of exploitation and tapping skill; this evaluation focused on tapping-skill, bark consumption, and their consistencies. Because uncertainty and skill variations frequently occurred, tappers needed to be supervised in order to improve tapping skill and to keep a check on bark consumption according to the owner's expectation. In fact, farm enterprises usually marked dot paint on the renewed bark at the tap at monthly intervals, or would mark the expected bark consumption for six-month periods. The evaluations were for automatically checking the number of tapping-days, level of bark depth, and consistency of skill.

(2) To verify quantity of the product and scrap rubber; owners frequently visited plots in order to check the quantity of the main product and scrap rubber at daily and monthly intervals to compare with past experience and with other farms in the same area. In the case of fresh latex, the weight of latex and dry rubber content (%DRC) were recorded by marketing agents (middlemen, group marketing, or cooperatives) while the number and weight of rubber sheets were recorded by the rubber owner or share-tapper. These records were useful to check and to verify the level of production, tapping days and share-outputs.

(3) To evaluate biophysical conditions of the plantation; the attention here was concentrated on the evaluation of tree physiology and requirements of fertilizer and weed control. These tasks were performed monthly or annually. These were to ensure potential yield and to have sufficient farm maintenance.

(4) Informal talk with share-tappers and people in the village; as in the previous discussion, everyone knew and was observed by everyone else. Working effort, farm practices, indiviaul behavior, and social behavior were all observed by people in the village. Owners could assess through informal talks and interviews with such persons about share-tappers, marketing men, the neighborhood, and other owners. Kinship and social networks often helped to monitor uncertainty, production variations, farm performance, working effort, shrinking, and disputes.

The results made unobservable behaviors and unpleasant tasks able to be monitored and assessed. Owners might support credit or some other allowance if the hired tappers required. According to common strategies, relying on farm visits and informal talks with people in the villages, owners often walked around the plantation so that they could assess the average level of rubber exploitation, bark consumption, skill, and tree physiology. Sales records and informal talk markedly informed them about tapping-days, quantity of production, scrap, price, and weather compared with other farms. Their observations of cheating and disputed behaviors initially came from selling records and informal talk.

Table 3-17 The distribution, frequency and cost of monitoring and supervision, according to the types of rubber owners

Monitoring and supervision	Large family farm enterprises		Medium family farm enterprises		Patron farms	
	Frequency (time)	Cost (baht/yr)	Frequency (time)	Cost (baht/yr)	Frequency (time)	Cost (baht/yr)
Kinships	12.0	600.0	69.6	3391.3	81.5	4236.4
Local village	62.3	3114.0	130.6	5212.3	99.3	4677.3
Other provinces in southern regions	100.0	5000.0	-	-	130.3	4500.0
Total	64.8 (150*)	3240.3	100.1	4301.7	88.5	4462.0

Remark: the survey data in 2011: cost of monitoring and supervision per time and frequency, by self-estimation of respondent; cost of monitoring and supervision = frequency x (cost of transportation + opportunity cost); opportunity cost = calculated from official wages of 246 baht per day in Songkla, 241 baht per day in Pattalung

Table 3-17 shows that the lowest amount of monitoring and supervision was observed in large family enterprises because these tasks had been delegated to farm managers which had been their functions every tapping day for about 150.0 days per year. It was the farm manager's responsibility, production had to be checked for the total weight of latex, %DRC, and scrap on every tapping day. Skill and bark consumption had to be monitored and supervised monthly. The frequency of monitoring was high on medium family farm enterprises due to their working on-farm, therefore they could visit the farm very day if they wanted. With regards to sources of share-tappers, farms dealing with kinships had lower frequent monitoring and supervision costs than with laborers from local villages and other provinces. This was true for each type of farm.

In Table 3-18 farms relying on 60:40 share-tapping show that the average frequency and cost of monitoring and supervision was higher than for 55:45 and 50:50 share-tapping. Our respondents stated that 70:30 share-tapping had the highest frequency and cost of monitoring and supervision. This implies that the higher the output sharing to the owner was, the higher the cost and frequency of monitoring and supervision would be. Table 3-18 also shows that when 50:50 share-tapping was adopted with different sources of tappers, the average frequency and cost of monitoring and supervision was lower than those with 55:45 and 60:40 share-tapping. It seems

that farms adopting 50:50 share-tapping could induce good working effort and self-supervision more than each of the others. Thus, monitoring and supervision costs were low.

Our interviews revealed that absence or very low monitoring and supervision was observed on farms dealing with share-tapping with kinships, relatives, friends and share-tappers with long-term employment. In these cases, total quantity, share-income, input requirements, and costs on the plantation were often reported monthly to rubber owners. It is likely that share-tappers worked with temporary rights to manage production. These share-tappers had attributes of self-enforcement, self-supervision, and high working effort for responsibility of all tasks on the plantation. Owners then gained efficient contracts with much less cost.

Table 3-18 The distribution, frequency and cost of monitoring and supervision according to share-tapping contracts

Monitoring and supervision	60:40		55:45		50:50	
	Frequency (time)	Cost (baht/yr)	Frequency (time)	Cost (baht/yr)	Frequency (time)	Cost (baht/yr)
Kinships	113.2	5661.5	53.0	2450.0	57.0	2992.0
Local village	115.4	4867.9	105.5	5275.0	31.1	1392.9
Other provinces in southern regions	127.5	6375.0	-	-	53.4	2671.4
Total	115.8	5165.1	88.0	4333.3	48.6	2456.5

Remark: survey data in 2011: cost of monitoring and supervision per time and frequency, by self-estimation of respondent; cost of monitoring and supervision = frequency x (cost of transportation + opportunity cost); opportunity cost = calculated from official wages of 246 baht per day in Songkla, 241 baht per day in Pattalung

Furthermore, our respondents argued that monitoring and supervision varied depending on location, distance between the owner's house and plantation, and social ties. Farms in remote areas also had a tendency to increase the frequency and cost of monitoring and supervision. Owners and share-tappers who were living in the same areas or closer to neighbors could visit the plantation and meet with share-tappers every day if it was within walking distance or a half-hour by motorcycle, if they needed to. In sum. the higher the output sharing was to the owner, the higher the cost would be to monitor and supervise. Higher labor relations tended to decrease the cost of monitoring and supervision.

7) Risk sharing rules: production and price

Rubber owners face various risks on rubber plantations, such as variation of yield, price fluctuations, increases of cost, and variations of weather. These risks can be reduced or compensated for by risk sharing. The goal of risk sharing is to reduce the total amount of loss from uncertainty and variation. Here, risk can be classified into two groups, namely: 1) production risks and 2) price risks.

First, production risks are related to high variability of yield, the uncertainty of production, and the uncertainty of the weather. Yield will be diminished and vary depending on technological use, topography, and farm maintenance. Disease may also decrease production, and tree losses will have effects on uncertainty in the amount of production in each productive year. Weather and climate are also uncertainty variables, with unpredictability that strongly determines the total tapping days and annual production. Our analysis found that share-tapping contracts had arranged proportions of output and cost sharing in order to cope with production risks. Small holdings were usually more exposed to high yield variability than large farms. Thus, 50:50 share-tapping was mostly performed with relatively low yields, while 60:40 share-tapping was applied to higher yields. Owners and share-tappers perceived that variabilities in production were consequently reasonable, so would deal with share-tapping and further change output sharing accordingly.

Second, price risks refer to the uncertainty and fluctuation of price in the input and output. Rubber price fluctuates greatly in response to the supply and demand of rubber on the world market (see Annex B). High price fluctuation or volatility has been observed throughout the history of rubber's economy. This has resulted in fluctuations of income generation and levels of income. It was observed that price variability was higher than the yield variability, and we concluded that all farmers were more exposed to price risks than to production risks. For instance, all farms were faced with low rubber prices during 1990-2002 and then there was a price boom during 2003-2011. Some farms relying on 50:50 share-tapping had then changed their output sharing to 55:45 share-tapping. This implies that output sharing to hired tappers decreased, but monetary value (total share-income) increased in response to the high price. In parallel, all farms were more exposed to the rising cost of production, especially the price of fertilizer and weeding, which has increased since 2003. 55:45 and 60:40 share-tapping has been used to cope with the high price risks of input; as well, cost sharing was applied. It seems that share-tapping arrangements could cope with the price risks and consequences of risks to act for the benefit of each party.

8) Tapping and production management

Our data reveals that the rubber owners have a right and obligation to decide and regulate production sets and execute contracts accordingly. Jobs and hired tappers' acts regarding tapping, collecting, transportation, sheeting and sales are fixed. For instance, the tapping system is selected by the rubber owner. A pause in tapping day is acceptable in case of rain, and other pauses should be justified to the rubber owner as soon as possible. Any change of the tapping system can be cause for dispute. In fact, the tapping system varies depending on clones, age of the trees, tapping technology, weather, biophysical condition of the trees, the needs of income, etc. Tapping systems of S/3 d2 or S/3 2d3 were popularly used by family farm enterprises and patron farms. Working times also may be fixed if it would be easier for production control, output processing and sales. Generally, tapping activities will be finished in the early morning.

Fresh latex is collected one or two hour later. The collecting of latex should be started after stopping the flow of latex because the losses of product will be low. The minimum of total scrap per day indicates the appropriate time for collecting latex. In the case of selling latex, bulk latex or "Kea-Lhon" is transported to marketing places by share-tappers, farm managers or middlemen.

The marketing place is fixed by the rubber owners. Marketing channels for latex selling in the study area are comprised of local middlemen, large middlemen, farm groups, and cooperatives in which the selection depends on price, credit, and relationships between owners and marketing agents. Large middlemen and cooperatives are the dominant marketing channels for selling the product of medium and large family farm enterprises. When bulk latex is brought to the marketing place, the total weight and dry rubber content (DRC) are measured to calculate the total dry rubber and total gross sales at the daily price. All data are recorded on a bill or selling record for both the share-tappers and the owners.

Wage payments can be made in three ways. First, the share-tapper receives only his/her income sharing and selling record from a middlemen. The rubber owner will get his income sharing and selling records every two days, three days, once per week, or very two weeks. Our study observed that marketing agents contributed an important role in managing income sharings and also monitoring the farming functions and performance of share-tappers, which reflected high trust and honesty between the rubber owners and marketing agents. Only a bill or selling record could confirm the total dry rubber, fresh latex weight, price, and the gross sale on tapping day. This system was commonly applied to conduct contractual arrangements in remote areas and by patron farms. Second, wage payments are managed by share-tappers. Share-tappers have the responsibility to keep and manage income sharing and selling records for the rubber owner every two or three days, weekly, or monthly. The selection and conduct of wage payments are solely based on kinship, trust and honesty between the rubber owner and share-tapper. Lastly, the rubber owners have the responsibility to manage sales, income sharing, selling records and wage payments as a whole. Share-tappers received selling records that presented latex weight, %DRC, price and wage (share-income), which were deposited into the bank account of the rubber owner every week, two weeks, or monthly. Bank deposits were applied that would be modern and convenient in order to manage wage payment and transaction security, according to expansions of the modern financial system. This wage payment system is currently selected by family farm enterprises. In case the latex is transformed into rubber sheets, the rubber sheet was usually stored in a sheeting room or the owner's house, which made it easy to verify the number of rubber sheets and total weight. Rubber sheets are usaully sold at local markets or a central rubber market every week or twice a month. The rubber owners are responsible for managing the selling of sheets and wage payments.

9) Social institutions

Social institutions have the power to mold and standardize the pattern of rule-governed habits of thought, decisions, behavior and collective actions in consistent ways. As proposed by Turner (1997), social institutions are complex and integrated sets of rules, norms, culture, convention, and value systems lodged in particular types of social structures and organizing relatively stable patterns of human activity with respect to fundamental problems in producing life-sustaining resources, in reproducing individuals, and in sustaining viable societal structures within a given environment. In this study, our study emphasized determinants and how they affected the arrangements and conduct of share-tapping. Social institutions are 1) religious belief and prestige, 2) kinship networks and labor institutions, and 3) legitimacy processes.

Firstly, the principle of karma based on Buddhism plays an important role in Thai society and enriches their lives in all aspects. The belief that life does not begin with birth and end with death, but life links to a chain of lives, means that what persons have done in their existing life would have affects in their next life. This means that everything you do in this life will affect your next life. Buddhism belief has affects on the lives and activities of people to do everything carefully, because people don't want their next lives to be affected by what they have done in their present life. Concerning belief in an after-life, people believe that prestige and love brings happiness and wealth, while selfishness will result in suffering and poverty in the next live, so people have to do well and be responsible for their own lives. It means that the next life is determined by the present through our thoughts and actions. People have duties to accumulate good karma and avoid bad karma, so that their next lives will be good. If one wants to be powerful and have the potential to become rich, one must be in full agreement with high moral standard values, prestige, and a manner of life closer to religious principles. Wealth should be shared, especially to the poor, characterizing generosity and prestige. The amount of sharing of land or labor and the willingness to share cooperative labor is measured by the level of generosity, as our respondents said, "a very rich man should be very generous". Large farms are from rich families, or "Tao-kea; เถ้าแก่", who must have great prestige through crop sharing or share-tapping to poor families. This is not only a way to have happiness and wealth for their next lives, but also a way to earn honor and high social status and be rewarded for their good deeds.

In turn, religious belief and prestige have influenced share-tappers to induce them and act with moral obligation and good attitude in order to repay these kindnesses in particular ways. Gratitude is what is gained in repayment for that kindness. When laborers have deals for cropsharing or share-tapping, the principle of karma also dictates what they should or should not do. Respondents stated that a view of "treating the rubber owner as he did" is a common proposal governing the system of behavioral and arrangement patterns of share-tapping. Moreover, laborers would sometimes offer free labor according to the gratitude and appreciation of that owner's kindness, and then realize the honor of a higher social status themselves. Thus, patterns of behavior and actions in share-tapping arrangements are governed somewhat by the

principle of karma. Religious belief plays a dominant role in shaping economic behavior with less concern for maximizing profit and more for reducing capitalism's less savory ethic. Secondly, the roles kinship, social networks and embedment of labor institutions play have already been discussed in the previous section (3).

Third, this study postulates that share-tapping contracts could be considered legitimate institutions that structure tapping employment in the rubber economy. Share-tapping arrangements are grounded on social beliefs about what is the right thing to do. The notion of legitimizing the explanation, as proposed by Mahoney (2000), is applied. Institutional reproduction occurs because people believe and view institutions as legitimate, and they therefore voluntarily use and reproduce them. Legitimizing the explanation assumes that the decisions of people are derived from their self-understanding about what is the right thing to do. Since the institution is selected, the institution would be reinforced through a process of increasing the legitimacy that was marked by a positive feedback loop, in which an initial precedent about what was appropriate forms a basis for making future decisions about what is appropriate. Thus, institutions set a standard for legitimacy and reproduce it because it is seen as legitimate, and the reproduction of the institution reinforces its legitimacy (Mahoney, 2000). Our analyses found that share-tapping contracts and wage contracts have been available, but only share-tapping contracts were reproduced to endure contracts in the rubber economy. It seems that the legitimacy of share-tapping contracts have occurred since the introduction of plantations when the farms were faced with labor shortages and new technology. It was associated with the exposure to risks and uncertainties in production and price during the productive years. These reasons were legitimate enough to pay wages with output sharing and reproduce enduring labor contracts as a result of the positive feedback realized by increasing the legitimate process. There was a legitimacy of institutions that was derived from belief and self-understanding about what were the roles played by owners and tappers, which practices and responsibilities were oriented by which party, and how contracts were conducted for their mutual benefit and fairness. There was institutionalization of share-tapping, creating a rule-governed system of what were appropriate contracts to be adopted in accordance with certain circumstances.

10) Contract negotiations

This study found that once owners and tappers agreed to discuss a share-tapping agreement, the negotiation was carried on by each party, regarding their expected benefits and costs. The parties (owners and candidate laborers) usually had a clear idea of what benefit or cost he wanted and to what extent, out of which had come comparable agreements with each other in the village. Negotiated proposals and counter-proposals could entail low cost sharing, fewer duties for farm maintenance, and return of scrap rubber; as well, farm practices with details such as working times and payment systems could be negotiated. Respondents argued that negotiation was not needed because agreements were governed by local institutions. Our data found that a small percentage of farms had experienced negotiations, mostly by patron farms, and the highest

bargaining power of negotiation belonged to large and medium family farm enterprises. On the other hand, negotiation tended to increase on farms with old trees, small tapping sizes, highly exploited panels, low yield, or were located in remote areas. To recognize high bargaining power with the rubber owners, share-tappers should carefully negotiate and avoid making any unpleasant statements on his efforts, expectations and reputation. Accordingly, it has been observed that 50:50 share-tapping was a better ratio than 55:45, 60:40, and 70:30.

3.6 Duration of Contracts and Risk Averse Actors in Share-Tapping

Our data reveals that share-tapping contracts are often valid for as long as the parties need it. Contract duration will vary from a few years to the year of replanting (over 25 years). Generally, the owner might inform them with their right of cancellation, default causes, and date to invalidate in advance, but some contracts were imminently terminated without any information. This study found that invalidation of the contracts had been either by default of the owner or the tapper. The first examples correspond to default by the rubber owners. Various reasons are inlvoved for terminating a contract. The main causes are lack of obligations, shrinking, cheating, and disputing. Many owners argued that if share-tappers were guilty of fraud, disobeyed reasonable supervision, and had been habitually neglectful of duties in production, they would need to have close monitoring and supervision. Invalidation might consequently happen in the following year if improvement was not observed. Obviously, cheating would invalidate a contract immediately. Our data revealed that most terminations occurred in the period of re-planting. As such, the rubber owners might help them find new share-tapping contracts or deal contracts with new plots. In a few cases, termination was considered to have causes of default by the rubber owners. It was usually either because the owner needed to change types of share-tappers, or he might have a new deal of contracts that would earn more benefits compared to the existing contract.

The second examples correspond to default by share-tappers. Share-tappers could default the existing contract due to low share-income or high cost sharing, compared with a new contract that they were dealing with. The offer of better conditions and terms mostly led to default of the existing contract. Another cause to default involed low numbers of available laborers and declining tapper attributes, such as work fatigue, old age and declined working capability. When a default was being considered, share-tappers must inform the owner of the date and causes, at least before the season of leaf-fall. Consequently, owners could review their contract and find a new deal for the share-tapper accordingly. Unfortunately, many contracts were terminated due to personal conflicts, some more serious than others. This stems from behavioral and relationship problems between the owners and share-tappers, in which they have different perspectives in the social realm and economics. The conflict would make it difficult to maintain a share-tapping contract.

Table 3-19 shows the duration of contracts from the beginning year to the present. The average working year was similar for the three types of farms. More than half of the plots in each type of farm had a contract duration longer than 10 years. 18.8% of total plots had contracts over 20 years, indictating the parties had been contracted since the first tapping panel.

Table 3-19 The distribution of working years in each plot according to the types of rubber owners

Working period (year)	Large family farm enterprises		Medium family farm enterprises		Patron farm	
	Nb	%	Nb	%	Nb	%
Less than 1.0	-	-	-	-	-	-
1.0-4.9	-	-	9	19.1	20	20.8
5.0-9.9	8	22.9	4	8.5	17	17.7
10.0-14.9	17	48.6	10	21.3	21	21.9
15.0-19.9	7	20.0	14	29.8	23	24.0
≥ 20.0	3	8.6	10	21.3	15	15.6
Mean	14.9		14.5		13.1	
Max, Min, S.D.	30.0, 7.0, 5.9		30.0, 2.0, 7.4		35.0, 2.0, 7.6	

Table 3-20 shows the distribution of working years according to share-tapping contracts. The average was longer than 10 years in each type of share-tapping. Our respondents stated that they would like to maintain the longest contract as possible. Working for over 20 years obviously highlighted long-term employment and working relationships between the rubber owners and share-tappers. Accordingly, the respondents argued that if share-tappers had a frequent turn over, the adverse effects would be low yield, high bark consumption, high cost and reduced productive years. Therefore, the parties (owner and share-tapper) would do better to deal with a long-term contract, resulting in longer working years and the lowest termination of contracts.

Table 3-20 The distribution of working years according to share-tapping contracts

Working period (year)	60:40		55:45		50:50	
	Nb	%	Nb	%	Nb	%
Less than 1.0	-	-	-	-	-	-
1.0-4.9	8	14.3	6	20.0	7	15.2
5.0-9.9	10	17.9	7	23.3	10	21.7
10.0-14.9	15	26.8	8	26.7	13	28.3
15.0-19.9	14	25.0	6	20.0	8	17.4
≥ 20.0	9	16.1	3	10.0	8	17.4
Mean	13.8		12.4		13.8	
Max, Min, S.D.	35.0, 2.0, 7.01		30.0, 2.0, 7.4		33.0, 2.0, 7.5	

Risk averse actors

Our analyses found that risk averse actors were identified that could lead to invalid contracts. Risk averse actors originated from both the rubber owners and share-tappers. It is assumed that the rubber owners and share-tappers were willing to pay a premium to reduce exposure to risk (Meuwissen et al., 2001). The parties already perceived risk sharing to cope with exposure risks in the future as a form of overall risk management. The first source corresponds to labor variability brought by the share-tapper. These risks were observed through low working effort, shrinking, low self-supervision and a lack of obligation in a manner that may have contributed to yield decline, reduction of productive years, cheating and disputes. Our interviews revealed that share-tappers' risk aversion appeared to be specific risky behaviors and characteristics of the actors (share-tappers). It was easy to prevent risk aversion through closer observation and complete information to gain insignt and assess the apparent risk taking in the share-tapper candidate. The reason for observing share-tapper differences in risk taking is to ensure that contracts deal with share-tappers who have low risk aversion. Laborers who are low risk averse would tend to be characterized by good reputations, skill, specialization and long relationships. If laborers are possiblly risk averse, share-tapping options should be organized to reduce and compensate for those risk aversions. For instance, 70:30 and 65:35 share-tapping appeared to be organized to compensate for those of risk aversion. Monitoring and supervision also tended to increase as well.

A second reason corresponds to risk aversion from the rubber owner. Risk aversion arises due to personality and risky behaviors confronted during contractual arrangements, production orientation, and farm strategy. Risk aversion would tend to be characterized by actions resulting in expectable outcomes of contractual arrangements. This was responding to the fact that share-tapping agreements were organized and might be terminated by the owner without legal responsibility. Respondents argued that share-tappers were exposed to more owner risk aversion than in the past. Large farm enterprises would tend to be more risk averse than rubber owners who are kin, have high social status and relatives in the village. This is a consequence of local institutions and high relationships between the rubber owners and share-tappers.

3.7 A Set of Rules for Explaining Share-Tapping Arrangements

This section intends to identify the set of rules governing observed share-tapping arrangements. This study postulates that a set of rules is established and that a standardized pattern of rule-governed behavior and actions belongs to share-tapping arrangements. A set of rules is a collection of rules, more than one of which are elements of that set. i.e. rule members of that set display a list of rule members and state the property of rule elements in that set, as discussed in section 3.5. The degree to which rules govern patterns of behavior and actions in that set depends on effective enforcement. Three sources of rule enforcement were identified. The first level is a self-imposed code of conduct which is strongly related with belief, ethics,

personal characteristics, farm objectives, capability, economic behaviors, and personal standards including resources and physical attributes. The second is one which is imposed by human interrelations and relationships with each other, such as kinships, relatives and labor relations. The third is by social order, perceptions, value systems, and social institutions. By that set, the degrees of rule enforcement associated with rule interrelations are coherent for behavior, action and relationships between the rubber owners and share-tappers in each type of contractual arrangement, which is more meaningful if the rules are called "*coherent rules"*. Coherent rules could be extended to show how a set of rules works and how coherent behavior and actions are unified and featured.

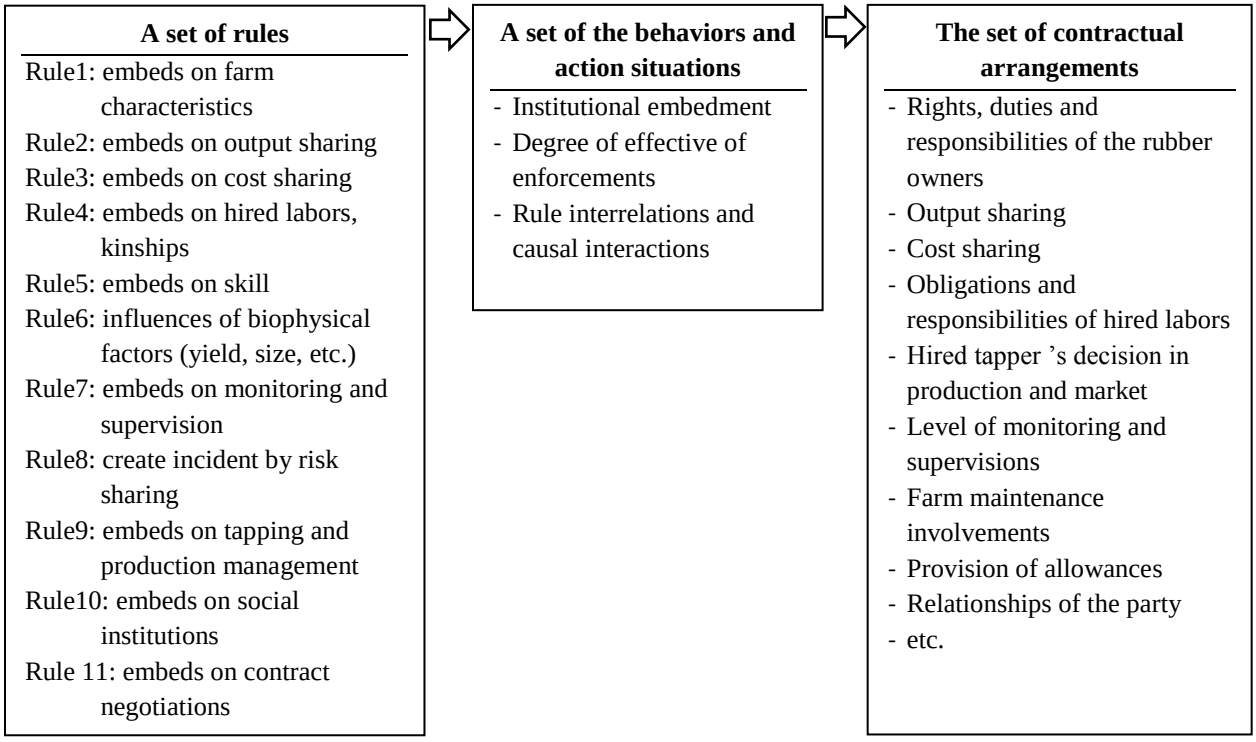

Figure 3-3 Simple model of a set of rules for explaining a set of behaviors and action situations, and the set of contractual arrangements.

Our study revealed that five sets of rules were identified; 70:30, 65:35, 60:40, 55:45, and 50:50. Each of these share-tapping arrangements specified a set of rules. Output sharing and cost sharing are principal rules, and rules produced by other factors (section 3.5) are elements of that set and hence could identify the boundary and scope among the sets of rules. A given principal rule combined with following rule members formed a set of rules which governed and constrained behavior and action in a consistent way. A set of rules coherently produces the set of behaviors and actions pursuing contractual arrangements. The difference between repeated behaviors and a way of actions is determined by the degree to which a set of rules are embedded

and constrained coherently. Changes in any of the rule members in which the degree of effective enforcement will enforce or decline, may cause it to form new behaviors and action situations in such a way. This study reveals that a set of rules expresses resilience and flexibility to which contextual differences can expose shock, risk and uncertainty. This is because a given set of rules is not only embedded within the behaviors and activities of humans, but also constrained and molded by them. Once share-tapping is established, a given set of rules embeds and constrains to form a set of behaviors and action situations for the parties (owners and share-tappers), and hence produces the observations of contractual arrangements, as in Figure 3-3. Thus, each contractual arrangement depends on a set of the rules that are embedded.

For instance, a set of rules governing 50:50 share-tapping can be interpreted such that the contractual arrangement relies on economic partnerships regarding the embedment of member rules derived from high remuneration (50% of output sharing), cost sharing, kinships, skill, social institutions and relationships between the rubber owner and share-tappers. Consequently, the parties (owners and hired tappers) agree to execute contracts based on a system of trust and confidence, kinships, and recognition of high remuneration. Hired laborers might participate by designing and regulating the mode and manner of jobs to be done, and then the obligations and responsibilities of production would mostly be delegated to the hired tappers. Hired-laborers would express proper behaviors and actions, presenting working efforts, self-supervision, and less shrinking, which would contribute to improved productivity, low production costs and efficient contracts. Thus, 50:50 share-tapping entrusts the hired tapper to execute the contractual arrangement. 55:45 share-tapping is also a closely arranged contract, the same as 50:50 share-tapping. As well, when the rubber trees had low yield and high exploitation, the rules would generate accordingly, to which it was reasonable to apply 50:50 share-tapping to compensate for hard working conditions and a reduction of remuneration.

60:40 share-tapping is a set of rules that governs the way farms execute share-tapping contracts and how farms will operate. Coherent rules are derived by a farm business orientation and the attention to profitability, and provide strong enforcement to execute contractual arrangements based on employee and worker contracts. Jobs, working conditions and the number of hired laborers are designed and regulated by the rubber owners. Contractual arrangements carried out by frequent monitoring and supervision, intensive control and modern farm management, would thereby take in both increasing profitability with lower labor costs by coping with risk aversion, redundancy, shrinking, and disputes. Also, hired laborers should adapt their behavior and actions to comply with contracts and production orientation. They should also keep some account of their social relationships in order to keep up the owner's satisfaction and their long-term employment. Compared with 50:50 share-tapping, output sharing rules and cost sharing rules (i.e. the absence of cost sharing by hired laborers) are strong when enforced, thereby the rubber owners play important roles in order to execute contracts pursuing profitability and low labor costs. It is likely that social institutions, kinships and labor institutions

are too weak to stimulate enforcement in that set of rules. Thus, the set of rules coherently enforces productivity, profitability and attention of business pursuits. These executions of contracts similarly are observed by 70:30 and 65:35 share-tapping, even though output sharing and the details presented by the agreements might be different.

In order to understand the choices of share-tapping and how rules are embedded in the choice, this study reveals that the general rule was that economic agents (the rubber owners and hired-tappers) would always choose the highest output sharing and the lowest cost sharing. There was utility maximization under constraints; the economic agents acted to maximize their profits and compensated with constraints. Generally, economic agents face two kinds of constraints. The first is the labor constraint, which is the exploitation of laborers in adequately productive rubber areas. Another constraint is specified by production sets that are the means of production, use of technology, and the effects of biophysical conditions (yield, size, age, etc.). Furthermore, this study revealed that the economic agents were also faced with constraints by institutions and institutional embedment. It is assumed that if the economic agent sought to identify and select a profitable mode of production, the economic agent would choose the most profitable contractual arrangement plan from the available options. Therefore, the rubber owners would choose share-tapping agreements of 60:40, 55:45 and 50:50, respectively. The selection of 50:50 could be described by the economic agents concern that the constraints and institutional embedment determined the maximum profits. This choice would ensure the uniqueness of the optimal production plan, with regards to a satisfactory level of earnings and labor exploitation.

3.8 Contractual Arrangements of Share-Tapping

It can be observed in Table 3-21 that each system of share-tapping shows different sets of contractual arrangements with due emphasis on output sharing, cost sharing, rights and obligations in production and marketing, level of monitoring and supervision, farm maintenance, and provisions for allowances. Five share-tapping agreements show that complex arrangements of share-tapping involve labor relationships, obligations and responsibilities in production and marketing, and farm maintenance involvements, which would delegate to whom and how to conduct them. Often the hired-laborers performed all of the tasks of production, i.e. main tasks are tapping, latex collection, transportation, sheeting rubber (if it is selected) and sales.

Contractual arrangements that relied on 60:40, 65:35, and 70:30 were similar in many aspects, particularly with regards to the roles played by rubber owners to execute contracts and farm strategy that were being pursued for either increasing profitability or coping with averse behaviors (shrinking, cheating and less working effort).

Table 3-21 Contractual arrangements according to main types of share-tapping

Types of share-tapping	70:30	65:35	60:40	55:45	50:50
Relations between owner and tapper	Employer and Worker	Employer and Worker	Employer and Worker	Economic Partnership	Economic Partnership
Rights and obligations of the owners	- To design the jobs - To decide no. of hired-labors - To regulate mode and manner of work - To decide the working conditions - To pay wages	- To design the jobs - To decide no. of hired-labors - To regulate mode and manner of work - To decide the working conditions - To pay wages	- To design the jobs - To decide no. of hired-labors - To regulate mode and manner of work - To decide the working conditions - To pay wages	- To design the jobs - To decide no. of hired-labors - To regulate mode and manner of work * - To decide the working conditions* - To pay wages**	- To design the jobs - To decide no. of hired-labors - To regulate mode and manner of work * - To decide the working conditions* - To pay wage**
Obligations and responsibility of the hired-tappers	- To perform the jobs as a given job discriptions -Prohibits changing of practices in production	-To perform the jobs as given job discriptions - Prohibits changing of practices in production	-To perform the jobs as given job discriptions - Prohibits changing of practices in production - To report quantity and any practices in production	- Having participation to decide mode and manner of work, and working conditions -To perform the jobs for completion of harvesting activities - To be responsible for proper adjustable production activities in working day	-Having participation to decide mode and manner of work, and working conditions -To perform the jobs for completion of harvesting activities - To be responsible for proper adjustable production activities in working day
Marketing duties and responsibility of the owners	To perform sale of output , bills and wage payment	- Mostly done by the owners - To decide marketing places and to regulate mode for sale, bill and payment system , if it was performed by hired laborers	- Mostly done by the owners - To decide marketing places and to regulate mode for sale, bill and payment system , if it was performed by hired laborers	- To decide marketing places - To regulate a mode for sale of output, bill and payment system	- To decide marketing places - To regulate a mean for sale of output, bill and payment system

Table 3-21 cont.

Types of share-tapping	70:30	65:35	60:40	55:45	50:50
Marketing duties and responsibility of the hired tappers	N/A	To perform sale of output as a given job discription	To perform sale of output as a given job discription	To perform sale of output, bill and wage payment	To perform sale of output, bill and wage payment
Level of monitoring and supervision	Very High	High	High	Moderate-low	Low
Farm maintenance involvement	-Farm maintenance is paid/done by the owners	-Farm maintenance is paid/done by the owners	-Farm maintenance is paid/done by the owners	-Farm maintenance is done either by the owners or shared in proportion by the hired-laborers	-Farm maintenance is shared equally or shared in proportion
Provisions of allowances	Providing a proportion of allowances	Mostly providing some allowances	Mostly providing some allowances	Absence	Absence

Remarks:

* Hired tappers may participate in order to decide the mode and manner of work, and working conditions

** Wage payment may be deligated to others such as middlemen and hired tappers with specific conditions

The rubber owners have a right and obligation to design and regulate jobs for specified production sets, which intend better controls in order to execute contracts to serve the farm business and its related businesses. Table 3-22 shows two sub systems of 60:40 share-tapping. Harvesting tasks were performed by hired laborers, except that daily output was sold by the rubber owners. The first and main sub-system is when the rubber owners pay production costs as a whole. Then there is an absence of cost sharing by the hired tappers. In the second one, costs are shared in a particular proportion of total costs by the rubber owners and the share-tappers. Often, the rubber owners would pay all the costs of material inputs (fertilizer, chemicals and fuel for weed and disease control). Applications of material inputs are done by share-tappers or together. Transportation and sales are often carried out by the rubber owners, which prevents negligence and cheating. Wages are paid by the rubber owners every few days, weekly, or monthly.

Contractual arrangements of 65:35 and 70:30 share-tapping were similar to the first sub-system of 60:40 share-tapping. Farm maintenance was paid for and conducted by the rubber

owners. Recently, 70:30 share-tapping has been applied on the plantations which use stimulation technology or gas stimulation, of which all of the costs were shared equally.

Table 3-22 60:40, 65:35 and 70:30 share-tapping arrangements: types of arrangements and obligations according to the rubber owner and share-tappers

Farm activities / Tasks	1/60:40		2/60:40		65:35		70:30	
	owner	tapper	owner	tapper	owner	tapper	owner	tapper
Harvesting tasks								
-Tapping		X		X		X		X
-Collecting		X		X		X		X
-Transportation		X		X		X		X
-Sheeting rubber		X		X		X		X
-Sales	X			X	X		X	
Farm maintenance								
-Fertilizer costs	X		X		X		X	
-Application of fertilizer	X			X	X		X	
-Weeding costs	X		X		X		X	
-Weeding labor	X			X	X		X	
-Disease and pests	X		X		X		X	
Monitoring and supervision	X		X		X		X	

Where: X = activities or tasks performed by owner/tapper, sheeting rubber is omitted by fresh latex form

Our analysis reveals that contractual arrangements of 50:50 and 55:45 were similar in many aspects. These contracts are normally executed through economic partnerships. The parties agree that the rubber owners shall have the right and obligation to design and regulate the production sets and can also refuse contracts over manners of work that do not contribute to production and performance. In many cases, the rubber owner does nothing to involve the execution of contracts. Jobs and duties in production are considered to be performed by hired laborers. To do this, the participation of hired laborers is high. Typically, the rubber owners agree that the hired-laborers hold temporary ownership of production, which establishes a motive for production performance and further extends the roles of the hired-laborers in order to execute their contracts.

Table 3-23 shows three sub-systems of 50:50 share-tapping arrangements. The main sub-system is when the costs are shared equally. In the second, the costs are shared in a proportion between the rubber owner and share-tappers. The rubber owner will usually pay for fertilizer cost and its application. Weed control would done by the hired-laborers. The third is when all of the costs are paid by the rubber owner. The last two sub-systems are commonly used when the hired tappers are family members, siblings, and grandsons.

Table 3-23 50:50 share-tapping arrangements: types of arrangements and obligations according to the rubber owner and share-tappers

Farm activities / Tasks	1/50:50		2/50:50		3/50:50	
	owner	tapper	owner	tapper	owner	tapper
Harvesting tasks						
-Tapping		X		X		X
-Collecting		X		X		X
-Transportation		X		X		X
-Sheeting rubber		X		X		X
-Sales		X		X		X
Farm maintenance						
-Fertilizer cost	X	X	X		X	
-Application of fertilizer	X	X	X		X	
-Weeding costs	X	X		X	X	
-Weeding labor	X	X		X	X	
-Disease and pests	X	X		X	X	
Monitoring and supervision	X	X	X		X	

Where: X = activities or tasks performed by owner/tapper, sheeting rubber is omitted by fresh latex form

Table 3-24 55:45 share-tapping arrangements: types of arrangements and obligations according to the rubber owner and share-tappers

Farm activities / Tasks	1/55:45		2/55:45	
	owner	tapper	owner	tapper
Harvesting tasks				
-Tapping		X		X
-Collecting		X		X
-Transportation		X		X
-Sheeting rubber		X		X
-Sales		X		X
Farm maintenance				
-Fertilizer costs	X		X	
-Application of fertilizer	X			X
-Weeding costs	X		X	
-Weeding labor	X			X
-Disease and pests	X		X	
Monitoring and supervision	X		X	

Where: X = activities or tasks performed by owner/tapper, sheeting rubber is omitted by fresh latex form

As shown in Table 3-24, 55:45 share-tapping can be grouped into two sub-systems. The main sub-system is when all of the costs are paid by the rubber owners. Respondents stated that an amount of 10% of the output sharing was deducted for the cost of farm maintenance, as a form of cost sharing by all the parties. The second sub-system is when the costs are shared in a

particular proportion by the parties. The costs of material inputs (fertilizer and weeding) are paid for by the rubber owners, while application of material inputs are paid by hired laborers. Sometimes the application of fertilizer was done together. Relying on 50:50 and 55:45 share-tapping, the sale of output is done by the hired laborers. The hired-tappers frequently got their wages from market agents (middlemen or cooperatives) on a working day.

3.9 Wage Contracts Challenging Share-Tapping

This section proposes to explain the introduction of wage contracts and their development, which has allowed us to demonstrate the institutionalization of share-tapping. In response to a price boom, labor mobility has been increasing, especially for laborers who have tapping skills and the capability to work. Wage contracts (paid tappers) were introduced by some rubber owners in 2009 in Ban Kok-Maung and Ban Lo-han. At that time, this study didn't observe the use of wage contracts by large family farm enterprises, but it tended to interest medium farms and patron farms. It is likely that the rubber owners sought the maximum economic return at the lowest labor cost. Paid laborers were employed to tap rubber trees, of which the cost of tapping was about 15-25 baht per rai, depending on the age of trees, location, and exploitation of tapping panels. Two paid laborers could tap about 20 – 35 rai per day. Wages were paid every day or every three days. Paid laborers (workers) are also employed for collecting latex, which costs about 200 baht per day. Family labor may often be engaged to work at collecting tasks and sales outputs together. Data from the 2011 survey estimated that the average share-tapping cost was about 1.0 baht per tree for an average minimum, whereas a wage contract would cost about 0.5 baht per tree. High rubber prices, more available farm laborers and potentially increasing profitability contributed to an expansion of wage contracts into Ban Kao-Phra, Ban Lohan and nearby villages.

Because of a gradual expansion in wage contracts, people raised the question as to what was an appropriate labor contract, and impacts of contract changes when they highlighted social issues that were being discussed. Respondents argued that people came to a turning point, where social values and social networks had declined, which were observed by increased selfishness, and a regression of generosity and kindness. These may be blamed on a breakdown of social relations, social networks and social value systems between the groups of rubber owners and hired laborers in the villages. Social conflicts consequently developed.

Moreover, questions and discussions related to the impact of wage contracts and their practices were increasing. Respondents argued that the level of tapping skill and working effort was low. Oberved variations in skill and capability were high compared to share-tapping. Paid tappers would cause low yields, high exploitation and a reduction of productive years. Indeed, some owners who had experience with paid tappers stated that paid tappers had shown low working effort, a lack of self supervision, uncertainty of work and moral hazard. Paid tappers

would have to tap a maximum number of rubber trees, which caused an increase to be observed in the variation in tapping skill. On the other hand, some rubber owners stated that wage contracts were developed on their plantations due to high returns and low labor costs. They could deal with tappers doing only tapping tasks, and other tasks (latex collecting, transportation and sales) could be done by family laborers or paid laborers. Control and monitoring on the plantation would need to be increased in order to cope with skill variations. One production tactic is when the rubber owner works together, i.e. the owner taps a plot, and a nearby plot is tapped by paid tappers. This study observed that these owners mostly owned farm sizes below 30.0 rai, which enabled them to have close observation within the plantation. Thus, wage contracts could have negative impacts on both agrarian society and production, leading to closely observe and assess the people concerned.

In the second round of fieldwork in 2012, our study found that share-tapping had replaced wage contracts considerably. The rubber owners had changed back to share-tapping again. Respondents argued that they observed several cases of working variations, lack of labor quality and uncertainty, etc. The argument is that paid tappers would tap a maximum number of rubber trees, about two plots per day, which had negative affects on skill and a lack of working quality. Observations were of inconsistent skill, high bark consumption and a trend of diminishing yields. So, this made some people (including some rubber owners) to have a dialogue on what contracts were appropriate and meaningful. Accordingly, as when rubber prices declined in the fourth quarter of 2011 until 2012, price fluctuations with a declining trend can be bad for both the rubber owner and hired tappers. Rubber earnings decreased substantially while the cost of paid tappers (wage contracts) remained high. Respondents stated that if prices declined to below 100 baht per kg, paid labor costs (wage contracts) would be similar to share-tapping and might be a burden during price drops. Importantly, people considered the owner's family, marking selfish or greedy families that the tappers thought might have made for their bad feelings and suffering. They said that life was not only well being of livelihood, but also a wish to have appreciation by people for the happiness of life as well. It is likely that both economic reasons and social order regarding social institutions have influenced wage contracts' decline, and so it has turned back to using share-tapping.

Therefore, it is notable that wage contracts provided evidence to demonstrate the institutionalization of share-tapping contracts and explained why share-tapping contracts were appropriate for rubber production. Share-tapping could be beneficial for economic reasons, social functionality, and legitimacy. In mid 2012, our study found that wage contracts were replaced by share-tapping, consistent with a declining trend of rubber prices. By the point of view of local philosophers, if paid tapping had been widespread enough to replace share-tapping, the social value system would be challenged by capitalism with new forms of labor contracts based on workers and employers. These are expected to bring about de-agrarianization, declines in social values and social relations. These expectable observations seem to be more prevalent

with people in the villages. Therefore, share-tapping institutionalized the lock-in of labor contracts with its arrangements for rubber production, which was proven through the challenge from wage contracts.

3.10 Summary: Analysis of Share-Tapping Arrangements

In this section, our study found that labor availability evolved over the study time. Share-tapping has been employed since the introduction of plantations. A conceptual framework of share-tapping was developed here to explain a set of rules embedded in share-tapping arrangements. Share-tapping contracts are organized by the rubber owner as the contract maker. Share-tappers are considered contract takers which are attributed with unique skills, quality, and availability. Share-tapping can be committed through informal agreements or formal agreements with regards to the economic reasons and institutions in a certain context of circumstances. The general rule is output sharing of 50-70 percent to the rubber owners, and the share-tapper will get less than or equal to 50 percent. Cost sharing varies from 0 to 50 percent of the total variable costs. Institutionalization of share-tapping and its resilience has facilitated the arrangement and conduct of contracts, which results in both gaining economic and social functionality, as well as legitimacy. On average, the farms under 60:40 have high returns to both the rubber owner and per labor for the share-tappers, regarding large tapping sizes and productivity. Because of the high remuneration of share-tapping comparaing to relative wages, share-tapping is the key factor for availability of hired-tappers. This study had no evidence supporting the stopping of tapping rubber due to a shortage of hired-laborers, even though low availability of skilled labor was observed. The use of share-tapping was strongly related to the typology of farm trajectories. Large family farm enterprises and medium family farm enterprises tended to choose 60:40, 55:45 and 50:50, while patron farms relied on 55:45 and 50:50, respectively. Because of the availability of laborers, share-tapping reinforces polarization. Thus, our thypothesis was not fully verified because the share-tapping arrangements have been challenged. Share-tapping is institutionally locked-in due to a combination of economic performance, resilience, adaptation to risk and path dependence, which has reproduced themselves due to a combination of existing individual and behavioral norms related both to the tapping contracts and the values of the cultural environment.

Chapter 4

A Path-Dependent Analysis of Rubber Farm Polarization and Share-tapping in Southern Thailand

The concept of path dependence as elaborated by Mahoney (2000, 2001) and further refined by Vergne & Durand (2010) is used to analyze how policies and government intervention govern the process of rubber development in southern Thailand. Section 4.1 presents the analytical framework of path dependence and then applies it to the transformation of the rubber economy in southern Thailand. Section 4.2 explains the path dependent explanation of farm polarization and share-tapping. Section 4.3 provides a conclusion and summary.

4.1 Analytical Framework of Path Dependence

Mahoney brought new thinking about path dependence when arguing that "path dependence characterizes specifically those historical sequences in which contingent events set into motion institutional patterns or event chains that have deterministic properties. The identification of path dependence therefore involves both tracing a given outcome back to a particular set of historical events, and showing how these events are themselves contingent occurrences that cannot be explained on the basis of prior historical conditions" (Mahoney, 2000:507). More recent works on path dependence discuss the relevance and the usefulness of the concept argued that "path dependence is bound to remain limited if it explains both persistence and its opposite (i.e. novelty)" (Vergne & Durand, 2010: 739). Vergne and Durand proposed a narrower, more operational definition, of path dependence as "a property of a stochastic process which obtains under two conditions (contingency and self-reinforcement) and causes lock-in in the absence of exogenous shock" (Vergne & Durand, 2010: 741). This more specific framework of analysis is applied to provide further understanding about the dynamics of the polarization process which the study highlighted in Chapters 2 and 3. It is hypothesized here that the polarization process of rubber farms in southern Thailand obtained under contingency and self-reinforcement and caused a lock-in which even exogenous shocks or reactive sequences did not modify. In order to apply this framework, this study needs to characterize the five constitutive elements of the path dependence process are the lock-in of outcomes, initial conditions, critical juncture and contingency, institutional setting, and self-reinforcement.

1) Outcome here is defined as "a specific state of persistence called lock-in" (Vergne & Durand, 2010:739). This definition differs from that of Mahoney (2001) for whom outcomes are resolutions of conflict generated by reactions and counter-reaction, as it is a much more operational definition.

In this study, the outcome is the polarization dynamics of rubber farms in southern Thailand, which this study considers as a persistent state of transformation which is characterized by the observed farm trajectories and share-tapping arrangements in the current period.

2) Initial conditions: this stage is about characterizing the antecedent historical conditions. The study needs to understand the broad picture of social and economic development and to identify initial policy selection including their impacts. In this stage, the study highlights historical factors and/or conditions and the available policy options. The broad outcome at this stage determines a range of available policy options to be necessary to chose a particular policy and put the pressure to reform policy. The initial conditions do not play an important (deterministic/explanatory) role related to the outcomes, and that from similar initial conditions other outcomes would have been possible. The influence of initial conditions must be very weak that can be labeled as being path dependent.

3) Contingency and critical juncture leading to the institutional setting. According to Mahoney (2000: 513), "Critical junctures are characterized by the adoption of a particular institutional arrangement from among two or more alternatives" Mahoney called these junctures "critical" because once one arrangement is selected it becomes progressively more difficult to return to the initial point where several alternative arrangements were available. The range of possible outcomes is narrowed after a critical juncture. Critical junctures are often characterized in moments by contingency. Contingencies are unforeseen events where an occurrence is not expected, explained, predicted by theory or is outside of an available theoretical frameworks. The key property of contingency will be treated by an important impact for formation of institutions or choice points on a particular option. In the essay by Vergne and Duran, the notion of critical juncture does not appear but the authors highlight the role of contingent events in path dependence "Path dependency occurs when initial conditions are followed by a series of contingent events whose influence on the path taken is larger than that of the initial conditions" They define contingent events as "Unpredictable, non-purposive, and seemingly random events" (Vergne & Durand, 2010: 755). In order to identify critical junctures and contingent events, the study focuses on events related to external factors, social phenomena, unforeseen events, and actor or collective activities.

4) Institutional setting: this stage is institutional production. Mahoney (2000) stated that "Critical junctures increase the probability that countries will follow particular paths of development. Critical junctures have this effect because they lead to the formation of institutions that tend toward persistence and that cannot be easily transformed" An institutional setting is characterized by the adoption of a particular institutional arrangement from the available institutional options. Institutional settings are contingently institutional formations and the selection of a given institutional arrangement. Once institutions are selected, it is reproduced overtime.

5) Self-reinforcement is defined here as "A set of mechanisms endogenous to a given path that makes it more and more dominant over time relative to alternative paths" (Vergne & Durand, 2010: 755).

Once a critical juncture is established, a contingent event sets the path to a specific institutional arrangement, Mahoney (2000; 2001) argued that other processes then operated in which the social patterns set would reproduce themselves. An important point here that characterizes path dependence is that the initial process of institutional formation (the combination of an initial situation and some contingent events) is different from the process of institutional reproduction (the existence of self-reinforcing sequences). Once institutional formations are contingently selected, the stable institutional reproductions can lead to their self-reinforcements. These reproductive mechanisms may lock in by one of the possible outcomes on the path. In this study, lock-in is characterized by outcomes at the current state.

In this stage, the study identified how the institutional arrangements that have been created due to the occurrence of contingent events operated to reinforce themselves and lead to the "locked-in" outcome. Thereafter, the study concentrated on analyzing institutional reproduction focusing on mechanisms of reproduction and causes of institutional reproduction. The study also proposed to examine implementations, consequences and the relationships within institutions that embed the behavior of actors and collective actions. The study focused on analyzing self-reinforcement and other feedback mechanisms that led to persistence of a given institutional pattern and its institutional lock-in. Moreover, the study paid attention to assess reactive sequences and counter-reactions to institutions. The definition of reactive sequences as Mahoney's notion was applied. Reactive sequences are chains of temporally ordered and causally connected events. When policy makers or collectives have resisted the prevailing institutions, there will be initial forces to create a reactive sequence and counter-reaction. Reactive sequences have been properties of a backlash process that may lead to transformative or reversing outcomes. Thus, more stable final outcomes will be achieved (Mahoney, 2001), but these arguments have not been observed by Vergne and Durand (2010).

Table 4-1 shows that five stages of analytical framework of path dependence were identified. Each stage of analysis presented policies, major events, and their characteristics. In doing this the study began with document analysis based on an historical approach in order to deeply understand the history of rubber development, market, policy, implementation, and the impacts as detailed in Annex A, and then an analytical component framework of path dependence was performed. Initial conditions defined a range of options available to actors at a key choice point (Mahoney, 2001). During the period of critical juncture, the study identified contingent points and thereby analyzed the selection of policy options, characterized by the institutional setting. Once institutions are contingently selected, institutional settings reproduced through mechanism of self-reinforcement endure overtime. These are institutional production and reproduction. The study concluded that an important finding of the significant farm trajectories and share-tapping revealed outcomes of institutional lock-in.

Table 4-1 Stages of change and characteristics of period according to path dependent analysis

Stage of analysis	Policies and major events	Features of path dependence
Initial condition	1900-1933 - Trial rubber plantation policy - Beginning promotion of expansion of new plant - Policy for promoting the settlement of Chinese immigration - Rubber boom in the mid-1910s	Free rubber planting and the rise of market economy - Settlement of Chinese during 1920s – 1930s defining the expansion of new plant and strongly influenced to diffuse rubber to local people - 50:50 share-tapping
Critical juncture/ contingent point	1934-1946 - International Rubber Regulation Agreement (IRRA) during 1934-1946 - Rubber Control Acts: quota of production, new plantings and trade	Rubber Control Act - Contingent events defined by the great expansion of new planting and rubber control Act
Institutional setting	1947-1960 - Establishment of NESDP - Establishment of government agencies involving rubber - Establishment of the replanting scheme - Short price boom 1950-1951	Policy reform - Policy for promoting expansion of new planting and production - The replanting scheme - Given institutional arrangements under the replanting scheme
Self-reinforcement	1961-1990 - Policy for promoting expansion of new plant and production - The replanting scheme	Production and reproduction of institutions - High growth of new planting - Success of the replanting scheme - 60:40 and 55:45 share-tapping
	1991-2000 - Policy for promoting expansion of new planting and production (1982-1996) - Policy to suspend new planting (1997-2001) - The replanting scheme - Marketing policy • Development of rubber market • Price support - Price decline	Institutional reproduction and consolidation of market policy - 70:30 share-tapping
	2001-2010 - Policy for promoting expansion of new planting - The replanting scheme - Marketing policy • Development of rubber market • Price support - Policy for promoting rubber manufacture and industrial rubber products - Rubber boom 2003-2011	Price boom reinforcing institutional reproduction - Expansion of new planting - Structural changes in the market
Outcomes	- Transformation and polarization of the rubber farms	Farm trajectories and share-tapping arrangements during 1990-2010

4.2 Path Dependent Explanation of Farm Polarization and Share-Tapping

4.2.1) Outcomes: the dynamics of farm polarization and share-tapping

The results of this study revealed that farm polarization has continued to develop during the last 20 years and labor contract in rubber production has been locked-in in share-tapping. Two opposite directions of farm changes are identified and assessed as the results of Chapter 2. In summary, the first direction grouped trajectories of farm growth; growth of large family farm enterprises (TR1), growth of medium family farm enterprises (TR2), and toward patron farms (TR3). These farms undergo the growth of structure and farm enterprises, characterized by increment in size and the use of hired labor.

Conversely, the second direction grouped trajectories of farm decline; high structural change of farms (TR4) and declining very small farms (TR6). TR6 are the poorest farms, which has been in a downward farm structure as "small farm getting very small" and the highest adoption of off-farm activity with share-tapping contracts. Financial stress was markedly higher in this trajectory. High structural change of farms (TR4) has been found to characterize the largest decrease in size as "large farms becoming small farms". These farms continued to decline in size, saw a high adoption of off-farm activities and more availability of farm labor to compare with landholding. More than one third of total farms undergo a trajectory of stability, characterized by stable the size and farm labor forces over the study time. Some farms in this trajectory appeared to have the potential to project downward into very small farms. Thus, the polarization process is still at work, progressively reducing the number of the typical family rubber farms which still represent 38% of all farms.

Regarding share-tapping, the analysis revealed that this is the institutional form in which labor contracted in rubber production have been locked-in. Share-tapping provided a means for the exploitation of hired laborers and thereby contributed to polarization. Share-tapping was institutionalized through the productive mechanism of self-reinforcements. Share-tapping has been highly resilient to contracts in response to the changing conditions and new environments. A set of rules has power to order a set of behavior and actions accordance with arrangements of share-tapping. Because of self-reinforcing mechanisms and more resilience, share-tapping is lock-in in labor contracts in rubber production. Thus, outcomes are the observations of farm polarization and share-tapping, presenting institutional lock-in in the current period.

4.2.2) Initial conditions: introduction of rubber plantations

In the late nineteenth century, most of the population in southern Thailand was concentrated on the lowland paddy areas along the east coast, where rice provided the livelihood for home consumption and surplus for cash income. In the inland villages or narrow valleys, populations lived by subsistence production which were self-sufficient and had less importance as a cash income. Rice in favor of shifting cultivation required production above the minimum

subsistence level. Also, they were free for other economic activities such as hunting and forest harvesting for earning cash, if they needed it (Ingram, 1971; Thungwa, 1994; Taanthai, 2002).

In 1896, the need to introduce rubber plantations became apparent when King Rama V saw the difficulty to establish estate plantations regarding capital and new technology. Since 1900, Phraya Ratsadanupradit, who was high commissioner of Monthon Phuket, had established a government project in order to trial a plantation for demonstrating rubber plantation and for promoting rubber cultivation in the villages (Karrakarm, 1985). These were the first government policies involving rubber plantations. By views of local government, there were many reasons why rubber should be promoted. Of primary importance was the fact that the few sources of foreign income had declined due to the low price of chili pepper and low yield in tin mines (Songprasert, 1993). They also pursued a policy to increase market economy instead of a subsistence economy (Stifel, 1973).

In order to introduce rubber, Phraya Ratsadanupradit brought large quantities of seeds from Pinang in 1901. These seeds were planted in a trial plantation that aimed to produce seeds for distribution to farms and would have to demonstrate new rubber plantation. Other seeds were given to each of the local officials in an attempt to introduce rubber in the villages (Karrakarm, 1985). Much of the new planting was believed to have spread from this official promotion program for Thai people (Stifel, 1973). In early 1910, the government firstly encouraged attention of local offices to promote new planting across the southern region. The objective was to increase economic activities in villages and further to reject subsistence economy, but this policy was reluctant to aid massive implementation and lacked coherency among local governments. The first planters was contributed by local governors and Chinese capitalists. The first Chinese rubber planters were owners of pepper and had rights of tin mining. They invested in rubber plantations for economic opportunities and to offset falling income due to decline in pepper price and tin mining (Karrakarn, 1985; Songprasert, 1993).

In response to the high rubber price during 1905-1910, the rubber boom was curiously slow in moving new planting into southern Thailand. The Chinese were the pioneers of rubber planters in the south by having brought rubber seeds, new plantings, and spreading rubber seeding widely. It is likely that the growth of rubber plantations had begun in dependence on immigrant Chinese. All of them were familiar with rubber plantations in Malaya and migrated into southern Thailand because of land availability for clearing and new planting. Chinese planters often had settled in Thailand and some of them held plantations in Malaya.

Due to full commitment to cash economy, the Chinese had consequently needed to establish large size holdings to provide full, rather than partial, family employment. Size of landholding by individual farms varied from 50 rais to 5,000 rais. Companies owned up to 30,000-rai (Songprasert, 1993). Songprasert (1993) stated that the largest individual plantation

was Zoong Nguan who was the owner of a 2,000-rai rubber plantation at Tamon Ta-ngew, Amphoe Mueng, Nakhon Si Thammarat who had requested permission to hold rubber planting in 1910, and Chin Pak Jin who owned about 3,000-rai of rubber plantation at Tambon Ta-Chang, Amphoe Hat Yai, Songkhla. Most of Chinese plantations from Malaya were located on the border of Thailand which held thousands rai of landholding.

At the end of the 1910s, the Chinese of the "Hog Jew" tribe who were employed to be workers in rubber plantations in Perak, Malaya also had immigrated to the south of Thailand. They were settled along the railway line from Nabon to Klong Chandee station, Nakhon Si Thamarat. Moreover, the government had a joint venture with Chinese capitalists to establish rubber estates. These Chinese capitalists were the contractors to build the southern railway line. The estate invested about 6 million baht to establish two large rubber plantation companies: The Jeng Plantation Co., Ltd. and The Wae Chang Yen Plantation Co., Ltd. in 1917. These companies had employed Chinese "Khae" tribes people to work on the railway line and did not want to go back to their country. They also employed Chinese "Khae" tribe from British and Dutch colonial workers. The Jeng Plantation Co., Ltd. has held rubber land of 30,000 rais on the border between Hat Yai and Ban Klong Ngae, Amphoe Sadao. The Wae Chang Yen Plantation Co., Ltd. has invested in rubber land of 20,000 rais on the border between Tambon Padangbezar, Amphoe Sadao, Songkhla. In addition, these companies had occupied other landholdings by approval of the Thai royal family at that time. These companies consented to overall expenses for those workers and allocated half of area of plantation to Chinese workers. Since World War I, Chinese planters actively expanded from Nakhon Si Thammarat to the border provinces (Karrakarn, 1985; Songprasert, 1993).

Rising political pressure by the British during the 1920s caused the Thai government to be seriously concerned about political uncertainty and needed to counter the threat from the British, which would expand to invest in estates into the southern region of Thailand. The government had launched a policy for promoting settlement of Chinese immigrants and their investment in rubber plantations. There was a critical reason enabling resistance to the British. Immigrant Chinese labor who did not claim to be under the control of the British or Dutch could occupy new land for plantations and free settlement. There was a policy to encourage a large immigration of Chinese labor into the southern region, especially a group of Chinese who were familiar with rubber from Malaya and Indonesia (Karlakarn, 1985; Songparsert, 1993). Chinese immigrants were attracted by landholding equal to the local people, free settlement, and free commercial enterprise. Songparsert (1985) stated that many Chinese who were smallholders or workers in Malaya had substantially immigrated to the south of Thailand. They had concentrated to settle along the railway line from Yala, Naratiwat, Pattani, Songkhla, and Nakhon Si Thamarat.

In the first decade, expansion of rubber concentrated in Monthon Phuket pioneered for new planting and later had subsequently extended to Pattani, Naratiwat, Nakhon Si Thammarat, Surat Thani, Songkhla and Chanthaburi, respectively. In response to extraordinarily high prices from 1900-1917, rubber areas were substantially increased to total 109,000 rai in 1917. The study has imagined that these planters apparently used plantation technology similar in Malaysia and then the average size had always large enough for economic return. Due to lack of statistics, it was difficult to estimate the average size of landholding except in case of planters as above discussion. As a consequence of policy for Chinese settlement, rubber land increased from approximately 109,000 rai in 1917 to 886,000 rai in 1928, indicating a large expansion of new plant holding by Chinese while it was very less held by Thai people (RRC, 1971; FAO, 1973). The rubber market was started by a network of Chinese capitalists to tie in with Perak and Singapore (Songparsert, 1993). This was the first expansion of rubber as a consequence of the price boom and the rapid estate diffusion from Malaya.

It was difficult to know how fast rubber diffusion occurred at village level when Thai people had not recognized the value of new planting. Local planters had just started to attract new planting in the 1920s. Stifel (1973) argued that when the Chinese began to extend new planting of rubber, local people remained to cultivate subsistence agriculture. They never had any cash crops or geared to market economy. Rubber plants were new and they did not have knowledge about planting and production, so they did not know how much value of rubber plants could give outcomes. The study revealed that Chinese planters/immigration was an important factor affecting diffusion of new planting in local population. This was able to influence farm decisions to plant recognizing the success of the Chinese planting and their learning of the value of rubber in terms of cash income generation and improving livelihood. Songprasert (1993) stated that new planting caused a large demand for laborers who were specialized and skilled laborers in plantation from Malaya, Perak, and Singapore. These laborers had been employed for new planting, farm maintenance and tapping, while local laborers perhaps were employed for land clearing and land preparation. These immigrations further helped to transfer skills and knowledge to local people. Perhaps the growth of smallholdings in Perak, after the early 1930s, helped to rapidly adapt simple technology and to suggest alternative options of plantation technology (Barlow, 1980). Chinese plantations also became a source of seedlings, knowledge, production, and markets. The diffusion of knowledge and skills in plantation were considerably due to a close relationship between Chinese and local people. Local people began to adopt specific technology into simple technology in cooperation with traditional cultivations (Karrakarn, 1985; Thungwa, 1994; Taanthai, 2002). Due to scarcity of capital, they had used family labor and rubber seedlings, which could be collected from Chinese plantations. They typically cleared new land to plant unselected rubber seeds in response to high rubber prices in the first decade and continued to expand when prices rose again during the implementation of the Stevenson Plan (Stifel, 1975). Thus, simple technology was also the key factor affecting the diffusion of new planting and its growth to dominance by smallholdings.

Ingram (1971) stated that London reports in the late 1930s said that most of the small planters had 2,000 to 3,000 trees and that only a few estates had as many as 10,000 trees. These data indicated that the average smallholding was 30-50 rai (4.8-8.0 ha). They would have to plant rubber as a means for supplementary income generation at the farm level. Rubber was integrated with traditional cultivation. New planting often intercropped with food crops, fruit trees, and rice with shifting cultivation. It also was a means to claim unoccupied land. Utilization of labor was fully employed and was complementary between rubber and rice. They typically cultivated rice in October to December and then harvested in March to April when rubber could not be tapped during the raining season and when leaves fell in the summer season (Speirs, 1973; FAO, 1974, 1980). Thus, rubber growing had increased the utilization of land where it was abundant and stopped shifting cultivations (Stifel, 1973). This was considered a strong motivation to the expansion of new planting because levels of cash income exceeded earnings from other crops even though the price was low (Ingram, 1971). This mechanism was substantially widespread and reproduced at the villages in response to the level of price and the need to generate cash income. A cash economy was gradually developing in the villages whereas the subsistence economy was left out. It is likely that rubber brought the growing importance of a cash economy into the village. Therefore, policy for promoting the settlement of Chinese immigrants was the first important means influencing a large expansion of new planting and further impacted on the introduction of a cash market into the villages.

In summary, from the 1900s to World War I, rubber had less influence on the economy of southern Thailand. The production of rubber was first recorded in 1906 with the value of exports were less than 0.16 percent of total exports, whereas the economy depended on rice and tin mining. The growth of new plantings in this period was driven by policy choices and the price of rubber. Rubber would be able to have new sources of foreign income generation as a “new golden cash crop”. The first movement in new plantings was contributed by Chinese capitalists and Chinese labor immigration. Because of international political reasons against the British, the royal government promoted Chinese’s planters and their settlements and thereby protected against any estates by Western investors. As well, the royal government was reluctant to be involved in massive promotion of new planting for Thai people; except the local government at Monthon Phuket. Consequently, local planters occurred quite independently in respect to price, new profitable crops, and the achieved adoption of simple technology. Even when prices fell, the level of cash income had earned a high satisfaction by the views of village’s life that had impacted on progressive expansion of new planting where surplus of resources (land and labor) remained. New technologies used by Chinese planters had primarily adapted into simple technology in respect to scarce capital and less knowledge. Simple technology allowed its diffusion to new planting by Thai people and thus had impacted on large expansion of new planting. Thai people had gradually committed to this with cash economy and geared to the international market.

4.2.3) Critical juncture and contingent points

The great depression of 1929 in the USA had a profound effect on rubber prices, causing them to sharply drop from 451.5 dollars in 1929 to 75.6 dollars per ton in 1932. The world rubber price also rapidly and adversely affected the farm gate price in Siam, falling from 2.57 baht in 1917 to 0.13 baht per kg in 1932 (RRC, 1967; FAO, 1974; Wasuwat, 1974). In response to the great recession of the global economy, the International Rubber Regulation Agreement (IRRA) was created by the cartel of territorial rubber producers led by the British, the Dutch, and France. They launched an international policy for regulation of the world rubber market. These agreements were enacted to regulate control of supply, visible stock, and new planting that would increase rubber price at level of remunerative producers. The means of achieving this cartel were the control of above 98 percent of the world output and an effective administration of the regulatory scheme.

In 1933, the Thai government signed the IRRA. The Rubber Control Act 1934 illustrated the change of policy from free planting to control of rubber production. Stifel (1973) argued that Siam agreed to participate in the IRRA agreement without information, lack of understanding of the rubber economy and poor availability of statistics. With below 1.0 percent of the world production, the agreement signed by Siam had little effect on the international price, but the quota had restrictions of production, trade, export, and new planting that disturbed rubber production. The British government required to control a large amount of rubber outputs even from the less important producers such as Siam. The British put Siam under political pressure to participate in the IRRA agreement. The underpinning reason was that all rubber outputs depended on the market in Pinang and Singapore. The implementation of IRRA in Malaysia might threaten the rubber trade from Thailand, if the government did not participate. According to the Rubber Control Act of 1934, one of the important defining rubber developments was the establishment of the Rubber Division in 1934. This organization was established as the administrative rubber authority of the Rubber Control Act 1934.

In controlling rubber production as per the requirements of IRRA, the Rubber Division had experienced difficulty in administrating the regulatory scheme and hardly controlled the total amount of rubber outputs. Because of the poor statistics and burden of administration, the international quota from IRRA had been misallocated in the internal quota system. The internal quota system caused problems and complaints from both farmers and traders. The main problems were restrictions of coupons, unfairness of coupons, and corruption. The quota discriminated against the small farms to the benefit of larger holdings. The procedure for requiring coupons was difficult due to the official process and political power of the rubber owners. For owners of large farms, officers would quickly handle the required coupon in return for bribes.

Progressive corruption and poor administration of quotas were the failures of the enactment of the Rubber Control Act. This caused much discontent from small farmers regarding

quotas and new planting. Karrakarn (1985) stated that corruption caused a large coupon fraud whenever someone had no holding of rubber. Officials in the Rubber Division also had cooperated with the local officers and farms by claiming a large number of coupons more than what they really had. For such, 20 kg of rubber could be claimed on a coupon of about 200 kg. Some of them did not have any plantations and new planting. These corrupt coupons would be handed out to these fraudsters without checking or inspection. As well, some rubber farms generally could claim a surplus coupon rather than their own products. These coupons were brought to sell in the black market, which could create returns without the need to invest at all. Another problem was the expansion of counterfeit coupons, whereby a lot of counterfeit coupons were confiscated. The government had tried to end this by a change of coupon every 6 months even it was less effective. This resulted in the growth of a black market where new farmers or middlemen could purchase coupons for production, trade, and new planting that reflected poor administration and lack of control as Rubber Control Act requirements (Stifel, 1973).

In spite of the IRRA agreement, new planting and production in southern Thailand continued to expand. These also fully reflected the lack of government control, the burden of administration, and poor communication to the villages. The government had trouble controlling new planting, rubber output, and trade that led to revising the Rubber Control Act in 1936, 1938, and 1940 in order to make more efficiency for the enactment. In the meantime, rubber control had little effect on the farms even the quota had constricted new planting and production. Most farms did not feel any difficulty to comply with the law when coupons could be claimed or bought from the black market. The rubber quota did not cause many constraints to production, new planting, and trade. New planters who began to tap rubber trees during the year also could have a quota through certification by local officers and teachers in the villages, if they did not hold any document of land right to claim for a quota. This was a simplified method to verify landownership and rubber owners before coupons had been issued accordingly. Most small farms had less restriction due to small production and difficulty to be controlled in remote villages. It is likely that the enactment of Rubber Control Act had no effective in remote areas and new land (Taanthai, 2002). Karrakarn (1985) stated that even if the farms held coupons, the price was higher than marketing price regarded to the value of coupons. The farms could access coupons not only from the Rubber Division but also could be purchased from middlemen and the black market. Many farmers who did not comply with the law did not hold a quota and coupons. They still produced and traded just like other farms even when the price was low. As well, middlemen would purchase rubber even if they did not have any coupons. This rubber could be acquired by coupons in the black market. New planting still grew because it was not controlled by the quotas, especially large expansion in remote areas. An important factor causing inefficiency of quota was the cost of coupons being about 0.50 baht which was a burden to the farmers. Prices rose again after 1935 and reached a sustained high level so that new planting continued to expand in spite of the restriction of new planting.

Regarding the IRRA, quota for new planting in Thailand it was about 24,800 ha during 1934-1940, but the actual expansion was more than 10 times higher at 293,300 ha with a growth of 209.1 percent in 1934/41. As Table 4-2, RRC (1971) shows it is estimated that rubber areas increased from 140,300 ha in 1934 to 433,600 ha in 1941. Meanwhile in Malaya, for example, rubber areas decreased from 1.329 million ha in 1934 to 1.302 million ha in 1936 and steadily increased to 1.389 million ha in 1940 with a growth of 4.5 percent. It was clear that during the period of rubber control by IRRA, the major producers had limited new plantings and experienced a reduction of production while new planting in Thailand had substantially developed. This is important evidence with characterizing contingent properties.

Table 4-2 The new planting and rubber production in Thailand and Malaysia during 1934-1941

Year	Thailand		Malaysia	
	Total rubber areas ('000 ha)*	Production ('000 tons)	Total rubber areas ('000 ha)	Production ('000 tons)
1934	140.3	23.2	1329.0	484.7
1935	140.3	31.2	1286.5	379.0
1936	140.3	35.3	1302.7	365.7
1937	140.3	36.1	1330.7	506.0
1938	184.3	42.3	1327.3	362.7
1939	228.4	42.2	1386.5	363.7
1940	272.5	45.2	1389.3	553.0
1941	433.6	47.0	-	-
Actual New plantings (ha)	293,300		60,300	

Source: McFadyean, 1944; RRC, 1971, 1975; FAO, 1973

Remark: In Thailand, there was estimation of rubber areas during 1934-1940. Data in 1941 combined with the survey and estimation by RRC and FAO.

The inability of the Thai government to properly implement the rules of the Rubber Control Act in southern Thailand was a contingent event, which resulted in an unexpected situation opposite to the intended effect of the IRRA agreement. The inability of the government to control the local production and to regulate quotas created a situation where rubber planting kept expanding. As a result, Thailand did grow as a rubber producing country while other rubber competitors limited their new plantings and production, and the rubber economy started to develop on a farm polarization path.

4.2.4) Institutional setting

Post war, rubber plantings grew widely across the region and dominated the regional economy of southern Thailand. In 1950, the NR market recovered the full potential of production and markets. Prices boomed during 1950/1951 in response to the growth of the global economy, industrialization in Western countries, the Korean War and stockpiling in the USA and UK. The government realized a large expansion of rubber and the value of rubber exports generated

amounts of foreign income. Rubber was the second largest source of foreign income since 1951 and still remained the same in spite of subsequent price slumps. Consequently, the government launched a policy for promoting rubber production and trade through a revised Rubber Control Act. The government also began to establish several rubber agencies involving promotion of new planting and to support the use of new technology. The important rubber agencies were the Rubber Research Center (RRC), the Rubber Experiment Station (RES), the Rubber Nursery Plot, and Rubber Estate Organization (RES). The Rubber Experiment Station in Koh-Hong (Hat Yai, Songkhla) especially, was the center of rubber technology and training for government officials and farmers.

The settings of rubber experiment stations and rubber nursery plots across the region stimulated to attract farmers to expand new planting and to allocate resources into plantations. Where rubber stations and experiment plots had been established, the expansions of new plantings around those centers were high (Karrakarn, 1985; Taanthai, 2002). The Rubber Estate Organization (RES), which proposed demonstration of trial estates, rubber manufacture, producing planting material, and promotion of new technology, became a center of rubber technology, training, and knowledge that had impacted on a rapid expansion of new planting in Trang, Nakhon Si Thammarat and Surat Thani (Songprasert, 2005). Thus, several establishments of rubber organizations demonstrated an increasing appreciation for policy reform and the formation of institutional arrangements. The government had also formulated policy structures relying on extensive rubber production and promotion of new planting. Policy had reformed a great deal with contingent events regarding the growth of the rubber economy and responses to a greater demand from the world market.

During the first few years after WWII, rubber production had recovered in response to rising prices. Farms were faced with shortage of tappers, coagulants, and difficulty to clear weeds away from the stands of rubber trees. The recruitment of tappers became a serious problem in the large farms due to the restriction of Chinese immigration and the long break in tapping during the war, which caused hired tappers to move back home. The village laborers consequently became an important source of tappers (Chikhan et al., 1963; Speirs, 1973, 1974; Karrakarn, 1985; Taanthai, 2002).

Furthermore, a price boom in 1950/1951 strongly stimulated a surge in new planting during the 1960s, driven by new settlements, known as the “rubber boom”. Another factor was the increase of population density in lowland paddy areas that forced labor to move into new settlements. The falling earnings from rice further affected the rapid movement to new settlements (Stifel, 1973). The expanding road network into the remote areas also substantially developed. This offered more accessibility to new land (Siamwalla, 1996). The farms were able to access new land in the deforested areas. Areas were free to clear and claim as unoccupied land beyond the villages through a network of settlements and their relatives. Size of unoccupied land

depended on availability of labor, capital, level of capitalism, and local political power. Purchasing land was very cheap, and it was made for the exchange of landholdings. Farmers began to clear land and cultivated rice or food crops with techniques of shifting cultivation during the first few years and planted rubber later. New plantings used simple technology regarding native seeds and associated with traditional cultivation. New planting was a supplement rather than rice or food crops for home consumption (Boonma, 1966; Speirs, 1973, 1974). Basically, the aim was to raise sources of cash income generation whereas rubber was the main occupation of Chinese planters.

Table 4-3 shows that farm size was relatively larger in the Chinese sector while Thai people tended to own small sizes. It was roughly estimated that about half of the total rubber areas was owned by Chinese or Sino-Thai (Thai citizens of Chinese decent) who mostly owned large farms more than 50 rai and 7 percent of farm holdings were less than 50 rai. Thai people had smallholdings with an average plantation area of roughly 14 rai. Because of strong committed cash economy and capitalism, Chinese and Sino-Thai generally claimed large unoccupied land and established new planting as their main occupation. Ingram (1971) stated that about 50,000 to 60,000 tappers, dominated by Chinese labor, were employed in rubber plantations. They were paid a wage of 50 percent of the selling price of rubber sheet which this study identified as share-tapping of 50:50 (Boonma, 1966; FAO, 1973). The earning of tappers in rubber was higher than the rest of country. Thai people had rapidly raised tapping skills to replace Chinese laborers in this period (Speirs, 1973; Taanthai, 2002).

Table 4-3 The estimation of number of holding and rubber areas by ethnic groups in 1949

	Holding under 50 rai		Holding over 50 rai	
	Number	Areas	Number	Area
Thai	77,845	1,058,507	1,716	267,934
Chinese	5,752	143,050	1,858	326,638
Others	151	2,503	67	20,368

Source: Ingram, 1971

One of the important factors explaining the rapid growth of new plantings was that rubber plantation was considerably more profitable than rice. At the average of rubber price in 1951 of 15 baht/kg and even with low yield such as 60 kg/rai, rubber income was about 450 baht/rai against 200/baht/rai for rice. Rubber remained competitive with rice even when its price dropped by about two times after 1951 (Ingram, 1971; Stifel, 1973). It was therefore a great new planting responding to price and profitability, in parallel, the government initially established a given institutional arrangement and reformed policy.

The study revealed that the government had clear ideas for policy reform in the late 1950s in accordance with the forcing of international order. When the USA was fighting against

the spread of communism in Asia, Thailand became an important global geo-politic stake. The close relations between Thailand and USA were furthered through technical assistance and economic aid from the World Bank and IMF. During 1957 to 1958, the World Bank carried out an intensive field survey in Thailand which produced a most important report entitled "A Public Development Program for Thailand" which presented recommendations for social and economic development and relevant issues in Thailand. The World Bank and the US advisors forced the government to bring it to implementation in 1960. The World Bank strongly recommended the government to be more active in the country's development. The National Economic and Social Development Plan (NESD) was established as the master plan of national development. The first NESD (1961-1966) was developed with the guidance of the US advisors and the World Bank. The objective was transforming Thailand's capitalist development into an industrial country in the late 1980s. Importantly, the report also suggested that the initial government policy in NESD should emphasize the importance of rubber in southern Thailand as a source of economic development and foreign income. The main recommendations for the rubber sector were: 1) to promote expansion of planting with regarding to abundance of land to be suitable plantation 2) to establish the replanting scheme for rapid replanting with high yield and 3) to promote the expansion of estate plantation (World Bank, 1959).

The government consequently created a replanting scheme to enact the Rubber Re-planting Aid Fund Act in 1960. The scheme aimed for replanting old seedling varieties with high yield, governing technological use, supporting the grants, attempting the improvement of productivity and developing new planting. The scheme also emphasized a policy for promoting expansion of new planting (FAO, 1974, 1975, 1980). The government also rearranged authority, function, responsibility, budgets and relationships among RRIT, ORRAF, RES, DEA, and DOA. This implied an institutional setting to shape path of rubber development. Thus, the contingent events during 1934-1946 caused the selection of a particular policy from available options. These were institutional formations and the reformed policy structure emphasized promotion of new planting and replanting schemes, and further reproduced enduring sequence motion overtime.

4.2.5) Self-reinforcement

By the end of the institutional setting period in 1957-1960, institutional development relied on extensive production and a replanting scheme that embedded a long path of rubber development. There were institutional reproductions based on a self-reinforcing mechanism. These resulted in a great expansion of new plantings and improved productivity. Thailand became the largest producer and exporter of rubber in the early 1990s. Institutional reproduction also had profound impacts on polarization and the lock-in of share-tapping. The analysis revealed that when policies were implemented for whole farms, large farms had more capability to take advantage with rapid responses to policies than small farms. This was true because without the government's regulations, large farms occupied a lot of new land. They also started to benefit from the replanting scheme with biased policy implications. Large farm size was

associated with shifting productivity helped to increase capital accumulation that further marked potential investments for extensification and intensification. In small farms, the small scale of unoccupied land and delayed replanting caused much more pressures on vulnerable livelihoods and less intensification. When the replanting was adopted, shifting yields helped to compensate with raising living costs and improving livelihoods. These were difficult for scaling up farm size and improving productivity. The rubber economy has featured a steadily polarized farm structure and income since the 1960s. It was associated with the absence of land reform and any entrenchments by the government to trigger polarization. Polarization has continued to increase during the study time. Table 4-1 summarizes policy structures and provides a guide to discussion.

Since the first NESD in 1961, the government launched a policy for promoting expansion of new planting through several projects. The objectives were an increasing of rubber production and utilization of land and labor. Table 4-4 shows production targets and yield by the first to fourth NESD plans. Accordingly, the government promoted new settlements and converted deforest and forest areas into new plantings. The government also put much more investment for rapid infrastructure developments that helped people to access new land and furthered interest where abundant land and cheap prices remained.

Table 4-4 Targets of rubber production and yield according the NESD plan during 1961-1981

	1960	First plan (1961-1966)	Second plan (1967-1971)	Third plan (1972-1976)	Fourth plan (1977-1981)
Production targets ('000 tons)	171.0	210	250	397.0	466.0
Yield target (kg/ha)	-	-	-	-	412.5

Source: NESD, 1961, 1967, 1972, 1977

At the farm level, the price boom in the 1960s, even though it was less marked than the price boom of 1950/1951, continued to have influence on a great expansion of new plantings. Rubber income was high compared with falling earnings of rice and fruit trees. Thus, the rubber price remained to attract new planters that helped to explain a large conversion of new land into new planting. In response to prices and policies, farmers had moved into new settlements for claiming free new land located in the deforest/forest zones in the central line of the region. Respondents stated that the first settlement mostly could claim large amount of unoccupied land and good locations for new planting. In the absence of regulations to regulate the occupied new land, it enabled many farms to claim large amounts of new land which were often observed by Chinese or Sino-Thai. The Chinese and Sino-Thai, who generally had more capital, mostly started with a large amount of purchased land combined with unoccupied land, in which landholding varied from about 200.0 rai to above 1,000.0 rai. Accordingly, respondents stated that they could claim large new land during the time of settlements in 1960-1970 and also continued to accumulate landholding where land prices were very low. Increasing capital

accumulation allowed them to increase capability in acquisition of landholding and investments in plantations.

A large number of new settlements belonged to owners of small farms who claimed small unoccupied lands. Small farms and the following settlement mostly could have about 15-50 rai per household. The newcomers had followed to claim inside or uphill areas to the edge of forests, especially when they moved to claim unoccupied land in the conservation areas. A large number of new settlements were farmers who had experienced land constraints regarding the rising of population pressure and the falling of earnings from rice. These farmers started to move into new land through networks of relatives and neighborhoods in the villages who were the first settlements or moved for share-tappers in the new areas.

Because land price was very cheap compared with land for rice, farms adopted land strategy for the first landholding by selling their rice land, which could purchase a large landholding in new land areas. Governing by local customary rules, small farms had a living based on rice or horticultural activities for home consumption. Rubber could earn daily cash income for daily expenses and children's tuition fees. Most farms would be not only plant rubber but also intercropped with several fruit trees in the same plot, called "Paa-Yang or jungle rubber". When the fruit was sold annually, farmers could earn, thereby saving money. Fortunately, the farming calendar for growing rice, fruit, and rubber coexisted perfectly in seasons, land use, farming systems, and working time. Hence, small farms had daily cash income from rubber production and cultivated paddy fields for home consumption. These were overall agrarian life satisfactions. This livelihood pattern dominated the traditional agrarian society across the region before farms were developed into dependent rubber farms. Meanwhile, farm enterprises was established by large farms and offered dependent rubber income. They were characterized by specialization and high capability to invest new technology and intensification in production that could be profitable. Capital accumulation enabled them to increase capability for land accumulation when land was very cheap. Size of landholdings increased continuously during 1960 to 1980 while small farms were still accustomed to traditional ways of farm life.

The analysis found that when the government launched policies for promoting new planting in new land it had unintentionally impacted on more disparity of landholding in the rubber economy. The government had less concern about distribution of landholding and their impacts. Free claimed new lands and settlements were promoted by the government without claimed land regulations or effective enactment of any acts, presenting a liberal policy choice. In the late 1980s, new settlements gradually declined because the unoccupied land encroached to the edge of the conservation state areas. Market land began to make progressive landholding where land remained low in price. This indicated that means of access to landholding were via purchased land and transferred land (inherited land). Land acquisitions were carefully recorded for possession dependent on land price, rubber price, intergenerational land transfer, and the

needs to own more landholding. It was becoming increasingly common for the land acquisitions to attribute capital accumulation, so that size of holding continued to increase by farms that had benefit from a relative income by rubber-led capital accumulation and the farms that had credit accessibility. From this point, new planting continued to expand in farm owned land instead of new land.

In the same period, the government implemented a policy for promoting the replanting scheme since 1961. The Office of Rubber Replanting Aid Fund (ORRAF) was established and had responsibility for the functioning and implementation of the replanting scheme. The scheme aimed to replant old seedlings with high yield clones, to manage the grants, to govern technological use and to increase knowledge in production and marketing. The replanting scheme was a crucial institution governing technological use, the grants, knowledge, behavioral and actions of farmers in production and markets. Production growth and improving productivity were very successful. The replanting scheme could be beneficial for whole farms, but it further induced farm polarization when reluctance with the massive replanting and bias of implementations were observed. The analysis found that large farms relatively benefited and took advantage of the replanting scheme. They were the first movers of the replanting that enabled them to capture the grants and shifting productivity. The maintenance of technological use as the scheme's recommendations and more capital investment in plantations were observed by these farms, which they said would contribute toward stimulating expansion of farm enterprises.

Respondents argued that when the ORRAF began to promote the scheme in the villages, it was worrisome with regard commitment to the scheme and serious intervention of the government. This was because the government and the grants had never involved the farms in the past, which the farms said was unusual or just a trick by the government. To cope with these constraints, the ORRAF began to promote a replanting scheme with those at large farms such as head of villagers, Chinese, and Sino-Thai. Some of them already used new technology and had experience of replanting by importing new technology from Malaysia. These farms were also prompted in complying with the replanting in regards to farm size, specialization, and capital. Jiranakorn and Tipyakul (1974) stated that the replanting scheme was commonly promoted to medium-large farms during the 1960s to the early 1980s. The majority of re-planters were large farms such as Chinese, Sino-Thai, and Thai people who owned large farm size (ORRAF, 2002). The grants and new technology were attractive and the participation of replanting and would be able to spin over the diffusion of replanting to other farms. Accordingly, the RRC survey of re-planters during 1962-1972 showed that 46.3 percent of total re-planters owned landholdings of more than 100 rais and only 8.81 percent were holding less than 20.0 rais (Table 5-41 in Annex A). In addition, the study revealed that our respondents in TR1 and TR2 were the first re-planters with the scheme in the villages. Successful replanting in their farms presented high yield and new levels of income helping rapid diffusion of replanting in the village. The analysis provided

strong evidence that large farms often could benefit and take advantage of the replanting scheme allowing improvement of productivity and new levels of income. This also implied a bias of policy implementation adversely affecting farm polarization.

During the first of NSED plan, the replanting areas were low; only 13 percent of total mature rubber areas during 1960-1972. The average replanting areas increased from 3,910 ha in 1962 to an annual average of 7,200 ha during 1963-1972. This partly was because of budgetary limitations, inadequate staff, and the initial setting of administration. This was a serious issue for the NESD plan that proposed to increase levels of replanting to compensate the expansion of old trees and new planting with old seedlings.

At the second NESD plan, the government had supported an additional budget for the replanting scheme. The rate of replanting gradually increased to an annual average of 21,920 ha during 1972 to 1977. Hence, limited expansion of replanting during 1961 to the early 1980s reflected reluctance to implement massive replanting. In order to expand the replanting areas, the government created rapid replanting projects which had much support with loans, grants and technical assistance from the World Bank, Commonwealth Development Cooperation (CDC), and United Nation Development Programme (UNDP). The project proposed to increase at the rate of replanting of 48,000 ha per year during 1977-1990 which would cover above 50.0 percent of total mature rubber areas. As a result, the annual average of replanting was about 42,560 ha during 1977-1990. The accumulated replanting was a total of 0.77 million ha or about 40 percent of total rubber areas in 1991 (ORRAF, 2005). Until the late 1990s, 98 percent of total rubber land had been re-planted with high yield and only 1.9 percent remained with old seedling areas (NSO, 1998). Importantly, the average yield had increased from below 400 kg per ha in 1961 to 1,016 in 1990 and rose to 1,815 kg per kg in 2004. On average, farms had reached shifting productivity about four times, indicating new levels of income and reduction of cost per unit. Thus, this evidence indicated that the vast re-planting with high yield happened during the 1990s-2000s, indicating a reluctant massive replanting.

Rather than bias and constraints made by policy implications, delay or resistance to the replanting was observed at small farms. There was a serious adverse effect on polarization. The ORRAF argued that most small farms firstly refused or delayed to participate in the replanting scheme. They had questioned what new technology could be possible to raise a burden cost to them. They also did not respect any of the government provisions and the grants that might be constrained on their landownership. The replanting had promoted only large farms and local governors who already knew new technology and replanting that would offer diffuse sources to promote the replanting advantages. The ORRAF argued that small farms always preferred to wait and see what new technology offered and how the scheme was managed. They had observed and learned new technology and the roles of schemes from ORRAF staff and their neighborhoods to ensure the gaining of high yield and new levels of income to decide for the

replanting. When some replanting plots in the village could be tapped with high yield, the extension of the replanting was rapidly increased.

Another important reason was the loss of income during the immature stage with accompanying hardship to decide for replanting. If replanting happened small farms would seriously face limited alternatives to generate household income. Even if they could replant a particular plot, if land size could be split into two plots, they could earn declining income from old trees. Off-farm activities with share-tapping were commonly adopted for survival of farms. Then small farms generally would retard as long as for replanting period. The old trees had forced farmers to replant with the scheme. Moreover, underpinning reasons were the total cost of replanting that was a burden cost to small farms.

Even though the scheme was supported with grants and some planting materials, it was not enough to cover all costs. Either sufficient capital at such level or source of income generation was made to decide the replanting. Small farm size together with complexity of socioeconomics had impacted on the delay or resistance to replanting. There was the loss of potential gains from economic opportunities and new productivity. Delay to shift productivity simultaneously contributed to suffering loss of earnings and resulted in vulnerable livelihood when prices fell and new living costs rose. Improving productivity, associated with reduction of cost, considered earning a new level of income stimulated to improve livelihood and to have more capital accumulation for increased size and re-investment in plantation. The replanting had increased after the mid-1990s–thanks to high efforts of the ORRAF's staff and the rapid replanting projects.

The replanting scheme was marked by enforcement of the government that rapidly pushed the farms on a course of intensification. The scheme and new technology had also impacted on the utilization of labor and contracts, which caused an extension of paid labor and changes in share-tapping arrangements. For instance, because of new technology and regulations in the scheme, budded stumps would be needed to be prepared in the field making it necessary to employ paid laborers who were experts in planting materials. Some farmers who specialized in budded stumps and planting became paid laborers. This resulted in a widespread use of paid labor in the villages. The use of paid labor was in high proportion and perhaps applied in all activities in large farms.

During the mature stage, in large farms, hired laborers were employed to tap rubber trees with share-tapping contracts. 50:50 share-tapping contracts were generally applied for general farms. Because of high yield, new costs and modern plantations, 60:40 and 55:45 share-tapping were developed to apply to modern plantations. If 50:50 share-tapping was selected, cost shared a proportion or equally. At that time, the general rule was that 60:40 share-tapping was applied by modern plantations (high yield) while 50:50 share-tapping for old seedlings. Hired laborers

had preferred to deal with 60:40 share-tapping due to high remuneration to compare with old seeding rubber. Therefore, the shifting yield, combined with new costs, was an influence to create new arrangements of share-tapping through creating new rules for output sharing and cost sharing. Moreover, the scheme had adversely impacted on declining farming diversifications when mono-specific plantations was mainly used to a great extent for both large and small farms. The scheme also contributed to promote applications of chemical fertilizer and new tapping technology, which would change from high frequent tapping to a low tapping system. In fact, these often were not maintained and led to adopt technologies thereafter. Thus, the scheme achieved the replanting of high yield and a great extension of new technology into the farms, but this policy did not directly apply to the disparity of landholdings that was actively polarized.

Consolidation through institutional reproductions

Since the early 2000s, the government tended to realize the importance of smallholdings. The government implemented policies by addressing issues for stabilizing farm income, strengthening marketing function, and supporting the grants for new planting with other crops. These might be potential policies to disrupt polarization, but there is no evidence in this stage that reverting or slowing polarization occurred. This was because policies did not fundamentally threaten economic power, potential growth of large farms, and disparity of landholding distribution. The failure and reluctant massive policy implementations were observed by all of policies as well as the continuity of policy implications. Typically, government policies had remained on a consistent path where policies launched concerned all farms.

The study observed that the policy implications were carried out to favor large farms when they could take advantage though their better capacity to access policies for price support, development of marketing, and infrastructure provisions. During the 1990s to early 2000s, the falling price had hampered farms' ability to raise finance and to improve livelihood. These were good explanations of active polarization. In order to understand the impact of policies on polarization, the study will discuss the main policies to highlight the impacts or observations of self-reinforcement.

During the late 1980s to 1990s, the recession of the world economy and price slowdown had profound effects on maintaining policy structure and implications, and further forced policy makers to find alternative choices. In response to unintended consequences, the government presented the need to control rubber areas and limit new planting. The main propose was a reduction of supply and bring about a raising of the rubber price, and enabling the nation to maintain competitiveness in the world supply chain.

Table 4-5 shows NESDP controlled rubber areas of 2.0 million ha during 1997-2001 that could supply rubber equivalent to the world demand. The government had suspended the policy

for promoting new planting in old areas and then promoted replanting areas with other cash crops. However, the lack of implements was one of the main challenges when new planting increased. New planting was also introduced into new rubber areas (North-east region) in 1991.

Table 4-5 Targets of rubber areas, production, and yield according the NESD plan during 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Rubber areas (million ha)	1.90	1.93	1.96	2.0	2.0	2.0	2.0	2.0
Production (million tons)	1.69	1.75	1.84	2.08	2.11	2.17	2.28	2.43
Yield (kg/ha)	1,025	1,094	1,125	1,231	1,237	1,263	1,331	1,381

Source: RRIT, 1993

In order to reduce the rubber supply, government policies were emphasized promoting replanting with other cash crops. The grants increased comparable with replanting rubber, its primary propose was to attract the farms to replant with other cash crops. The grants consisted of 1,500 baht per rai during 1960-1982 and increased to 6,800 baht per rai in the beginning of 1993; the same level as rubber replanting (Table 5-30 in Annex A). As a result, replanting with fruit trees was the lowest before 1990 and substantially increased from 624.5 ha in 1992 with the average size of 1.4 ha per plots to peak of 13,909.6 with the average size of 2.2 in 1994 and decreased to 3,196.1 ha with the average size 1.06 ha per plots in 1997. The area of replanted fruit trees was above 3,785.2 ha during 1998-2000 and thereafter gradually declined (ORRAF, 2012). These implied that policy implementations and level of the grants had impacted on expansion of the replanting with fruit trees. The data showed that replanting with fruit trees was very small. These farms were familiar with fruit cultivations and held rubber plantation together. Replanting with oil palm was low before 1997 due to new cash crops, high production cost, and lack of promotion.

The ORRAF argued that it was difficult to promote replanting with fruit trees and oil palm even though the grants increased. The constraints faced by farmers to replant were the burden costs, lack of specialization, low availability of laborers and price fluctuation. It is likely that only rubber could generate enough daily cash income for their livelihood. In relation to this, respondents argued that size of oil palm was about 25.0 rai per household for viable economic scale in comparison with 15.0 rai for rubber. Production costs and intensive farm maintenance were burden costs to them. They also had to learn new skills and specialization regarding technology, production, and market. These were difficulties to decide replanting with oil palm. The replanting with oil palm was characterized by large farms.

As a result, rubber land in the south steadily increased from 1.73 million ha in 1989 to about 1.95 million ha in 1999 with slow growth rate of 1.3 percent, reflecting that self-

reinforcement continued in forcing along the period. This evidence showed that the policy for suspension of new plantings had shown reluctant implementation and then failed to control expansion of new planting. The rate of replanting had slightly decreased from about 42,880 ha per year in 1977-1990 to 36,960 ha per year in 1991-2002. Respondents claimed that slowdown of new planting appeared a postulated effect of the falling price.

The replanting with other cash crops was comparatively low despite much attention paid by ORRAF. In small farms, falling rubber prices associated with promotion of the scheme had influenced the choice of replanting with fruit trees, where they often kept both plots of rubber and a small amount of fruit trees. Fruit trees could generate profits rather than when rubber price dropped. The ORRAF claimed that this policy was done to promote replanting with fruit trees for small farms, but it was unable to carry over to large farms. The study found that large farms continued to invest intensification in plantations and expanded farm enterprises. Even when the rubber price dropped, rubber was profitable. Productivity and cost per unit should be improved accordingly. Large farm size and improving productivity allowed them to cope with the falling price. The productivity was higher in relation to price and this could maintain profitable production. Large farms were not concerned about temporary changes in the government policies. A combination of price slowdown and increasing labor mobility continued to tighten the supply of farm labor that caused owners to employ foreign labor to replace local laborers. 70:30 share-tapping was introduced in response to the new source of hired laborers. Price support and market development may contribute to remain rubber profitable and stimulate to continue expansion of large farm enterprises.

From the late 1980s, the world market still marginally grew in response to the global economic recession and global political uncertainty. The rubber price dropped from 1,159.0 US dollars per ton at the end of 1988 to 949.0 US dollars per ton in the second quarter of 1989 and continued to decline. It was associated with the buffer stock of International Nature Rubber Organization (INRO, see detail in Annex A) to depress the rubber price to continue slowdown trends since late 1980. The rubber price in Thailand had declined and fluctuated around the declining trend. The price at farm gate had rapidly declined from 19.17 baht per kg in January 1989 to 15.7 baht per kg in the December of the same year and was still low at the average of 16.16 baht per kg. This was a low remunerative level for the farmers. Because of declining price rather than political reasons, the rubber farmers had protested in 1989. The protest led to increased pressure on the government to find alternative options. The protests of famers provoked the government’s price support at the remunerative level. Underpinning reason was that the INRO had less effective price stabilization into the world market. The government also claimed that the INRO had less activity in Thailand and questioned benefits to members with INRO. Consequently, the government created a policy for price support and market development.

Price support aimed to stabilize farm income at remunerative producers. Price support was periodically implemented during 1992-2002. Farmers who were members of cooperatives, farm groups, or registered with ORRAF's market could earn from this program. Only rubber produced by 8.0 ha could be sold with price support which was higher than market price at about 1.0-2.0 baht/kg. To serve this policy implementation, the government also promoted and supported the establishment of many cooperatives, farm groups, 220 of ORRAF's markets, and 675 of rubber smoked sheet factories during 1994-2000. The number of rubber entering programs were about 9.1% of the total rubber production during 1992-2002. Price support had benefited approximately 5.0 percent of total farmers. Respondents argued that the farmers rarely sold their rubber to the price support due to difficulty of regulation and the gap between prices was low. The price support caused an increase market price in the short run, and then market price was still lower. The gap in price support and the large amount of government stocks failed to raise market prices.

Respondents also stated that the price support was characterized by poor administration, lack of budgets, and implementation that caused difficulty to stabilize market prices. The study observed that there was a failure of stabilized farm income and widespread corruption in the program. Price support regulations had been adopted to cope with the corruption and poor administration but it there were delays to respond to the decline of the market price. Price support ended when rubber prices increased after 2002.

The analysis found that price support had impacted to deteriorate long-run improvement of productivity when it appeared that the farms would have less improved farm productivity and more exploited production. A falling price had largely affected real income and vulnerable livelihoods, especially small farms in which livelihood depended on rubber income. TDRI (2001) argued that price support had less effect on stabilizing farm income as complaining for lack of price support implications. Small farms had limited asset bases and lack of accessibility to government interventions. Then, adoption of technological uses were high in order to maintain livelihoods. They were results of massive rural to urban migrations where non-farm employment substantially grew. A majority of those who have left farming said that landholdings has been sold to medium or large farms in this period. Accordingly, our respondents claimed that they had explored ways for more increment of size when the negative consequences of falling prices forced some farmers to leave the farm sector. The analysis found that large farms had been found to be resilient to falling prices in which a large farm size associated with high productivity enabled them to remain profitable. They were also adopted farm strategies for reduction of cost per unit and access to modern markets and government interventions. These were achieved to cope with the period of price reductions.

In parallel with price support, the government implemented a policy for market development that has had profound influence on the pace and direction of market development

since 1991. The study assumed that these policies might affect farm polarization; if marketing power, the fairness of price, and stabilize of income increased by small farms. If this policy benefited whole farms, polarization would continue to increase. The government believed that the traditional marketing systems were a multistage of middlemen and lacked market development which were characterized by high marketing power of middlemen, less market competition, imperfect market information, and threats to small farms in marketing function. Subsequently the government launched a series of market development policies, emphasizing building modern markets, establishment of a central market, and enhancement of marketing function by cooperatives and farmer's groups. The primary propose would enable an increase in market competition and the fairness of rubber price at the farm gate. Especially, central rubber markets and marketing provisions would contribute to set modern marketing channels and increase market information to be able to induce market competition and the fairness of price. Price at the auction of central rubber markets is presented as representative of market price to be fair for the farmers and the buyers and it can stimulate to increase the price at the farm gate.

The first central rubber market was Hat Yai, established in August 1991 in Songkhla. RRIT stated that by auction regulations, the sellers were from large farms, middlemen, and cooperatives which should come with a large volume and specified quality to bid with the buyers who were factories and exporters in service areas. The majority of sellers were large farms that operated middlemen as a part of farm enterprises. The average of 0.9 -1.20 baht per kg was higher than market price and strongly attracted the sellers. About 5.0 percent of total rubber in the service areas entered into the central market. The volume of rubber entering the central market substantially increased from 1.88 tons in 1991 to 13.6 tons in 1994 and rose to 35.0 tons in 1999. This was suggested as a success of central markets in terms of volume, price, and marketing actors.

Another important role up to now is that auction prices at central markets is widely used to reference price and elements of pricing for marketing actors at the local market. The central market also introduced new market channels, which had consequently re-structured traditional marketing channels. The number of peddler merchants and merchants at the village and the sub-districts gradually disappeared to be replaced by cooperatives and large middlemen. This suggested that multistage markets are replaced with modernized market channels. The central market also was the source of marketing information, reporting marketing situations and market prices to obtain information necessary for all marketing actors. Such sources had a noticeable impact on the nature of competition and pricing. RRIT (2010) claimed that the roles of the central market had strongly influenced the setting of modern marketing channels and the quality of rubber. The famers tended to bargain both the price and quality by claiming the price of the central market. This had created potency to the merchants to adjust prices based on quality and price related with auction price at the central market. During the 2000s, five central rubber markets were established to cover rubber areas at Nakhon Si Thammarat, Surat Thani, Hnong-

khai, Buri-raam and Yala. These central rubber markets played important roles in setting modern marketing channels, pricing, and market information in each service area.

However, respondents claimed that central market regulations for serving auction systems had urged small farms to change their status to be sellers instead of trying to compete with the other large farm enterprises. In fact, large farm enterprises could take advantage of central markets and the price rather than small farms. Large farms became the dominant rubber seller in each central rubber market while small farms were indicated to participate in cooperatives. It meant that, except via the cooperative, small farms were not able to bring their products to bid at the central market. Cooperatives in Pattalung mentioned that Hat Yai central market located in town where they incurred transportation costs. They did not account the cost of transportation and a large volumes that provided a bargain to central market. Small farms were more likely to sell their products directly to a distant middleman or cooperative. In large farms, respondents stated that they had been the sellers in the central market since 1992 because of they owned large volumes and provided a good quality. The central market's auctions could obtain a better price and the fairness to attract them as sellers. These farms sought to obtain the highest possible price through comparing prices at the factory and central market. These could generate the highest possible return to them and became a specialization in marketing.

It seemed that the establishment of central markets and its functionality provided direct benefits to the large farm enterprises in terms of reduction of marketing cost, fair price and profitability. When auction's price and competitions effectively forced middlemen at local market, they could benefit all small farms that exclusively pass through cooperatives. At least in the late 2000s, central markets had an effect on marketing developments in terms of modern marketing channels, price, quality, and competition. The analysis found that price support was an important factor to depress functionalities and price in the central market. Price support associated with financial constraints had led to considerable delayed expansion of central markets in other areas until the 2010s. Presently, central markets located in the main provinces accounted for approximately ten percent of total rubber production. This suggests that central markets have to be in quite a few locations and offer services to cover a large amount of rubber production.

In addition, the ORRAF's market has been established to serve the price support program since the early 1990s. Cooperative and farmer's groups have been widely established and promoted to join the ORRAF's markets where price support was conducted. The objectives were to achieve selling and buying of USS (un-smoked sheet rubber) directly between buyers and farmers in terms of fair price, quality, and volume. The sellers were cooperatives, farmer's groups, rubber farms, and the buyers came from middlemen, factories, and exporters. The ORRAF's market also would induce strengthened marketing function and performance in cooperatives and farm groups. During 1992-1999, more than 290 of ORRAF's markets were

established that were able to support implementation of a price support program rather than attention to develop markets. The ORRAF continued to develop these markets in different types of markets in response to the changes in marketing systems and to meet the demand. Only 171 ORRAF's markets were active with marketing function in 2002 and declined continuously. The number of the ORRAF's markets rapidly decreased consistent with the decline in price support since 1999 and ended in 2002. This indicated that the majority of ORRAF markets had failed to conduct their functionality when the government support ended. It appeared that the main functions of these markets were the collection of rubber from the farm members and sold for the only purpose of price support program.

Much of this failure could be attributed to less recognition of cooperatives and declining support by the ORRAF. In 2011, 89 of the ORRAF markets remained well-functioning when they adopted production and marketing functions to meet the market demand. The ORRAF stated that trade volume was about 308,000 tons or approximately about 10.0 percent of total productions in 2011. The average price of 1.0 to 2.0 baht per kg was higher than the market price that attracted the sellers to join this market. The analysis found strong evidence that the government intervention in the market was high during the 1990s. Many ORRAF markets and cooperatives were established as specific marketing channels to support the price support program. This was the underpinning reason to explain why many of the ORRAF markets and cooperatives or farm groups had been terminated when price support had ended.

Even after some the cooperatives and the ORRAF markets had been terminated, the farmers still had learned about what was an appropriate marketing channel, fair price, and how to deal with middlemen properly. The movement toward market development had profound effects on the decline in traditional marketing channels. The results were a short marketing channel, a large number of marketing actors, fair price, and increased market information. The analysis revealed that these policies had been beneficial to whole farms and possibly caused polarization to continue. Overwhelming evidence showed that large farms could take advantage of government interventions and provisions, i.e. profitability made possible to stabilize by price support and a modernized market. Also, delays for implementation of cooperatives and the failure for sustain cooperatives were widely observed. Of particular relevance was the rubber market substantially developed driven by the growth of demand for block rubber and concentrated latex industries, which further provided business opportunities to establish middlemen and primary processors as a part of farm enterprises. These would expect to make added value from their products and greater profits. These were conditions to reinforce polarization.

Thus, the analysis found that when the government implemented the policy for price support and marketing development, large farms had captured benefits and advantages in infrastructure provisions, new marketing channels, and development of markets while most small

farms were widely challenged. This might have occurred due to more capability and accessibility of large farms to government intervention and lack of policy implementations. These brought a reduction of cost and a better price to earn more profit and expansion of related business. The crucial role of government intervention in this period helped small farms to relieve pressures in socioeconomic situations and reduced income. The focus needed to be on maintaining farm livelihoods at such level without implying to trigger polarization.

Consequences of price boom reinforcing institutional reproduction

In the early 2000s, the global commodity boom occurred over the decade in response to the growth of the world economy driven by the miracle of China's economy and new emerging economic countries associated with the peak of oil prices. Rubber prices continued to be an upward trend from 2003 to rally reaching the first peak in 2008 before it declined during the end of 2008-2009 in response to financial turbulence in Europe and in the U.S.A. Rubber prices rapidly recovered from the first quarter of 2009 and continued to be an upward trend to reach a second peak in early 2011. The price boom was over 530 percent when compared with the base price in 2002. A recession of the global economy, slow growth of China's economy, and financial turmoil in the Euro zone were signs to break this trend after the end of 2011. Rubber prices declined and fluctuated thereafter.

The main factors driving the price boom were demand shock and the deficit in supply of rubber over the period. The price boom was a key factor to shape the structure of policy and the farms actively responded. The analysis revealed that the price boom had impacted on reinforcing polarization when the farms could earn extraordinary profit and it then is allocated for the different views of farm attention. In large farms, profit was substantially higher, leading to exceeding the amount of capital accumulation to involve acquiring landholdings and increasing wealth. These farms progressively re-invested in scaling up, improving productivity, and expansion of related business. As well, small farms found an increase in profits and capital accumulation. A large share of income was largely undertaken to promote improved livelihood and a decent standard of living. More savings could then be used to re-invest to improve productivity but not to scaling up. This implies that, unsurprisingly, there were different intentions and objectives between large and small farms. These trends continued to reinforce farm polarization. As below, the analysis discussed policy and the consequences of the price boom. The observations also would link to what happened to polarization.

In 2003, the government launched policies for promoting new planting in new areas (northeast and north regions) where abundant land was available. The rising rubber prices together with political reasons were certain key factors influencing the reinforcement of an expansion policy. The underpinning reason was that the government proposed to maintain national competitiveness in the world supply chain in which the world demand is expected in

deficit. The objectives were increased farm income and sustainability of small farms in the new rubber areas and promoting new planting for the new farmers. The target areas were 112,000 ha of the north-east region and 48,000 rai of the north, i.e. the project was not implemented in the southern region in the first round of the project. In the first round during 2004 - 2006, the overall budget proposal was about 1,440 million baht to spend for material planting of 90 million trees. The government also supported special loans with low interest rates for production costs during the immature stage. The projects continued to promote expansion of new planting in both new and old areas in second round during 2007-2009. As a result, the combination of project implementation and price boom saw a great expansion of new planting in both new and old areas (Table 5-45, 5-46 in Annex A). Regarding these government projects, respondents argued that the projects confirmed that it was possible to grow rubber with a potential for profits in new areas. This was a great economic opportunity coming to them and they quickly responded to the projects through finding a way to invest in new planting in new areas. Many farm enterprises (TR1 and TR2) were the first large planters to acquire substantial land for new plantings.

During 2011-2013, the government continued to promote the expansion of new plantings. New planting was targeted for 128,000 rai at different locations; 24,000 rai in the north, 80,000 rai in the northeast and 24,000 rai in the old areas. The budget proposal was 569.18 million baht in 2011 and increased to 1,053.85 million baht in 2013. Most recently, the government announced that cooperative and farms groups would promote for strengthening production and markets in small holdings. The project had ended in 2013 because of budget constraints, falling price and several questions to appropriate technologies for new rubber areas. As a result, new planting under government projects was about 147,767 ha during 2004-2006 and 90,400 ha during 2011-2012. Total rubber areas increased from 1.70 million ha in 2003 to 3.0 million ha in 2013 (ORRAF, 2012, 2013). This implies that the massive implementation combined with the price boom was achieved to promote a great expansion of new plantings and further introduced new cash crops in new rubber areas.

The analysis found evidence that, during 2004-2013, government policy had favored conditions for smallholdings through the access of credit subsidization, grants, and technical assistance, where the benefits were found to be great for the small farms. The government concerns were ensuring that smallholdings could benefit from economic opportunities, price booms and advantages of government interventions. It could be interpreted that this was a primary attention to counter against achieving of large farm enterprises and their expansion. However, it was difficult to evaluate the impact on polarization when a large new planting often was developed in the new rubber areas. Many of them were large farm enterprises from southern regions including a large investment of new planters. They were the first movers of large farm enterprises that might have advantages of government policy to expand new planting. Even what remained unclear policy structure to trigger polarization, the current policies and intentionality

relying on the promotion of new small farms reflected that policy makers had already considered that polarization was taking place.

The analysis revealed that price booms and consequences of progressive development of rubber markets and rubber product industries during the 2000s also influenced different observations in farm trajectories. In small farms, extraordinary profits allowed them to improve standards of living, pay off debts and increasingly save money. They managed a large amount of income to spend on living facilities, electrical devices, and rebuilding houses. New planting slightly grew through converting marginal land and other crop areas into rubber. For instance, about 32.0 percent of rice areas in Koa-Chaison, Pattalung were converted into new planting during 2002-2006 and to peak during 2007-2011 (Pongsapan, 2007). In large farms, respondents stated that thanks to large farm size and productivity, the price boom brought a period of high financial return and a large amount of capital accumulation that they were able to contribute to more intensification in production and expansion of farm enterprises. Farmers said that latex middlemen and rubber sheeting processors (USS and RSS) grew increasingly profitable more than in the past in accordance with growth of the concentrated latex industry, market structural changes and modern marketing channels. Respondents claimed that increments of landholding have slightly increased during the 2000s because of high land prices and a transition to low available land for rubber. It was therefore large farms that often were found to move into new rubber areas where land prices remained the cheapest. They came with capital, specialization and new technology including business networks. Thus, it was apparent that price booms and consequences of industry development were less pronounced to be triggered polarization.

In 2009, a wage contract was introduced instead of share-tapping by some medium farms and patron farms however it was rarely used by farm enterprises. Price booms and more availability of hired laborers, who were mostly mobilized back from the non-farm sector, had an effect on the emergence of wage contracts and its expansion. Wage contracts could be considered as a contingent event to challenge the lock-in of share-tapping. It also reflected some changes in economic behaviors and a decline in traditional social values. Wage contracts ended in 2012 when prices dropped and trends declined. The analysis found evidence that the government was never involved in labor contracts in rubber productions. The studies have no evidence that wage contracts affected reversing polarization, but in turn, it has failed to widely expand. This suggested that share-tapping contracts are strongly related to active polarization.

Interrelations between the polarization process and share-tapping

In this section, the study aimed to demonstrate self-reinforcement between the polarization process and share-tapping. It can be observed as seen in Figure 4-1 that the number of very small farms increased from 10.9% in 1990 to 25.5% in 2010. From 1990 to 2010, the average landholding decreased by -25.7%. These farms also increased their off-farm activities under share-tapping to more than double in size. The analysis found that a large and growing proportion of very small farms and declining size of very small farms over the period of the study was a consequence of the polarization process. Figure 4-1 further shows evidence of relations between the growing proportion of very small farms, a decline in the size of very small farms and their off-farm activities under share-tapping in size. It can be interpreted that the size of very small farms has not more economic scale with only rubber production from which it was difficult to generate income sufficient for their livelihood. As a result, very small farmers needed to find a way to overcome very small holdings. A better option than leaving the farm was the adoption of off-farm under share-tapping. They realized their tapping skills, specialization and more labor availability then very small farms had a competitive advantage in tapping employment to compare with unskilled workers. Thus, they were able to offer local available skilled tapping labor. All of them now worked off the farm in the village.

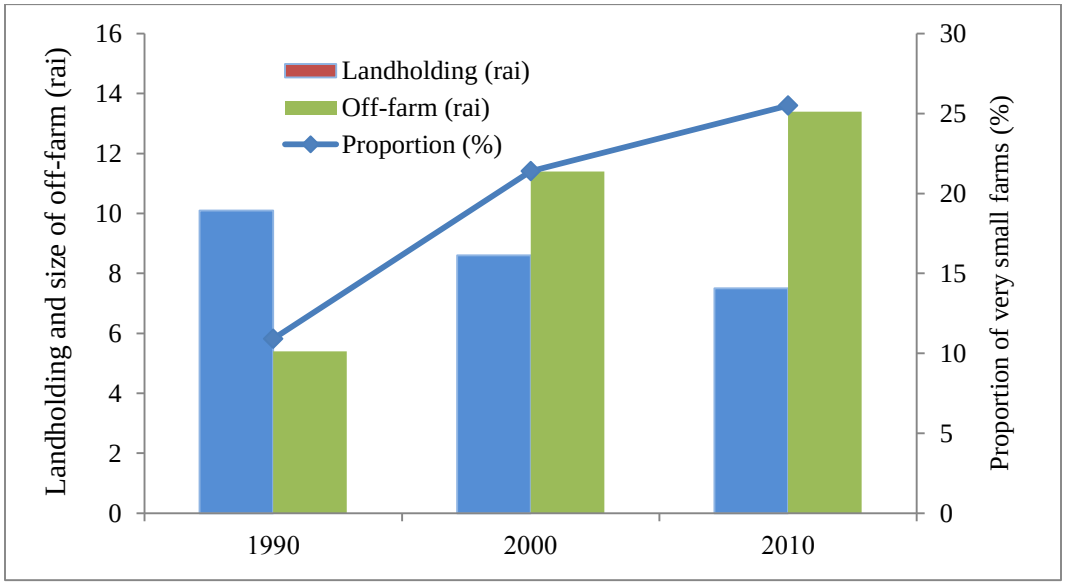

Figure 4-1 Landholding, size of off-farm and proportion of very small farms in each of the three years (1990, 2000 and 2010)

Remark: size of off-farms is only off work participation with share-tapping employment

In the same period, the expansion of farms underwent growing trajectories needing to recruit more hired laborers to which a critical factor related to tapping skills. Because tapping activity had profound effects on output, productivity and economic life span of the plantation, rubber owners preferred to hire skilled laborers whom they could trust, labor quality, and

specialization, characterized by very small farms. As analysis of share-tapping arrangement in Chapter 3 shows, share-tapping contracts were already available. The socio-cultural environment made it legitimate to hire local tappers through kinship, and people in the social network within the local areas. The data confirmed that a growing number of very small farms are being employed by the farms in the growing trajectories (Table 3-12). The prevailing share-tapping arrangements have made the potential expansion of farms requiring skilled tappers from which the reduction of the size in small farms provided a supply of skilled tappers.

In addition, the intention to use wage contracts by some rubber owners provided further evidence by its failure that continuous polarization and share-tapping are connected when it is apparent that the use of wage contracts did not only fail for economic reasons, social functionality and risks but also stirred a reactive sequence from the local institutions about their legitimacy.

4.3 Summary: Path Dependent Analysis

In this chapter, the study employs the concept of path dependence to explain outcomes of farm polarization and share-tapping in the rubber economy. A critical juncture was the period of rubber control from 1934 to 1946 where failure of the government to enact the Rubber Control Act as IRRA requirements was widely observed. A contingent point was characterized by the greatest expansion of new plantings that was a cause of the selection of a particular policy option from available options. During 1947-1960, policy reform and a given institutional arrangement including establishment of several government agencies were found to characterize the institutional setting. Since 1961, institutions reproduced through a self-reinforcement mechanism to govern the path of rubber development. Without involvement by the government, farm polarization set in motion reproduction from the period of institutional setting. Bias of policy, reluctant massive implementation and lack of policy makers' awareness are important factors driving the movement in polarization. Policy has less threatened economic power and disparity of landholding distribution of the farms in the growing trajectories. Resource endowments and capability allowed large holdings to take advantage of policies and government interventions rather than smallholdings. The analysis had not found evidence that the government directly contributed to share-tapping arrangements that led to sustained institutionalization of share-tapping. These illustrate the impacts of path dependence on polarization and lock-in of share-tapping in the rubber economy. Important driving forces that determined institutional structure and institutional reproductions are price and market forces. Price changes were found to have a great bearing on institutional reproduction and shaping outcomes of agrarian changes. The results have been a sharp rise in inequality and socio-economic polarization. These also illustrate interrelationships between institutions at macro level, meso level, and micro level.

Chapter 5

Discussion and Conclusion

This chapter focuses on the discussion of the core study findings and the policy scenarios for the future of the rubber economy in Thailand. The chapter is structured as follows: Section 5.1 discusses the hypotheses tested and the core study findings. Section 5.2 presents discussions of methodological development. Section 5.3 presents policy scenarios for the future of the rubber economy. Section 5.4 describes the implications for future development. Section 5.5 presents possible future research.

5.1 Hypotheses tests: Agrarian Change is Driven by the Co-Evolution of Land and Labor

This study was undertaken with the purpose of applying an institutional economic framework of path dependence to agrarian changes in the Thai rubber economy. The important findings were that co-evolution of land and labor were the key determinants to drive an agrarian transformation in the rubber economy. The results also clearly showed that government policies and the market played a key role in shaping and constraining path dependence of agrarian transformation. One of the main contributions of this study was to show the process of agrarian change in the rubber economy by demonstrating institutions' embedded agrarian change through a self-reinforcing mechanism. Three hypotheses were tested against key drivers of agrarian change in the rubber economy.

In the first round of research, the study focused on household data and statistical analysis. The study also looked at qualitative data analysis around these hypotheses. The results were empirical evidence from statistical analysis and the standard narrative to support and test hypotheses. The first hypothesis (5.1.1) was accepted by empirical evidence in Chapter 2. However, the important evidence was: 1) labor availability had evolved overtime and 2) wage contracts had applied to challenge share-tapping even it had failed to expand.

The second hypothesis (5.1.2) then had to be rejected or might need to be refined for testability and accordance with evidence to be obtained from the study findings. In the second round of research, the study focused on the simple correlations between land and labor contracts and their interrelation that might play as a key driver that affected the structural change and history of agrarian society. Empirical evidence from path dependent analysis were combined to test these hypotheses.

The third hypothesis (5.1.3) was accepted when the study results showed that there was a strong relationship between land polarization and stability of share-tapping. The main hypothesis was finally accepted by accepting three hypotheses. The following are further details in the hypothesis test.

5.1.1 Landownership polarization

The first hypothesis was "There is polarization of landownership: farm size of the smallholding is decreasing when some owners are increasing land accumulation leading to land concentration" verified by combining multivariate analysis and a systematic clustering technique. The study identified six significant farm trajectories from 1990 to 2010 (Chapter 2). The results showed that around 26% of the observed farms followed a pathway of land accumulation (Table 5-1). They belonged to one of these three types of trajectories: growth of large family farm enterprises, growth of medium family farm enterprises, and transformation toward patron farms. The farmers in this direction were characterized by increment of size and intensification. Using the method of systematic clustering, the study could characterize growing farm pathways associating with the increase of landholding and use of hired labor.

Table 5-1 Average landholding, landholding changes and distribution of landholding according to the six farm trajectories

	Toward increment of landholding			Downsizing landholding		Stable holding
	TR1	TR2	TR3	TR4	TR6	TR5
Number of farms (%)	4.1	14.5	7.7	10.5	25.0	38.2
Landholding in 2010 (rai)	151.8	45.0	28.4	24.9	7.5	14.6
Landholding in 1990 (rai)	119.4	35.5	25.5	74.3	10.1	14.1
Changes 1990/2010 (%)	+27.1	+26.8	+11.4	-66.5	-25.7	+3.5
Proportion of landholding in 2010 (%)	24.8	26.2	8.8	10.4	7.5	22.3

Remark: 1) Change 1990/2010 = (landholding in 2010 –landholding in 1990)*100/ landholding in 1990
2) Proportion of landholding in 2010 = total land of group*100/total land of 220 samples

The results also provided strong evidence that a large proportion of farms (around 35%) experienced a significant decrease in landholding. Two types of trajectories had been identified: high structural change of farms, where large farms become smaller and declining very small farms. The use of hired labor had sharply declined or they used only family labor. Another group of farms still remained on a stable trajectory. This group represented 38% of the famers observed size and farm labor forces that both remained stable. However, many farms in this trajectory have serious limitations for incrementing size and present more vulnerable livelihoods. Thus, the study concludes that the first hypothesis is accepted. The results strongly suggest that these trajectories corresponded to the bimodalisation theory of "the strong getting stronger" (Iraizoz et al., 2007).

This study highlighted the role of government policies influencing the polarization of the Thai rubber economy. Government intervention induced the observed transformation through policies promoting extensive rubber production and improving productivity through the replanting scheme. Government policies applied to all farms, but they intentionally tended to favor large farms.

These policies had increased profitability of farmers' investments in intensification and reduced risks for the farmers and then further simultaneously pushed them into an approach of intensification and capitalism.

Using a path dependent theory regarding the mechanism of polarization, the study identified some core factors: land accessibility, resource endowment, market factors, institutional factors, and individual response to the government policies. It is useful to have a discussion based on path dependence. The results provided evidence that policy for promoting new planting in new land had profound effects on farm polarization when farms had significantly different sizes of landholding since the time of settlement. In absence of regulations, settlement on unoccupied land depended on local customary rules, farm characteristics, capital availability and cash economy commitment. Chinese, Sino Thai, and local governors who had shown capital availability and business orientation often claimed large holdings of unoccupied land or were able to purchase the cheapest cleared land. All of them were pioneer settlements in new land. They came to the new lands with a Chinese network, new technology, and capital. Most of these lands were devoted to rubber plantations, which were considerably more profitable than rice. The operation of farm enterprises brought capital accumulation and further stimulated to increase land accumulation. Owners of large farms responded more rapidly to government policies and markets than local people and thereby took advantage of the policies and their implementation.

Thais and partly Sino-Thais usually claimed smaller sizes of unoccupied land (around 8 ha per household) in new land or state land. Population pressure had raised land constraints in paddy field areas and were associated with high rubber price that encouraged them to move into new settlements. The size of landholdings depended on available family labor, clearing technique, and their settlement network. An underpinning reason was the technology of clearing land which initially depended on simple hand tools that had limited effectiveness. The settlements usually claimed small amounts of unoccupied land on the edge of conservation areas or in state land. Intergenerational land transfer was passed down to many family members beyond their economic need. Family farms operated that of landholdings for a better option in traditional agrarian society regardless of productivity and economic scale. They transferred small amounts of plantation with low yield. High diversification in the manner of production systems dominated family farms before intensive production was developed through promotion and grants by the replanting scheme. Consequently, large deforest (new land) converted into rubber highlighted the success of the government policy, but the disparity of landholding was less

recognized by the government. The government policies had quickly withdrawn subsistence production, low economic activities and diversification toward modernized production. It was likely that the policy agenda had been supposed to liberalize policies. Small farms were faced with constraints by local institutions, new technology, capital, and bias of policy implications. The government policies were a privilege of the owners of large scale planters. This evidence indicated that the government policies were unable to differentiate among farm logics brought about the root cause of farm polarization.

Due to farm heterogeneity and limitations of the replanting scheme regarding budget, planting material, and official staff, the replanting scheme has been relatively biased toward large farms and farm enterprises since 1961. The implementation of the replanting scheme was expected to encourage its extension and diffusion into small family and very small family farms. There had been a technological spillover from large farms to small farms. In fact, the adoption of high yield varieties was expanded by large farms before the replanting scheme developed. The replanting scheme delivered much more benefits and suitable conditions for increasing profitability so that it could increase farms capacity to expand.

Problems facing small farms were small size, scarcity of capital and fragmented information and knowledge about proper technology. They thus did not adopt quickly and extensively to the replanting scheme. It was associated that the replanting scheme had been facing limitations of budget, staff, new planting materials and service areas. These pointed out the delayed implementation of the scheme for small farms. Until the rapid replanting project implemented during 1977-1990, the replanting scheme was achieved to promote massive replanting for small farms. Therefore, when small farms widely adopted the replanting scheme, large farms had reached to shift profitability and new levels of income, which could be advantageous to continue a capital-led expansion. For small farms, the delayed replanting might have further limited their restricted capital accumulation's capacity and was an important challenge to increase farm size. The trend of price slowdown and arising land scarcity since the early 1990s were important constraints either to treat farm expansion or sell up their landholding. Through the replanting scheme emphasizing new technology productivity and mono-specific plantation, caused small farms to become more dependent on rubber with small size activities, a situation to prove that small farms experience a more vulnerable livelihood to rubber price fluctuations and falling prices.

The government realized that vulnerable livelihoods were increasing in small farms, and therefore implemented price support and market policies attempting to stabilize farm income and modernized the rubber market during 1991-2002. The government has consistently prioritized public investment to target the modernization of markets and to promote cooperatives and farmers' groups. Large farms moved to integrate their related businesses (middlemen and primary rubber processors) with modern markets while cooperatives were formed by small farms

to conduct their marketing functions, to be a means to participate in modern markets and to benefit from the government provision. Small farms had been struggling in situations for improving livelihoods and restricting productivity. Large farms went beyond to expansion in the size and farm business. In these cases, the government policies were rather neutral to polarization, yet they did not contribute to reverse polarization.

Moreover, the results of trajectory analysis showed evidence that local customary rules governing inherited land also played an important role in the continuity of polarization. Land was equally transferred among family members, which had led to a progressive sub-division of land regardless of whether the son/daughter had non-farm employment or whether the son/daughter would be dependent upon farmland.

In some cases, inherited land was subdivided with the larger share going to the elder son or last daughter while other sons/daughters shared equally. If elder parents were likely to be more dependent on familial care, they consequently might wish to transfer a higher share of land for their land to sons and daughters who could be expected to provide care. The inheritance of land with sons dominating was particularly observed by Chinese and Muslims. This was an intergenerational transfer of land which primarily involved ethnic and religious lines. One of the strategies for land inheritance that people adopted was that land inherited was given to family members by parents at the end of their lives. Most family farms, very small farms and patronal farms now were recipients, which generally had been in a better position to receive inherited lands. Thus, the traditional inheritance system governed the size of landholdings passed down to next generation which further caused a rapid reduction of landholdings between intergeneration in trajectory of family farms and very small farms. In contrast, the "*Kong-si system*" embedded on family farm enterprises in which all of landholdings were owned by representative landholders in the family who were parents or elder sons/daughters. Success of family enterprises further reinforced the kong-si system to embed family share-landownership to be favored increasing for land consolidation. There was an important local institution enforcing the growth in large farms. As below, the study summarized two opposite directions in farm polarization.

Farm polarization: directions, processes, and the impacts of farm change

The analysis showed strong evidence that farm polarization continuously developed during 1990-2010, presented by the groups of farm trajectories moving in opposite directions: 1) trajectory of farm growth and 2) trajectory of farm decline. The first direction included the farms which continued increment of landholding and the use of hired labor, characterizing a trajectory of farm growth. Structural changes were varied and depended on resource endowments, capability, farm strategy, institutions, and characteristics of farmers. It can be interpreted that there was a set of rules embedded in, and constrained through thought, behavior and activities

pursuing either increases in the size or decline. The study claimed that each of the farm pathways illustrated the different set of rules governing trajectory of changes. Most farms in the trajectory of farm growth had an original large size and more capability for improving productivity and enhancing farm enterprises including strong attempts at farm expansion. A large farm size, technological accessibility, more information and their networks allowed them to have a better position to take advantage from policies and the government provisions. These farms also presented a high response and capability to capture benefits from government intervention, reflecting a competitive structural condition.

The government interventions therefore helped to reduce costs of production, increased accessibility to technology and markets, and reduced farm risks. Farm enterprises thus became the expression of investment in intensification and continuity of land consolidation that set in motion a growing farm structure. The results showed that most large family farm enterprises were already large and highly capitalized before 1990 and thereby continued to grow. They started with a large size of unoccupied land, a progressive technological use, improving productivity, efficient share-tapping contracts, and capability for enhancing farm enterprise, obtaining structural and conditions that created convergences between intensification and extensification to drive the growth of farm structure. Traders and businessmen were established to serve farm businesses regarding large volume, value of production and profitability. Many farms were found to have very impressive growth toward rubber product industries and other businesses in the non-farm sector. This implied the important roles of capital accumulation, investment, productivity and continuation of increment size to achieve the growth of large family farm enterprises.

Another important pathway was medium family farm enterprises in 1990 moving toward large family farm enterprises and continuation of growth. Farms often began with a medium amount of inherited land and later showed a large amount of purchased land during 1990-2000 that grew toward large family farms. The establishment of farm enterprises before 1990 was made to increase profitability and raise capital accumulation and then stimulate land consolidation. Similarly, these farms grew through a mechanism of capital intensification, capital-led extensification, and their synergies. Their related businesses mostly developed after 2000. The achievements of related businesses in these farm enterprises were subject to an impressive development of the rubber market and the growth of rubber product industries which provided better amenities and conditions favorable to the growth of rubber enterprises. In the period of the rubber price boom, farm enterprises still grew due to greater profits generated from both plantations and their related businesses. These farms have foreseen to expand their farm businesses into new areas where cheap land was available.

Furthermore, government policies also were a good explanation for the trajectory toward medium family farm enterprises. Farms had been growing depending on the medium amount of

the original landholding and soon came from intensification in production. Farms started with either a medium size of unoccupied land or inherited land and later grew through consolidation of purchased land. Most medium farms continued to grow within the structure and characteristics of medium farm enterprises. During 1990-2010, a moderate increase of landholdings relied heavily on either recent inherited land or profitable growth which enabled them to increase the capability of purchased land. Success of farm enterprises was an important factor affecting the growing farm structure. As well as this, their related businesses involved middlemen and processing productions was a great impact on the growth of farms during 2000-2010. The family life cycle and the feeling to have sufficient needs were rare, moving toward large family farm enterprises as these farmers said they did not want to become a large family farm enterprise. Ultimately, this impressive farm growth was characterized by family farms growing toward medium family farm enterprises. The farms were family farms in 1990 and substantially grew toward medium farm enterprises during 2000-2010. These farms were found to have a dramatic increase in landholding through a large amount of purchased land. Farm enterprises and their related businesses were established during the 2000s which certainly was favored to sustain their growth.

In an opposing direction, some farms were declining or had potential to decline which were characterized by three trajectories: declining very small farms, high structural change of farms, and stability of family farms. Two trajectories projected considerably: “larger becoming smaller” by trajectories of high structural change of farms (TR4) and “small getting very small” by the trajectory of declining very small farms (TR6), of which had a continuing decline in size. Some farms underwent the trajectory of stable family farms also could be grouped into this direction regarding potential decline in the traps of size and vulnerability of livelihood. The farms in TR6 were currently themselves more likely to belong to poor families compared with others. The study showed that a large number of farms were projected downward into very small farms and family farms including observations of leaving the farms, i.e. family farmers may leave the farm moving to the non-farm sector. There were various patterns of farm changes regarding to constraints and barriers they were facing.

Undergoing the pathway of larger becoming small (TR4), the farms were medium or large farm size in 1990 and had rapidly downsized into family farms or patron farms in 2000 or until 2010. The starting of medium or large farms suggested that they could take advantage of policy for promoting extensive rubber in new land. There had been no doubt that there were hardships and the failure to achieve structure and characteristics of farm enterprises to force them down through adoption of farm strategy relying on selling land. It was associated with unintended consequences and challenges due to price falls, new compound socioeconomic pressure and new living costs in that rapidly developed during 1990-2000.

In situations where farms owned relative large amounts, the farms had chosen a better option of selling land regardless to considering impacts of the reduction of farm size. The belief was that income generated by selling land would overcome constraints and financial stress, even it could not be fully offset. High debt, which mostly came from the needs and specific socioeconomic conditions increasingly put pressure on declining landholdings even though the rubber price increased during 2003-2010. In addition, high land price also encouraged the farms to draw on selling land. The study argues that often declining landholdings would not happen if there was an establishment of farm enterprise and sustainable intensification as in other large farm enterprises. In some cases, when landholdings were transferred to a family member, the larger farm became a patron farm in the study time. “The effect of farm lifecycle” graphically explained the rapid reduction of landholdings. Generally, landholdings were divided equally and passed down to family members. A particular plot of rubber land was held for financial needs during retirement or old age.

Pathways of small getting very small and stability of family farms, historically, a small size of unoccupied land had to be owned by the settlement generation. Dramatic reductions of landholding between generations was high. Inherited land appeared only to access land. Altogether small size farms and delays to participate in the replanting scheme was a serious threat to farm transformations into farm decline. The important consequences were that small farms could not raise productivity or reduce cost of production faster than falling prices during the late 1980s - the early 2000s, they could lose their income and be more vulnerable with the lowest capital accumulation and low intensification. These forced them either to keep the stable size or slightly decline in size.

When small farms began to generate income from high yield clones, rubber prices dropped. Productivity shift (high yield) helped them to cope with low rubber price during the 1990s. Generally, small farms had less ability to adapt to falling rubber prices than large farms. In parallel, the period of 1990s ushered in a time of high economic growth and rapid development of the non-farm sector, consequently considerably exposed the rising cost of living. Financial stress and socioeconomic pressure were increased, a situation which small farms might be less able to deal with these situations. Small farms fell in situations where new income generation had been in proportion with the rising new costs of living. Cash incomes were generally used for household expenses and educational fees. These situations also caused widespread technology adoption, for example, farmers used a high tapping system and omitted fertilizer application. They would have to maximize returns from plantation in order to overcome increasing costs of living.

Under such conditions, vulnerable livelihoods explained the stable or declining trends of landholding. Land parcels was sold to earn specific incomes, which would help to cope with financial stress and pay off their high debts in the short run. Other adoptions of farm strategy

were greater exploitation in their plantations and a large size of off-farm activities with share-tapping. It seemed that small farms would choose a better option from farm resources that was available.

Regarding land pressure, this has been forced to push young labor into moving out of farms. Family laborers also may become more involved in non-farm activities. If a farm had undergone a trajectory of declining to a very small farm, these farms became tenant farmers and hired laborers that were available to offer a supply of tapping laborers for share-tapping employment by farm enterprises and patron farms. Some of them may have left farming and entered into the labor market in local non-farm employment or migrated to cities depending on comparative wages, working capability and employment opportunity.

In the pathway of family farms, the small farms became more vulnerable to social and economic changes and so on. Typically, rubber was the main source of livelihood as dependent rubber production. With regard to no change in plantation technology, household income was determined by the farm size. The current small scale could earn sufficient income for living costs and children's education fees. Little money was saved as frequently cash was invested for children's education and coping with accidents or illness. This was certainly a situation those already under severe financial stress. Non-farm activities were either part-time jobs or similar occupations that gained both maximal utilization of labor and income diversification. Non-farm income was found to contribute increasing to small purchased land (by some cases) and improving productivity. Young laborers who were in non-farm employment donated money to support the small purchased land and to invest for improving productivity in plantations. The 2000s, price boom had crucial effects on the overall rubber economy. Household incomes had risen at a faster rate than those of other crops. Small farms also reflected a better livelihood, increasing investment for improving productivity and expansion of new planting in their owned marginal lands. Thus, the study found that small farms were trapped in a position of low productivity farming and high vulnerability to the risk of falling into poverty and farm decline.

The analysis revealed that the policy approach seemed to seek the right mix of liberalism in which had been successful transforming to a higher level of productivity, but it failed to overcome market failure in landholdings. The government policies did not realize polarization. Policy makers did not consider measurements for reversing polarization that was necessary for the development of the rubber economy. The predominant disparities of landholding were overlooked by the policy makers. Even the government tended to give importance of small farms since the 1990s, but policy remained neutral to polarize.

The government had shown flexibility to change policies in response to consequences of changing socioeconomic, political circumstances, and situations in the world economy. This was one of the causes of the neglected policy for polarization as well as difficulties arising from

political pressures. The structure of policies and their implementation were seen to deliver favorable conditions and to be able to capture large benefits to farm enterprises. Under such conditions, there had been achieved a more easy concentration of landholdings with farm enterprises. The high yield might be achieved to increase profitability and reduced risks to farmers on price, but it was much more difficult to reinvest for expansion of landholdings.

The size of small farms currently just offered people a better livelihood. Looking forward to the future of small farms, if the government does not intervene, this can be foreseen that family farms will largely move into very small farms, high adoptable non-farm activities and will be moving out the farm sector. The government therefore will reconsider the current policies and should draw policies with a wider approach for small farms and family farms. There are likely to be fundamental problems with declining farm size of small farms and concentrated landholding by medium and large farms, if the government does not implement an appropriate policy. Therefore, farm polarization is driven by path dependence of policies. The challenge to rubber development is how policy thinking to address what the future of the farm economy needs.

5.1.2 Stability of share-tapping arrangements

The second hypothesis stated that ‘‘apparently, there was no significant change in labor availability because institutional arrangements in share-tapping had never been challenged’’ was needed to be refined according to the study finding. The analysis provided strong evidence that both labor availability and share-tapping arrangements had evolved overtime. Labor availability in terms of number and quality of laborers had evolved over the study period. The number of the farm labor force had decreased while an increase in the number of foreign labor was observed. There was a long-term trend of declining labor force participation in the farm sector. Quality of labor also had declined considerably. However, this study showed that the rubber farms never stopped producing rubber because of a shortage of hired laborers. This was because share-tapping was a more flexible arrangement to cope with variations in labor availability and other constraints. These resulted in the prevalence of share-tapping over other contracts. The share-tapping contract had persisted as the main contract arrangement if it was unique for tapping labor. The study also showed important evidence that wage contracts were applied in the study area in 2009 and then ended in 2012. This evidence indicated that share-tapping had been challenged by wage contracts even if it failed to expand widely. This also was important evidence to demonstrate institutional lock-in of share-tapping. Current share-tapping arrangements continued to manage to ensure that hired laborers were in adequate supply for farm labor requirements. Benefits were efficient contracts, productivity, and social values.

The owner contracted out tapping tasks to share-tappers through informal agreements. Output sharing varied from 50% to 70% for the owners with the share-tapper getting less than or equal to 50%. A principal rule was more than 50 percent going to the owners and less than 50

percent or equal to the share tappers. The rubber owners should earn more than 50 percent of output or gross sales. The gap of output sharing would fully reflect an influence of the different embedment of rules taking place in each of the contracts. The conceptual framework of share-tapping illustrated that contract actors were the rubber owners who wanted to employ the right hired laborers to tap his rubber trees, and hired laborers who were skilled, specialized and high quality laborers. The results of the path dependence showed strong evidence that share-tapping found no significant changes and no reactive sequences to trigger its reproduction. Share-tapping was an effective contract to exploit availability of hired laborers with a high resilience to variations, risks and uncertainty.

The studied results highlighted that labor contract arrangements had been locked-in in the form of share-tapping contracts since the introduction of rubber plantations. The original set of rules establishing share-tapping was 50:50 of output shared between the rubber owner and tapper. Today the set of rules consists of 70:30, 60:40, 65:35, 55:45, and 50:50. The occurrence of 70:30, 65:35, 60:40, and 55:45 could be related to constraints and consequential events with creating new rules or its modification before deliberating of ongoing acquisition into the new set of rules. The set of rules was changed or triggered by new technology, resource endowment, new social conditions, new economic behaviors, policy, etc. For example, during the introduction of new technology (high yield), 60:40 and 55:45 share-tapping were developed. Cost sharing applied, if 50:50 share-tapping was chosen. New share-tapping was fully adopted for modern plantations because the remuneration was relatively high compared with unit of area of low yield. The formation of 60:40 share-tapping strongly related to high yield, high cost of production and modern plantations. Then, the high cost of production was a key factor to raising cost sharing rule to apply with 55:45 and 50:50 share-tapping. 70:30 was adopted regarding to falling price, new source of labor, high cost of production and new source of risks. These also indicated that the set of rules were flexible adoption, adjustable in specific conditions, and appropriateness when people encouraged social forces to make appropriate decisions for changing a particular rule in response to new environments or changing circumstance.

Thus, the analysis revealed that the resilience of share-tapping was high. The resilience of share-tapping is the adaptive capability (flexibility), which can be considered as the ability of a contract to deal with challenges and providing an appropriate response to the changes that they are faced with. Once any elements of a set changed to react to the challenges, share-tapping could bounce back by rearranging their institutional structures or re-orientating new rules to acquire their structures in order to maintain or improve its pre-change state. The evolution of contractual arrangements and the resistance to extensions of wage contracts during 2009-2012 were crucial to shed light on resiliency of share-tapping arrangements and its institutionalization.

The study found that because the set of rules governing contractual arrangements have been consistent and coherent in the behavior and actions of actors, confirming patterns of rule-

governed contractual arrangements as stated by Hodgson (2004) that the rules not only depended upon human activities but also constrain and mold them. For example, the set of rules of 60:40 share-tapping was often performed by family farm enterprises, representing coherent rules in that of a set of rules relying on business goals, while the 50:50 was considered an emphasis on more social values. The rubber owner had employed the same types and arrangements of share-tapping because the rules were socially constrained. This also very well explained the application of 50:50 and 55:45 share-tapping in the remote villages. This share-tapping was employed by farm enterprises who had fallen into the goal of financial return, and then the 60:40 was extended with difficultly.

The analysis of path dependence provided a useful explanation for why share tapping arrangements had prevailed and still was prevailing by three causes of self-reinforcement that could be highlighted as follows.

The first cause was economic. Share-tapping was reproduced through rational cost-benefit assessments for mutual benefit of the party and society. Share-tapping gained both cash return and non-cash in terms of social value and social welfare. Potential profit and relevance values were outweighed by the cost that led to reproduce share-tapping. Hired labor was a major cost in productive plantations. By linking the cost of labor to the value of the output, share-tapping arrangements protected owners against the rising costs of labor when either prices or yields dropped. As indicated above, the various set of rules ranging from 70:30 to 50:50 could relate to the economic conditions of the farms. Often farm conditions of 60:40 share-tapping showed large tapping size and high yield might caused an increase in incentives of hired-tappers at remunerations that could stimulate the supply of hired tappers as their demand. The lowest labor cost was 70:30, but it was difficult to apply when monitoring cost and risks were high. 60:40, 55:45, and 50:50 were appropriate share-tapping rather than maximizing returns of 70:30 and 65:35.

The second cause was the socioeconomic function of share tapping in serving the needs of actors and social dimensions. Functional consequences generated by share-tapping were adequate supply of hired laborers, resilience of contractual arrangements and against the risks and uncertainty including earning non-economic values. Functional consequences caused the reproduction of share-tapping to serve the overall social structure and system. When people learned the beneficial effects accounting for system functionality, this led to further reproduction. Social members realized that tapping was the most important task that needed to be done by hired tappers with requisite skills, availability, high working effort, self-supervision, and honesty. Hired laborers were responsible for several tasks from tapping, collecting, processing, and marketing, including farm maintenance. Tapping often started at midnight with working hours of about 6-12 hrs. per day. These were extreme conditions compared with other jobs. Working conditions made fatigue higher and the need for special attributions for accounting the

valuable production. They were significant practices affecting productivity, return, and long-term productive years. To recognize the important relevant functions, it was reasonable that rubber production was contracted out with share-tapping that could further recruit adequate quality hired labor with high remuneration.

When the rubber owner had dealt with hired tappers, share-tapping can be interpreted as the share of resources between those who owned those of surpluses and deficits. It also embodied economic activities and social interdependence that thus would be able to increase social benefits rather than purely maximizing for the individual. Another crucial point was to recognize non-cash income. Share-tapping gained strong social value to the rubber owners in terms of perceived generosity and kindness, and rubber owners would enjoy much more respect and high social status. Higher social status in turn increased potential economic opportunities and benefited the growth of related businesses and also helped to anticipate any negative consequences and suffering in the future. Typically, the rubber owners would measure those returns in terms of local political power and status of a rich man with generosity and good standing. Thus, there had been an increase of social welfare and gaining of social value to the rubber owners and people.

Regarding the rapid change in the context of social and economic development and a tendency to decline social relations, share-tapping had adapted to form new sets of rules which gave rise to changes in common practices that would eventually become part of traditional share-tapping. Each set of rules did not imply static rules nor did it prevent or bargain for adaptive rationality. Resiliency of share-tapping was high and this could vary considerably on matters of social and economic changes. Adaptive capacity of share-tapping had proved their suitability, functionality, and appropriateness of contracts to respond and adapt to the conditions that they were facing. When the social members had perceived their functionality for society, share-tapping reproduced and in turn it could enhance the ability of share-tapping to perform a useful function. Therefore, if share-tapping had been less functional in the long term than other contracts that could had been developed, share-tapping still continued to be institutionalized because of their functionality for the rubber economy.

The third cause was legitimatization. Share-tapping was institutionalized because actors believed it was morally just or appropriate. Using a legitimating framework as Mahoney's notion (2000), the study considered that institutional reproduction was related to actors' subjective orientations and beliefs about what was appropriate or morally correct. Once a given institution was selected, it would be reinforced through a process of increasing legitimatization. This process was marked by a positive feedback cycle in which an initial precedent about what was appropriate formed a basis for making future decisions about what was suitable (Mahoney, 2000). Under this legitimating framework, share-tapping was reproduced because of its legitimacy.

In order to understand how the process of increasing legitimatization works, it could be imagined that when the first plantation was established, which had presented new technology and no availability of tapping labor by local people, the tapping needed to be done by special laborers who had experience in the plantation mostly consisting of migrant workers from Malaya. The rubber owners had to use labor but it brought some difficulties, especially high and complex monitoring, supervision costs, new technology bargaining and so forth. This situation laid down the advantages of share-tapping where the remuneration depended upon the output or gross sale. Hired-tappers were motivated to maximize their work outputs. The rubber owners could manage their plantations without either losing their control over the landownership, weakening their contractual powers, or diminishing their capacity to intervene. It was associated with the Kong-Si system persisting in Chinese families, which was contingently selected in share-tapping.

The first Chinese planters believed it was legitimate when share-tapping could increase morality and incentives for work enabling the hope of improving the return. These were the conditions that encouraged the selection of share-tapping. Once share-tapping was adopted, it has continued until the present. Throughout all transformations of the rubber economy, share-tapping continuously worked to offer an adequate supply of labor combined with gaining knowledge, having experience, improving productivity, and getting mutual benefit in the long-term, which had led to its reproduction. Share-tapping shown flexibility in the forms it took over time which still achieved adoptive arrangements of share-tapping in response to the change of the social and economic context. This evidence helps to confirm that people still believed in the legitimatization of share-tapping, reflecting increasing legitimacy.

Ultimately, although wage contracts were employed to challenge the institutionalization of share-tapping in 2009 and later they did not continue any more in late 2012. This was important evidence which was considered a critical juncture caused by contingent events to reverse institutions of share-tapping. Wage contracts were used by medium and patron farms. Higher economic return coupled with a decline of social values caused to widely perform with wage contracts, but it did not succeed in leading to reversing the institution of share-tapping. The falling rubber price affected the cost of labor and risks and uncertainty in production. Labor costs substantially increased. The rubber owners also faced shrinking and difficulty to raise working efforts and self-supervision. A reactive sequence took place through the pressure from people that would maintain social values and social networks. These forced the rubber owners to return to share-tapping. People realized that the long term wage contracts were less functional, less economically viable, and less legitimate. This evidence demonstrates that the stability of the institutions of share-tapping can be explained not only by the fact that this arrangement was never challenged, but by the fact that they are path-dependent through mechanisms of self-reinforcement and reactive sequences.

5.1.3 Land polarization reinforces the stability of share-tapping contracts

The third hypothesis “Land polarization reinforced the stability of tapping contracts” is accepted. Because of polarizing response, there was an increasing demand for the hired laborers and growing supply of qualified tappers coming from the farms in trajectory of farm decline. More landholding needed to exploit more hired labor. There had no evidence about the shortage of hired labor in the farm enterprise. Land polarization had a positive effect on the persistence of share-tapping contracts to recognize the most important reasons in verification of the second hypothesis.

The analysis found that the large farms perceived the important roles of share-tapping in term of availability of laborers and efficient labor contracts. Intensification and extensification caused them to be lock-in with share-tapping. Share-tapping was a tool to exploit supply of hired laborers which could recruit from both hired laborers and a growing number of small farms (trajectory of declining very small farms), which had more available labor to compare with landholding. The share-tapping adoptions were essential to increase a farm’s capacity for enhancing land concentration, when profitability remained. This evidence proved the connection and relationships between land polarization and its reinforcing of share-tapping.

The results also provided evidence of relationships between farm types and share-tapping adoption. 60:40 share-tapping was commonly performed by family farm enterprises while 50:50 was employed for general farms, who presented a variety of conditions. During the period of low yield plantations, larger farms had to use hired tappers paid by 50:50 of share-tapping. Often the small planter worked as a tapper for someone else while land was cleared and planted. This indicated the relationships between large and small farms in terms of employment where ties and culture had been important in an agrarian society. Toward the trajectory of farm growth, increased land concentration made them lock-in with share-tapping of which a situation proved by the analysis of path dependence. Moreover, there was no doubt that government policy was never concerned to regulate share-tapping and this was considered one of the important factors to cause lock-in of share-tapping. Thus, there was plentiful evidence indicating that land polarization was strongly related to lock-in of share-tapping and thus the third hypothesis is accepted.

5.1.4 Co-evolution of access to land and labor

The acceptance of hypotheses 1 and 3 and the refinement of hypothesis 2 led to accept the main hypothesis that “Simultaneous co-evolutions of access to land and labor relationship are key drivers of agrarian change taking place in the rubber economy” The study found evidence of institutional lock-in of farm polarization and share-tapping with respect to agrarian change. As in the above discussion, the first hypothesis was proved through the results of farm trajectory

analysis. Farm polarization was characterized by the direction of increasing land concentration and in contrast landholding was decreasing. The second and third hypotheses were accepted through the results of share-tapping analysis. This also provided evidence of share-tapping's evolution and arrangement. Therefore, the co-evolution of land and labor relationships took place in social and economic development in a rubber agrarian society. The analysis of path dependence showed strong evidence that government policy and market forces were key factors to determine the co-evolution of land and labor. The results of path dependence provided strong evidence to confirm the acceptance of three specific hypotheses and followed acceptance of the main hypothesis.

5.2 Development of An Analytical Framework and Methods for Farm Trajectory and Path Dependent Analysis

An important contribution of the study is the development of an analytical framework and methods for analyzing farm trajectory and path dependence. Combing multivariate analysis and systematic clustering techniques developed in the study is an advanced tool for assessing and understanding the process of farm change, drivers, directions, and deterministic patterns. This also expands the applicability of multivariate analysis to the analysis of farm trajectory. Using a path dependent theoretical framework, the study contribution is to develop an analytical framework of path dependence to apply to the rubber economy's context and circumstances. The analytical framework developed in this study is a practical tool that presents some advances and subsequent empirical research. A better knowledge of institutions at micro, meso, and macro levels, and their interrelations also results from the analytical framework developed.

5.2.1 Combining multivariate analysis and a systematic clustering technique for trajectory analysis

Because of little documentation related to a systematic study of trajectories in farms up to now (Rueff & Gibon, 2010), the study began by looking for appropriate methods for analysis of farm trajectories and went further by developing formal procedures regarding how to interpret the statistical results. 57 variables presenting farm changes and deterministic patterns from a 220 of households sample were selected. A three-time step of analysis was conducted by using initial, intermediate, and final years to identify and characterize longer term dynamics of change, process, and deterministic patterns. It also allowed us to generalize links between stages of farm change. The case study had shown that the statistic results presented applicability and goodness of fit for identifying typology of farm trajectories and assessing amplitudes of change.

However, this type of statistic result was not sufficient to explain the dynamics of farm change and patterns of relations among initial, intermediate, and final years. This was not an error in the application of the method but an inherent problem linked to the applicability of

multivariate analysis to build characteristics and dynamic processes of change. In order to overcome this limitation, a systematic clustering technique was useful for identifying patterns of change and providing a dynamic view of change based on the relations between the three-time steps and the pathway of each individual farm followed. Combining multivariate analysis and systematic clustering has been shown to be robust, reliable, and provide valid statistical results. These methods thus appeared to have potential on the generalization of farm trajectories and agrarian transformation, but it has limitations.

The nominal scale of the use of hired laborers and changes in the size provided some limitations attached to the systematic clustering method. For instance, patterns of 2-3-3 were grouped into the difference in the types of farm trajectories. Three out of seven farms were grouped into the trajectory of toward patron farms, and four out of seven farms were grouped into the trajectory of high structure change farms. Size and the use of hired labor grouped the farms into characteristics of patron farms. Amplitude and its pattern of change in scale and labor discriminated the farms into the different trajectories by multivariate analysis. This was the proof of applicability of combing methods for the analysis of farm trajectories as per the previous discussion. However, the methods might present some limitations related to the study objectives that focused on trajectories of rubber farms in which the analysis relied on data collection in respect to long economic life span of rubber plantations. Data related temporal structural change depended on the memories of households and the length of time of that sequence events occurred, which obviously affected analysis of individual farm trajectories.

Considering analysis of farm change in the long term, physical variables were valuable, reliable, and applicable for analysis of farm trajectories. The limited set of variables related to land, labor, and demographic data showed sufficiency for providing the significant farm trajectory. These variables also could be precise collecting data throughout tracked back of family history. An analysis of farm trajectories might increase a capacity for assessing the complex dynamics of individual farms, if money value variables are included such as incomes, wages, and production costs. These factors were not examined in this analysis because assessing money value variables in the past rarely provided reliable data, it needed to reduce inflation, and included them with identification requirement of relevant indicators, i.e. reliable indicators that were easy to measure, which was beyond the scope of this study. The two methods enabled to account for the robustness and reliability of the results. Combining methods appeared to have a capacity for assessing the complex dynamics of individual farm trajectories and their temporality of changes at time-step. Rather than a statistical analysis, field interviews were performed in the representative samples of farm trajectories. These were certainly made capacity of interpretation with real farms not only by the statistical results.

5.2.2 Toward development of analytical framework of path dependence

Path dependency is an important method for political and social analysis (Thelen, 1999; Mahoney, 2000). This method emphasizes a path dependent process for analyzing the major outcomes of social and economic development. Farm trajectories are the outcomes of a path dependent process defined by a critical period in which contingent events have influenced to govern subsequent events and patterns of change (Mahoney, 2001). The trajectories of change is up to a certain point constraint of the trajectories after that point (Kay, 2005).

Path dependent analysis aims to explain institutional lock-in of polarization and share-tapping in the rubber economy. The study began to follow the analytical component of path dependence as a notion of Mahoney (2001). The series of sequential analysis were: 1) antecedent conditions, 2) critical juncture, 3) structural persistence, 4) reactive sequence, and 5) outcomes. Building research experience relied on this analytical framework, the study found that there was some difficulties to interpret and had less capacity for assessing path dependence. The main reasons were constraints in data and documents related to the history of the Thai economy, social and economic development, rubber economy, and related literatures such as the world rubber economy, global politics, trade, etc. There had been complexity and inter-consequences between the Thai economy and global changes. The second was the limited criteria or properties for identifying and assessing critical junctures, contingent point, and reactive sequences. Typically, the reactive sequence did not present to characterize path dependence in the case study. Thus, five analytical components of path dependence in this study were developed: 1) identification of policy structure, rubber development, relevant sequent events and the world rubber market, 2) initial condition, 3) critical juncture and contingent point, 4) institutional setting, 5) self-reinforcements, and 6) outcomes.

First, the study began with a review of the literature related to the history of the Thai economy, social and economic development, agricultural development, history of rubber economy, etc. This analysis was not only focused on the importance of the rubber economy but also on the whole agricultural development and national plan for social and economic development including what/how the world market and international interventions had influenced Thailand. The study also reviewed documents related to the history of the world rubber economy, global politics, trade, international intervention, and the history of the rubber economy in other rubber producing countries (Malaysia, Indonesia, and Sri-Lanka), etc.

In doing this, this stage thus relied on an historical approach and factual analysis was performed. This stage intended to depict a broad rubber development and policy structure and a long history of the rubber economy. It also contributed to identify and understand the property and characteristics of sequence events, sub-sequential events, and their impacts. These were intended to identify and assess policy structure, policy change, their impacts, and the occurrences

of events affecting deterministic patterns and potential subsequent events. As a result, the study could identify the period of policy structure, implementation, important sequence events, and consequential events to draw on the path development of the rubber economy.

As detailed in Annex A, six periods of change were obtained. Each period explained details what/how policies were implemented, objectives, budgets – if available, implementations, and their impacts, including available policy options. It also attributed to the role of institutional arrangements, organizational administration, and their relations. The considerable causal sequence of events allowed us to identify and assess critical juncture, institutional setting, and self-reinforcement.

Second, the study started to identify critical juncture and contingent events. Critical juncture was the key point for analysis of path dependence. The study argued that even critical juncture and contingent events seemed to be well defined by Mahoney (2000, 2001) and Vergne and Durand (2010), it appeared difficult to reach their criteria and properties. This was because overwhelming waves of small events that emerged that had been affected by both the history of Thailand and the global situation. In order to identify critical juncture, the study suggested that there should be a focus of attention on events marked by unforeseen events or information that could not be explained by the available theoretical framework. The occurrences of sequences of events before policy reform occurred would present to characterize conditions and property of critical juncture.

Once critical juncture was identified, sequence events and small events were analyzed to identify a contingency point. Contingent point was the existing conditions and event property that had profound influences on establishing new policy structure or policy reform, as the institutional formation. The observation of unknown events and indeterminate consequences in the motion of events in which it was necessary to provide sufficient events and conditions to explain sequential events, were possibly remarked as contingent point. Contingent events caused us to select a particular policy option from available policy options. The selection of other particular policy options would have a different effect on future outcomes. In doing so, unique conditions, events and options of available policies should be presented in order to demonstrate critical juncture and to characterize the property of contingency points. For example, a case study had shown that the period of international rubber regulation agreement (IRRA) was a critical juncture. Because of lack of enactment of Rubber Control Act as requirements of IRRA by the Thai government, Thailand had seen a great expansion of new planting and high growth of production while other rubber producers had diminished rubber production. This was an unexpected event and was considered as a contingency point.

After a critical juncture could be identified, initial conditions was easily highlighted and assessed. There was a period or sequential events occurring before a critical juncture. Initial

conditions here were structured by wide ranging options of available policy. It also was neutral to critical juncture and weakly affected consequential movements. The assessment of initial conditions should emphasize what/how the available options of former policies and persistence of a particular institution.

As discussed above, the contingent point had profoundly affected the setting and shaping of policy structures and a given institutional arrangement. It can be observed in the case study that institutional settings have taken time forming institutional frameworks and institutional arrangements. International intervention, marketing factors, and external factors have made progress and thus influenced institutional formation, and further forced to reproduce. Then, the study went further to consult previous authors with a discussion of institutional settings. Institutional settings relate to the formation of policy structures and relevant institutional arrangements. For example, in the case study, policies for promoting extensive production and the replanting scheme were formulated. These were attributed to the establishment of a national development plan and several government agencies responsible for policy implication. Institutional settings appeared to bring some advances and to have some potential generalization for how institutions emerged.

Once institutions reproduced, a self-reinforcement process was chosen to explain inertia forces of reproduction mechanisms. To build on notions of Mahoney (2000), self-reinforcement appeared to be a crucial concept for understanding institutional reproduction mechanisms through the process of economics, functions, power and legitimacy. These mechanisms also could be explained by the feature of learning effects, coordination, effects and adaptive expectations (Arthur, 1994; Pierson, 2000).

The study had advanced through generalizations on how institutions worked and constraints in individual farms (large farms and small farms). This was a crucial explanation to be able to account for coherent behaviors and actions of people. For such, the study showed several events to demonstrate the interactions between institutions (policy and marketing forces) and individual farms at periods of the great new planting (1960s-1980s). The influences of market forces and its interrelationship with policy produced some constraints attached to self-reinforcement mechanisms that caused market policy to consolidate with the existing institutional reproduction. However, this method still needs to develop mechanisms of reconstitutive downward causation to assess multiple-institutions and interrelationships between institutions.

Regarding reactive sequences, a reactive sequence is a backlash and counter-response to challenges or support existing institutions (Mahoney, 2000). There have been sequence events to challenge institutional reproduction. The study began to identify and assess sequence events which might present property and quality of reactive sequences. Some were possibly

characterized by a reactive sequence, but they were weak powers to reverse polarization. Then the case study finding did not discover the impact of reactive sequences. This was because the occurrences of new critical juncture and contingent events never developed. The study finding confirmed that the assessment of reactive sequences might be not necessary to explain institutional lock-in. This was because the occurrences of consequence events shaped by institutional reproduction that had caused to difficult the emergence of reactive sequences. The second was that the inertia forces of self-reinforcement were increasing, which influenced the delay reactive sequences or very weak. This indicated that the presence of a reactive sequence was not a necessary condition to take place for path dependent processes.

It can be observed, as the study found, that path dependence was a crucial concept for understanding how institutions governed social and economic development. This method proposed could help progress for adequately understanding institutional formation, institutional reproduction, and institutional change. The method was successful in treating some critics as seen in Blyth (1997), Raadschelers (1998), Gorges (2001), Pierson (2000), Kay (2005), and Greener (2005). The main arguments against this method were lack of explanatory power, analytical frameworks, and of coherent framework in the theory. Empirical results and the method developed in the study results has answered those critics. This point highlighted our methodological approach. However, the method still presented basic limitations related to descriptions and qualitative analysis, which needed important evidence for supporting the assessment of the impacts of institutional change in social and economic development.

The method also pointed some need to refine the analytical framework, in which this application was adopted regarding the study context, possible revised properties, and the set of indicators used for identifying and assessing critical juncture, contingent point, institutional settings, institutional reproduction, and reactive sequences. The study revealed that sequence events (chain of events) influenced to shape movements by other sequences. The interrelation among sequence events and the different chains of sequence events were increasing. This situation was the cause forcing the change taking place for other sequence events.

The current analytical framework presented some limitations in this case. The study could treat these problems by emphasizing contingent events and inherent sequentiality. These problems appeared to be a concern of Mahoney (2000) as well.

Micro-Meso-Macro Institutions: Institutional Structures and Interrelationships Discussion of Concepts

The study finding revealed that path dependence conceived three levels of institutions governed and constrained economic systems. These were macro level, meso level, and micro level. The concept is that institutions can be categorized into three levels of institutions; micro institutions, meso institutions and macro institutions regarding institutional structure, formation, reproduction, reconstitutive downward causation and path dependence of institutions. This concept would have to understand how institutions worked and how these institutions interplayed. This also would enable a deep understanding of institutional embedment, coordination and constraints by accounting for the path dependent process.

Micro institutions refer to the rules involving resource endowment, characteristics of actors, capability, productivity, contracts, local institutions and social institutions. These rules govern or constraint behaviors and actions of individual farms and how the economic agent originates, acts, allocates, adopts, and adapts. The study found that micro institutions consist of three elements. First, micro institutions were rules, norm, convention, and local customary rules involving the recognition of a social structure, social realm, economic context, and a traditional agrarian society. This was a social rule that structure was embedded with constraint decision, behavior, and activities of economic agents. These social rules remained, acting to some degree upon decisions, thoughts, and individual and collective actions. The second is composed of resources (land and labor), productivity, capability, contract, and farm strategy that enabled forming the rules transmitted to order consistency of thought, behaviors and actions in economic agents. These were economic rules to govern decisions, behavior, and activities for economic reasons. Economic rules were structured and constrained by both social rules and meso institutions. Third, micro institutions apparently depend upon meso institutions involves that established and structured the rules to govern and constrain individual accessibility, capability and usefulness to take benefits and pay the cost in infrastructure, government provisions and policies.

These micro-institutions imposed rules in recognition of regulations and measures in technological use, production and markets, which showed a consistent behavior and actions in such a way. For example, patterns of tasks, practices and obligations in plantations are governed and constrained by the replanting scheme, which regulated decisions and practices in farming and technological use.

The study reveals that micro institutions were formed to be the set of rules to constitute the farms as following rules for decisions, behaviors, and actions, which were more consistent with observations in patterns of farm characteristics, intentionality, resource use, technological use and farm strategy. It appeared that trajectories of farm change resulted from reproducing the

set of rules that there was a significant reconstitutive downward causation to direct projection of the farm changes. Thus, differences in reproducing the set of rules would make different outcomes of polarization. Increasing or decreasing farm structures (land and labor) was built upon embedment of institutions at the micro level. For example, the rules involving capitalism and market commitment strongly embedded the need to move toward growing farm structures and attempting farm expansion. The farms had been moving toward scaling up, specialization, intensification, and capability in managerial farm business and profitability. In contrast, the farms undergoing a pathway of farm decline appeared to be embedded by the set of rules that exactly differed from the former. The set of rule adoptions corresponded to small farm size, less market commitment, scarce capital and the need to make a sufficient living in an agrarian society. The farms were indicated for improving livelihoods constrained by low available resources and limited capability including more socioeconomic pressures.

At the micro level, it was clear that the outcomes of farm trajectories were considered to be embedded by the reproduction of a set of rules. Micro institutions embedded and constrained as rules-followed behaviors and actions to govern modes of response, structure, conduct, performance, strategy and acquiring reinforcements, resulting in trajectories of farm growth or decline. Changing rules of that set would be possible through the potential growth of decline in farm structure and integral dynamics of individual farms regarding knowledge, learning, experiences, and intelligence, induced and governed by institutions at meso and macro levels. This implied that micro institutions coordinated and interrelated with meso institutions and macro institutions. Institutions at meso and macro levels had strong influences to shape structure, conduct and constraint at a micro level. This indicated interrelationships and coordination between macro, meso, and micro institutions accounting for the trajectory change.

At the meso level, meso-institutions related to policy and government intervention. Meso institutions were reproduced to account for outcomes of institutional lock-in, highlighting that micro institutions are established and structured by meso institutions. For example, the government implemented policy for promoting new planting to encourage farmers to settle in new land during the 1960s-1980s. Business orientated farmers tended to claim a large landholding, while the current small farms historically claimed a small amount sufficient for needs. This revealed that the capability and resources (size of land) not only depended on the response to policy but also appropriately regarded the set of rules at the micro level. The replanting scheme launched to promote high yield and new technology had impacted on the changing rules at micro level through the potential capability for improving productivity and profitability. Self-reinforcing of the replanting scheme forced the farms to leave farming diversification into mono-specific plantations. The consequences of the replanting scheme had unintentionally affected formation of 60:40 and 55:45 share-tapping and cost sharing rules for 50:50 share-tapping. There was a new set of rules to constitute share-tapping arrangements. Meso institutions formulated a set of rules at micro level to govern and constraint resources,

capability, productivity, contracts, and farm strategy that farmers considerably adopted. Thus, meso institutions shaped and constrained the micro institutions in which would be observed through the repeated behaviors and actions of people at the micro level.

At the macro level, institutions were price, market forces, and interventional interventions, which presented a unique sequence of events in that of path dependence, which do have an enduring effect on trajectories of subsequent events. Conjuncture and intersection of these sequences could produce the rules for governing and constraints of both meso institutions and micro institutions in sub-sequential events that occurred (Mahoney, 2000). Macro institutions shaped and structured meso institutions and micro institutions through a self-ordering and self-reinforcing mechanism. The analysis also revealed that the bridges of meso institutions enabled linkage and interaction between micro institutions and macro institutions. Path dependence and its empirical results can demonstrate coordination and interrelation between micro institutions and macro institutions.

The analysis of path dependence revealed that the international rubber regulation agreement (IRRA) – a type of international intervention and order – was a key macro institution to determine a critical juncture and characterize a contingent point in Thailand, leading to policy reform. The selection of policy options was strongly guided by the USA and the World Bank as well as consequences of the short price boom of 1950/1951 and expectations of growth in rubber demand. Especially, international order ruling by World Bank and the USA were found the great embedment on structure patterns of policy and given institutional arrangements regarding the replanting scheme and policy for extensive production.

It is likely that institutional settings are shaped and structured by macro institutions, with recommendations from the World Bank and the U.S.A. Price booms in 1950/1951 and then again during 2003-2010 were key factors reinforcing policy for expansion of new planting which could benefit the growth of the world demand. In turn, the success of the replanting scheme in terms of high yield varieties and improving productivity helped to cope with falling prices. Institutional reproduction at the meso level underpinned to completely integrate the world supply chain in the era of industrialization and the open economy.

Conversely, price support and market intervention during 1990-2002 were characterized by counter reaction to variations and uncertainty at the macro level. When unintended consequences raised by falling prices and world market decline, price support and the government intervention implemented to overcome negative impacts which were subjected to stabilizing its structure, reducing unintended consequences from the global changes, and forcing the variations as their attentions. Thus, the analysis demonstrates interrelation and coordination between macro institutions and meso institutions. Macro institutions were considered to have a capacity for self-ordering (direct enactment) and self-reinforcing (institutional reproduction) that

then led to shape formation and reproduction of meso institutions. Simultaneously, meso institutional reproductions governed people to make decisions and to change rules of conduct at the micro level in accordance with the existed macro institutions.

The results of path dependence also revealed that macro institutions embedded and constrained to economic agents carried and used the rules at the micro level. Price bust and boom were important factors affecting farmers' decisions on resources, capability, strategy and contracts. At the initial condition, rubber price and its profitability had influenced farmers' decisions to establish new planting in order to increase sources of cash income generation. These brought new rules into the village when a market economy was developed. Several rules were developed consistent with new economic behavior and activities that helped to conduct more visibility on production, contracts and livelihoods. Governed by the rising committed market economy by smallholdings, new plantings grew to generate cash income complementary with food crop production. Rubber price and attractiveness of a cash income were the causes of high expansion of new planting even when rubber control policies were restricted.

It can be interpreted that rubber encouraged the farmers to develop new economic behaviors and directly geared them towards the new era of the world market. In addition to this, the price boom during 2003-2011 caused the farmers' decision to allocate available lands and laborers for new planting and to invest more production costs that would increase profitability and a desirable farm expansion. Wage contracts were firstly applied by some farmers even it had failed in 2012. This evidence shows that price ordered changing rules at micro level observed by new capability, contract and strategy that farmers adopted. In opposite, when price dropped, the rules at micro level were changed considerably to avoid harmful inertia from falling price and unintended consequences by the market decline. The government also responded in the same direction whereby policies for price support and suspension of the promotion of new planting were implemented, attempting to stabilize structure and reinforcement of micro institutions. Thus, the study can characterize that economic agents in which micro institutions existed is structured and embedded by macro institutions and was made various actualization of that decision, presenting the outcomes of opposite directions of farm trajectories.

In conclusion, the analysis revealed crucial understanding of concepts of institutions at micro, meso, and macro levels. An analytical framework of path dependence allowed us to understand how institutions form, reproduce, interrelate, coordinate and impact on social and economic systems. Macro institutions governed and constrained institutional formation and enforced self-reinforcements at the meso level and further passed the rules down to micro institutions. Meso institutions were the effective bridging rules and coordination between micro and macro institutions. It is likely that micro institutions governing economic agents were built upon embedment and constraints accounted by both meso institutions and macro institutions but meso institutions seem a relatively strong power to mold and to govern that of micro institutions.

Emergence of new rules to consolidate meso institutions could disturb micro institutions, which would cause the emergence of new rules following behaviors at the micro-level. Regarding the rise of unintended consequences, uncertainty and risks of which mostly had trouble by a worrying sequence of events at macro level, meso institutions would adopt either to produce appropriate rules to prevent coordination failure between micro institution and macro institutions or a counter reaction. Thus, policies and technology were the important meso institutions to give the rule-structured, constrained and embedded individual behaviors and collective actions in a fundamental way. Reconstitutive downward causation mechanism explains well how institutions mold or embed upon decisions, behaviors, individual activity, and collective actions (Hodgson, 2004b).

However, it remains unclear how exactly path dependence produces reconstitutive backward causation to macro institutions, especially as this study concerns about policy as all institutions depend on other institutions (Hodgson, 2006). The study believes that sequence events at micro or meso level can produce reconstitutive backward causation influencing uncertainty and variations at the macro level. The changing rules at meso institutions (i.e. policy structure in Thailand) can induce reconstitutive backward causation acting to some degree on macro institutions. These recognize structures of institutions at macro level to be constrained by meso institutions. The existence of reconstitutive backward causation means that meso institutions influence institutional changes at macro level and determine dispositions both of meso institutions and macro institutions.

Moreover, interrelationships and coordination between micro, meso, and macro institutions would become more serious when it is likely missing the link of coordinated rules. The study has a general idea that a coordinated rule is a principal accounting for the need in the same sense for institutions involved where outcomes would pursue a better social life for mankind, social, economic systems, and states that may wish to change. Coordinated rules are characterized by coordination between institutions at macro, meso and micro level, of which the rules take place within and throughout the social and economic system. The study assumed that coordinated rules are established and structured a pace of social and economic development in the era of market liberalization and globalization. Path dependence may be a useful concept and analytical framework to account how coordinated rules work and mold them all.

5.3 Policy Scenarios for the Future of the Rubber Economy in Thailand

Focusing on the future of the rubber economy, prospective analysis was performed to explore a possible alternative vision for the future of the rubber economy. The methodology used to build the various scenarios is prospective analysis. This is a valid method capable of undertaking the task of rationally studying the future (Gomez-Limon et al., 2009).

Prospective analysis in this study is based on elaboration and analysis of scenarios to explore alternative policy situations for the future of the rubber economy in order to guide the policy decision-making process. The analysis will formalize through a rational and analytical exercise based on empirical evidence in this study; five strategic determinants (resource endowments, productivity, profitability, governance and competitiveness), and the current status of policy, economic, social, agricultural, and technological circumstances in order to predict and picture the future situations that could arise from the combined influences of those circumstances. These will result in an alternative policy scenario to contrast the future of the rubber economy and to foster debate about the desirability of these futures by Thai society as a whole.

In order to understand linkages between the study findings and the current situation of policy, the study will firstly recall the main objectives of the policies implemented in the past and highlight the outcomes the study identified. The study findings, linking with the current policies and their impacts, will lead to formulate alternative visions of the future.

Typology of scenario building as proposed by Bourgeois and Jesus (2004) was applied to build types of scenario requirements; reactive, pre-active, and proactive. Reactive is no more desirable future and the adjustment to be changed by external forces. Pre-active is exploration of a possible available situation to be encountered in the future. There is exploration of the future to anticipate any changes and eventualities. Pro-active is the modification of the present to a desirable future. There is scenario building for expected influences for the future and to promote a desirable change (Bourgeois & Jesus, 2004).

A policy scenario proposal has been defined. The scenario must describe the future situations and a relatively detailed narrative description of essential features. Each scenario proposal should describe policy requirements and be hypothetical in its consequences. Policy requirements are key elements of policies, measures, implements, expectable sources of budgets, and other relevant details, which must be exploratory and open design according to the scenario proposal and desirability. The scenario might rationally assess expectable outcomes and/or consequences for the future and then enable a number of possible alternative policy scenarios to be evaluated.

Since 1961, Thai rubber policies have been guided by a series called the National Economic and Social Development Plan (NESDP). The main goal of rubber policies until the sixth NESDP period (1987-1991) was to increase agricultural productions for export. Then policies focused on direct incentives to expand production and improve productivity. However, rubber became steadily less profitable when the pace of growth slowed down in 1991-2002. The government reacted through price support policies to stabilize farm income in response to decreases in rubber prices. The policy emphasized the setting of marketing channels and marketing efficiency in order to increase fair price and profits for farmers. Starting in 1999, the "Comprehensive rubber development strategy (1999-2003)" emphasized increasing production, supporting market development and exports, and promoting industrial rubber products. This was the first national rubber development plan. It was followed by two more plans: "Re-structure of rubber and rubber industrial products plan 2006- 2008" and "Comprehensive rubber development strategy 2009-2013". These policy packages and the price boom during 2003-2010 induced a growth of rubber expansion and industrial rubber products. It appears that there has been no fundamental change in rubber policy structure since 1961. Rubber policies are structured by a combination of policy measures to promote the expansion of production, productivity, market development, added value of rubber export and price support. Those policies have evolved to include indirect provisions and measures. These covered a wide range of government assistance and interventions with research, replanting grants, extension service, farmer training, market information, central rubber markets, and cooperative and farmers' group support, etc., including construction and maintenance of rural infrastructure.

The results of this study showed that policy and government interventions had contributed to the observed process of farm polarization and itself re-enforced by strengthening the existing share-tapping arrangements in a process of path dependence. Path dependent analysis demonstrated that rubber policies over the period of analysis had never anticipated changes. Within the overall objective of increased production, farmers adjusted by reacting to new situations (i.e. price fluctuation, decrease, and increasing vulnerability of small farmers). Agricultural and rubber policy packages did not focus on the polarization process. Policies were expected to similarly impact on all farms, while in fact large farms had often taken advantage of those policies and more quickly responded to the government interventions. Today, rubber competitiveness in Thailand is also challenged by increased competition resulting from globalization. For example, high expansion of new planting and low cost of production in major rubber producing countries has been observed in the past decade, which has forced Thai products to meet the demand of the world market.

With recognition of path dependence taking place, policy scenarios are formulated by important study findings and emphasize five strategic determinants comprising of resource endowments, productivity, profitability, governance, and competitiveness. Key strategic determinants were obtained by a synthesis of the study findings and literature in order to achieve

the vision. First, resource endowment is defined as the resource and their access, allocation, and use in the rubber sector. Land and labor are two important resources to consider what policy orientations will be available. Productivity refers here mainly to land and labor as key factors determining sustainable agricultural development. The measures to raise productivity relate to effective research and extension, efficient use of inputs, efficient use of resources (land and labor), and sufficient/accessibility of capital to invest in intensification. Profitability is related to cost of production and income. In the case of rubber, a typical cash crop, profitability is directly associated with improving livelihood and well-being. Raising profitability in a sustainable way requires a set of measures that focuses not only price of output and input, but also market development and cooperatives involved in the rubber market and the world supply chains. Governance is defined as "the capacity of government to design, formulate, and implement policies and discharge functions" (ADS, 2013). Improved governance relates to policy credibility, accountability, implementation, and institutional arrangement. Competitiveness is defined as " the ability of firms, industries, regions, and nations to generate while being in, and remaining exposed, to international competition with relatively high factor income and factor employment level on a sustainable basis" (Hatzichronologou, 1996). Competiveness in this study emphasizes the ability to face competition and to be successful when facing competition.

These scenarios also considered the impacts of main drivers affecting the future of the agricultural sector at national level and the global subjects identified by FAO (2006), OECD-FAO (2011), FAO (2012), and Paloma et al. (2013). The important driving factors are population, economic growth, energy price, agricultural policies, climate change, world commodity market, and trade.

The study proposes in the next sections to discuss three alternative policy scenarios in order to highlight possible evolution of the rubber economy as a whole, not just see from the viewpoint of global output (production), but also in views of the study results related to the current polarization process. These scenarios are not predictions, they are possible paths that the rubber economy could take under different policy options for the future of the rubber economy.

The first scenario is the continuation of the current set of policy orientations. This is a baseline scenario, called *"*Continuation of present policies". This is typically a reactive scenario. The second scenario proposes to explore the conditions for growth and improvement of rubber smallholders. This scenario corresponds to an alternative vision for the future of the rubber economy where polarization is seen as not desirable and rubber smallholder development as the core of the rubber economy. This scenario is called *"*Reverting polarization". This is typically a pro-active scenario. The third scenario explores what would be required to maintain rubber competitiveness in face of major global and local economic uncertainties. This scenario considers that the global environment will dictate the policy options. It is typically a pre-active scenario. This scenario is called "Coping with global constraints".

5.3.1 Policy scenario I: Continuation of Present Policies

This scenario assumes a continuation of current trends in policy structure and institutional arrangements. It is assumed that the current policies will continue to be implemented; promoting production and being a leading rubber producer and exporter. This is a reactive scenario, as policies do not anticipate future transformations but are designed to respond to events with the sole objective to increase production and make Thailand the world rubber leader.

Scenario I

The baseline scenario described by "Comprehensive rubber development strategy 2009-2013" to continue implementation. Policy orientation remains an emphasis on policy for promoting extensive production, supporting market development and promoting rubber product manufacturing as Table 5-2. The government still emphasizes to largely promote expansion of new planting. New planting programs are assumed to continually apply where it will concentrate on new areas (northeast and north) regarding profitability and functionality of ORRAF. ORRAF continues to promote new planting in new areas both with farmers in the program and private investment. In response to a trend to diminish yield and high adaptation of technology in the past decade, the replanting scheme will focus on the use of appropriate technology and extension services. Clone diversifications, the use of tapping systems, and application of fertilizers as per RRIT's recommendations become a focus of ORRAF. In the southern region, the government is concerned by constraints and availability in land and labor and thereby the policy will continue to promote replanting with oil palms or other cash crops, but the replanting with new cash crops is expected to continue to be less. Even if policies did not contribute to promote new planting, new planting in the southern region marginally grew by private investment.

The emphasis of the market development policy remains to be developed at the same current level. The government will invest to build a few central rubbers and expand their services in new rubber areas. Three main rubber central markets in the southern region also continue to expand their services. The replanting scheme also is assumed to increase the playing roles in market development through setting of ORRAF's market and continued promotion of rubber cooperatives and farmers' groups. Those coupled playing roles of central rubber market are assumed to prevail for modernized marketing channels and the fairness of price. Price policy also is assumed to continue to apply periodically in order to overcome price variability and the challenge posed by the global market. The budget constraints associated with a large number of farmers are the main reasons for limitation of price support.

Table 5-2 Policy themes and implementations of the current policies

Policy themes	Implementations of the current policies
Increase production	1. Promoting new planting in new rubber areas (northeast and north) 2. Improving productivity through measures for promoting new clones, the use of appropriate technology such as tapping systems and fertilizers, and improving rubber quality
Market development and export	1. Develop modernize marketing channels through measures for setting new central rubber markets and expansion service of central rubber markets, future markets, forward contracts 2. Price stabilization through price support, stock management, and price stability fund 3. Develop market information by emphasis on accessibility, predictability and updatability 4. Promote marketing function for cooperative and farmers' groups 5. Support expansion of export market through increasing rubber standard and reducing trade tariffs
Promotion of rubber industries	Promoting investments in rubber manufactures through the establishment of rubber industrial estates, implementation of Thai rubber standards, research of rubber products, developing productivity of rubber industries and increasing the BOI program

Policies for promoting rubber product industries and expansion of rubber manufacturing are assumed to continue to be promoted through several programs such as foreign investment policy, BOI program (the broad of investment of Thailand), and export policy. The policy is expected to reach a high value added of rubber export and a reduction of raw material export. The expansion of rubber industrial products and manufacturing is also assumed to depend upon industrialization, new geo-economy progress, and the world economic environments.

Under the baseline scenario, capacity and arrangement of government agencies to govern implication of policies will be the same as in the past, which still faced budget constraints and difficulties to carry out their functions. The gaps in the past between policy statements and implementation remain. Instability of politics also causes less effectiveness of policy implementation. Supply of farm labor force is constrained by the reduction in population growth and young labor moving into the non-farm sector. The study assumes that the government does not consider problems of farm labor forces in terms of availability and quality. Changes in the use of the farm labor force are determined by relative wages and rubber prices.

In this baseline scenario, rubber production continues to grow. The main reasons for this are that the availability of land in new areas and level of the rubber price are higher than others that will bring high profitability when compared with rice or other crops. The level of rubber price induces farmers to expand new planting largely the northeast and north regions and expand marginally in the south region. The government policies for supporting new planting have influenced a great expansion of new planting in new areas, causing a large number of small farms to develop. Private investment by large farms as new farmers is expected to gradually increase. Typically, the expansion of planting will cover the country that will give a strong political power for rubber interest groups and this will need to be accounted for by policy

makers. The other reason to expect increasing rubber production is the change in rubber clones from the dominants of RRIM 600 to new clone of RRIT 251 and RRIT 408, which are expected to increase yields above 2,000 kg per ha. As well, the replanting scheme is expected to reduce barriers to technology adoption and to promote the use of appropriate technology.

Market development is expected to see a rapid development through the setting of central rubber market networks, expansion of market services for spot markets and the future markets, enhancing marketing functions for cooperatives and farmers' groups, increasing market information, and setting modern market channels. Rapid market developments come from both government policy and market structural changes driven by the needs to meet market demand and the rubber product industries. Efficiency of markets and fairness of price are expected to gradually increase. Rubber price is expected to highly fluctuate around the trend of increase, but the growth rate of rubber price is somewhat lower under the average growth of price in the last decade. The level of rubber price is expected to be profitable compared with rice and other cash crops and in turn, will stimulate the growth of new planting. Moreover, the rubber product industries are expected to grow in accordance with industrialization and global economic growth. The main drivers for this growth are coupled policies for promoting agro-industries in rural areas and for promoting foreign investments. The growth of rubber product industries is conditioned by the growth of automotive industries and the global market. Domestic consumption is also projected to gradually increase overtime. This increasing domestic consumption is that Thailand will be a major rubber exporter of rubber industrial products.

Consequences of scenario I

As a consequence of the continuation of reactive policies and according to the findings of this study, this scenario of continued path dependence will lead to further polarization of rubber farms while informal share-tapping agreements persist. Under the baseline scenario, growth in the number of small holders is assumed to be highest. The main challenges are that farm size would increase for improving incomes, but land reform is never implemented. Small farms need to increase productivity to cope with volatile prices. Facing these challenges, it seems that the government emphasizes productivity as a means to cope with small size. It is assumed that progress on new technology would be limited and technology adoptions will continue to stagnate. Because yield will decline, farm income growth will remain marginal or minimal. This would suggest that the socio-economic situation can be characterized by low income and a large numbers of highly vulnerable livelihoods, presenting an increasing poor farm for whom rubber presents one of the few opportunities to support and enhance their livelihood. Thus, poverty is expected to increase under the baseline scenario. Survival farmers will develop. These farms will become increasingly vulnerable to price, marketing risks, and low profitable production that leads to a subsistence oriented production strategy. These are the poorest households expected to trap smallholders with limited opportunities to undertake more productive activities and have

limited access to markets for both inputs and outputs. The difficulty to overcome land pressure and low profits production will push some small farms out to the non-farm sector accompanied by a growth of non-farm sectors.

In turn, if the number of farmers moving out to the non-farm sector increases, it will adversely effect the supply of labor force. As well, the growth of non-farm employment in rural areas will play an important role in labor absorption. The expansion of industries (rubber and agro-industries), commercial trade, and urbanization into rural areas will have the potential to generate economic growth and increase employment opportunities in rural areas. Off-farm and/or non-farm employment is necessary to increase household income for smallholdings. Small farms tend to engage on-farm and will adopt off-farm or non-farm activities together as a mean to improve livelihood and well-being. The study assumes that small farms will contribute to both the farm sector and non-farm or off-farm until they can find alternatives for household livelihoods. Higher non-farm or off-farm income to total income is characterized by very small farms. As a result, the large number of farms moving out into the non-farm sector will increase. The future development will not be very sustainable, which will elevate the serious problems of social conflicts, pressure raised by political interest, and depress economic growth.

Large farms are expected to have advantages over small farms. Structural growth will come from capital-led intensification and extensification, suggesting a land concentration trend and more capacity for expansion of related businesses. Improving productivity and increasing value added products through their related business are key factors to sustain profitable. Modern business management is expected to be applied to replace the Kong-si system that will enhance farm businesses and profitability. Another growth of large farms will arise to take advantage from the structural changes in rubber industries (primary and secondary rubber processors) and from a policy for supporting market development and promoting rubber product industries. For example, the expansion of central markets and modern marketing channels will expect benefits by the reduction of marketing cost, increasing market information, and the fairness of price. These situations will give economic opportunities to benefit from scale of production and farm business orientation.

Because of a large number of very small farms and landlessness, the supply of hired labor will not be restricted in the short run, but the perceived shortage of hired labor will increase. This may lead to finding ways for new sources of hired labor or replanting with less labor intensive crops. Share-tapping stabilizes because available skilled laborers are forced to move out of the rubber sector and will be hired by the large farms. It is expected that because skilled hired laborers will be less available, then large farms will contract foreign hired laborers through wage agreements. The contract still needs to employ skilled and quality laborers that are forced to negotiate on salary or wage agreements. The change in labor and contracts is expected to induce reactive sequences in this scenario.

As a baseline result, small farm size and farm labor will keep declining. Ultimately, many small and very small farms will disappear and their productive lands passed on to medium or large farm enterprises. Lack of generation replacement will gradually develop. Farms without generation replacement where the plantation has proved to be unprofitable or marginally profitable will be purchased by profitable farmers. Rubber production is expected to become more and more concentrated in medium or large farm enterprises by making profits with economies of scale and the ability to increase the added value of products through processing and quality. Exclusion of small farm enterprises from rubber production will release skilled tappers, which will contribute to maintain share-tapping as the dominant contractual arrangement, though still under its informal forms. However, since skilled tappers are mainly older people, then large farms may be progressively facing labor constraints which could be solved either through the use of less labor-intensive technologies, changes in hired labor with employment of overseas workers, or shifting to other cash crops such as palm oil. Farm employment as percentage of total labor forces will decline substantially. This is due to a reduction of population in rural areas associated with young laborers moving to non-farm employment indicating a decline in the living standards of farm households. This implies that many farms are expected to move from the farm sector into non-farm activities. Young laborers will heavily rely on wages and seek to engage in non-farm employment in urban areas. Leaving the farm sector to be employed by non-farm sectors is a route capable of lifting them from poverty and improving livelihoods. As the majority of the smaller farms are trapped in a cycle of low income leading to low investment, low productivity, and low income that a reduction in economic activity in rubber areas can be expected.

While under the baseline scenario, the main goal of the current rubber policy is to promote economic growth and to maintain national competitiveness in which the primary goals are export oriented production, economic growth, and poverty reduction. Polarization continues to develop in the southern region and is expected to rapidly increase in north-east and north. Polarization will gradually raise serious social issues resulting in income inequality, poverty, social conflicts, declining social values, and de-agrarianization.

As expectable results, socio-economic polarization measured by the land concentration and income inequality is expected to steadily increase by proportion. These will increasingly be observed in social conflicts and will have an indirect effect on economic growth. Inequality of income and landholding can create barriers and threats to sustainable social and social welfare. It seems that the gap of income distribution would increase the instability of social and economic development. These conditions may lead to de-agrarianization. De-agrarianization can be measured through declining structures and systems of agrarian society such as declining social values, narrowing social networks, declining value of kinship, highly inequitable social structure, and rising social conflicts. Then, the competitiveness of the rubber economy in Thailand is expected to decline in long run.

5.3.2 Policy Scenario II: Reverting Polarization

This scenario explores an alternative path of policies based on the position that the current polarization process of the rubber economy in Thailand is not a desirable one. This was triggered by actions set in motion through a path dependent process which was never intended to be so. Based on this assumption, the scenario explores policy orientations for reverting this polarization process and its potential impact on the rubber economy. As such, this is a pro-active scenario starting from a vision where smallholder farmers would be at the core of the Thai rubber economy. The vision is that smallholding is the center of agricultural development to pursue productivity, profit, and competitiveness that will drive economic growth and improve livelihoods to sustain social and economic development as a vision proposed by IFPRI (2007) and FAO (2014).

Scenario II

Policy orientation based on alternatives to overcome the challenge faced by smallholdings, and the current constraints identified by the study findings. This scenario is labeled by policy reforms in order to reverse farm polarization. Policy orientations concentrate on agricultural investment emphasizing fiscal and financial support for improving productivity, increasing real farm income, and improving livelihoods to pursue economic growth and competitiveness in the long term. Policy orientations therefore focus on public investment and creating environments for small farmers to invest in agricultural production and agricultural modernization. Land reform is prized as a way to increase farm size and to enable smallholdings to become competitive. Social sustainability and economic growth in the long run can be expected to gain ground.

As per the study findings, farm polarization had consequently affected the high growth of small farms to dominate the rubber sector. Small farms were not homogenous groups regarding size of landholding, the use of labor, socio-economic conditions, and diversified livelihoods. They can be grouped into three categories: large family farms (> 3.0 ha), middle family farms (2-3 ha), and very small farms (<2.0 ha). Large family farms and middle family farms can be grouped into pure family farms where farm size can generate income sufficiently to maintain livelihoods and living standards. Very small farms often operate with family laborers and where off-farm or non-farm activities are highly adopted. It should be noted that small farms are diversifications of households and farm characteristics, which are facing various constraints on their ability and capacity to the use of resources, improving productivity, and potential profitable activities. The main constraints are market failures and small size of landholdings that severely depress the ability of small farms to increase their production capacity and move toward profitable farming systems.

With regard to polarization, policy orientations are different from that of the baseline. Policies can be grouped into input and output policy. Input policy emphasizes land policy (land reform and land quality improvement), research policy (policy for research, extension service and technology), credit policy, and physical input policy (such as fertilizers and clones). Output policy includes measures such as price stabilization and market development. This intends to improve marketing and processing and to modernize market channels. This is public investment for promoting and strengthening smallholdings.

The first policy orientation is land reform, which is expected to redistribute landholding into small farms and landless. There is a demand for redistribution of landholdings through policy and measures to identify solutions to land use planning, land fragmentation, land tenure, and land ceiling. Land reform could take the form of selling at subsidized prices or unused state land to the actual farmers including farmers engaged in other crops (i.e. the study had witness that farmers who engaged in farming of palm oil, fruit trees, and rice had similar patterns of landholding as rubber farmers). Calculations based on the sample in this study combined with RRIT's recommendations, about 15.6 rai (2.5 ha) of a floor landholding was a threshold size for pure family rubber farms to ensure a standard of living. The specified minimum size is expected to attain levels of efficiency of land uses, optimize use of family laborers, and sufficient income generation for livelihoods. Perhaps landholding ceiling and land tax require a means to reduce inequality of landholdings and to prevent re-concentration of landholdings.

Land reform also requires several measures to raise productivity and profits by small farms such as land zoning, land quality, and land degradation. These measures will be needed to increase incentives for farm investment and improving profitability. These measures also will prevent the re-concentration of landholdings. In Thailand, the government has failed in land reform and its effectiveness (Suehiro, 1981; TDRI, 1990; FAO, 2006). The Agricultural Land Reform Act of 1975 was expected to fully enable land reforms in terms of budgets and implementation. It proposed that the land reform designated to redistribute land ownership from private ownership especially by elites and enterprises and the state land to the landless or to those who owned small landholdings.

By recognizing the published discussion, land transferred will be administered through a land bank system where the government will purchase land from other private land ownerships and state land and lease them out to the landless farmers. The landownership will be transferred to long-term leases, which will help to protect the resale of land (National Reform Committee, 2010). Measures of forcing land use for planning and zoning also will make utilization of land in full economic activity and in line with land carrying capacity, where suitability of land is used properly. This land reform also needs to be supported through policy and measures for improving productivity, the supply of subsidized modern input, credit, production, markets, etc.

Policy addressing improved productivity needs public intervention in providing research, extensive education, and information. The measures are expected to achieve: 1) creating new clones, 2) efficient use of agricultural inputs, 3) efficient use of natural resources, and 4) increasing resilience to market risks, climate changes, and external shocks. A large public research and development (R&D) program is required that could be direct and indirect investment toward the building and creating of agriculture based on science and research. This research policy emphasizes to invest and develop research infrastructures, a research center, experiment stations, strengthening human resources, new technology, and farm mechanization, suitable to different climatic conditions, farm size, farm structures, and farm objectives. Public research needs not all be conducted by the government agencies, but it could join or incorporate with private sector, universities, colleges, and international corporations. The government will offer subsidizes that would be able to rapidly develop new technology and agricultural research.

Regarding dominant smallholdings, the replanting scheme is expected to increase capacity and efficiency for extension services, technology transfer, and the use of appropriate technology. Technology transfer to farmers requires cooperation by several government agencies who understand the technologies, local conditions, and characteristics of farmers. Farmers' institutes, the community agricultural extension, and farm demonstration also are required to conduct intensive training for general farmers and specific programs to targets farmers, especially for new and poor farmers. Extension services and technology transfer also could integrate with education courses and curriculum in the agricultural universities, agricultural colleges, and schools. The joint research and extension programs could be promoted with universities and the private sector that could provide a progressive research and extension service.

Education is a key issue for successful agricultural development and its sustainability in order to improve farmers' productive capabilities. Farmers need specialized knowledge to create fruitful production and adoption of technology. The policy orientations will emphasize to increase education for farmers and should be easy to access into specific programs and training courses. Agricultural education also is expected to be promoted at the different levels from compulsory education to colleges or universities. Community learning and agriculture will be set up widely for increasing knowledge and education after farmers have left school. Agricultural universities and colleges are also expected to increase capacities and ability in terms of research and education and play important roles to build closer integration with research and extension with the needs of farmers.

Regarding measures facing market failures, increasing accessibility to credit is important for smallholdings. If farmers need to raise productivity, credit is necessary to buy more input and to invest in farm building. The measure requires having various types of financial schemes and funds to provide agricultural financing. Bank for Agricultural and Agricultural Cooperatives

(BAAC), local community credit fund, and credit cooperatives will be promoted to play roles for loans and subsidized credit. Indeed, the promotion of local community funds will provide specific agricultural loan or microcredit schemes focusing activities to raise expansion of production and productivity, which will be subsidized interest rates by the government.

Moreover, the policy orientations are needed in providing key inputs and intervention of their uses such as new clones and fertilizers. Input subsidies will suggest a means for increasing productivity and thereby improving profits. Government involvement will be required due to possible lack of credit, lack of technology adoption, and burden cost for poor farmers. New clones might be uncommon to small holdings and use suboptimal amounts of fertilizers. The subsidized inputs and/or promoting their use, especially new clones and fertilizers can be conducted through the replanting scheme, the government extension service, and government supported cooperatives. In the past, the replanting scheme supported the grants for the key inputs for 5.5 years in which the promotion of fertilizer use during the productive period was low resulting in low productivity by smallholdings. The credit measures for subsidized inputs needs to promote optimal use of fertilizers.

Under this policy scenario, the rubber market is expected to suffer from price variability and volatility regarding liberalization and global uncertainties. Small holdings need to have reliable future income regarding investment of production. High fluctuation in incomes tends to discourage productivity and investment. For these reasons, a price policy may require to stabilize farm income and to cope with high volatility of price. Policy will provide a measure to reduce the fluctuations in farm income. These policy orientations could be implemented on market-based measures and price support. The measures also require an insurance scheme for agriculture by the government. Income fluctuation can be covered by adequate insurance, whereby banks will make loans to farmers for the default risk at the lowest rates. An agricultural insurance system will be operated by private companies, but the government will subsidize the premium for smallholdings.

Another measure is price support expected to take place when the rubber prices do not give adequate remunerative levels. The government will set up price floors guaranteeing to purchase rubber products. The gap between marketing price and price floor will be subsidized through direct payments. Direct payment provides a means to overcome several problems from government run-markets such as a large fiscal burden, ineffective stabilizing income, corruption, etc. Price support should benefit only smallholdings with limited scale of production. Stock rising from price support projects should be exported as soon as practical. This policy may cause two prices of price support and marketing price. Then if marketing price is at a remunerative level then there would be no government programs. Importantly, the programs need to have complete statistical data such as the number of small farms, size of rubber, tapping areas, yield, structure of households, etc. It would require some efforts by the government to register the farm

households and to identify classifications of the farm households. The government will incur losses from price interventions, but it will be low compared with the government run market.

In order to stabilize income and cope with price volatility, the policy requires measures to emphasize increasing income diversifications. Diversification in production provides a mean to increase income stability, reduce impacts of price fluctuation, and reduce risks. Intercropping and multiple plots are expected to promote diversification activities that could generate diversified incomes, food security, and improving productivity. If farmers have diversified farming, they can stop tapping when rubber prices fall and concentrate on other activities. For smallholdings, several types of intercropping models have already been developed such as fruit trees, teak, vegetables, flowers, livestock, etc. Large farms would be reasonable to promote with multiple plots of other cash crops such as palm oil.

Policy also needs measures to improve marketing and processing and to modernize market channels. It also needs measures related to regulate oligopsonistic practices in the marketing and supply chain which enable farmers to get a fair price. Central rubber markets and local rubber markets (ORRAF's markets) are expected to be established and expand services across main rubber production areas. Cooperatives and farmers' groups will promote and strengthen their business performance in which the government will intervene indirectly through legal and financial subsidies. These farmers' organizations will attend for increasing capability and efficiency in production and marketing for smallholdings. Cooperatives will become a major processing arm of raw rubber and marketing agents which can add significant value, and thereby become major marketing players in central markets and to be integrated with the supply chain of rubber industries. The government will consider providing and/or subsidizing public goods that are necessary to strengthen cooperatives. These public investments include market information, setting up of central markets and local markets, and infrastructure development.

The policy orientations also require promoting the use of family labor of which the farms will have to depend to meet demand. Share-tapping is expected to stabilize to apply to farm enterprises and some farmers will need to be hired tappers. Regarding the growth of farm employment, share-tapping requires effective measures under labor and social welfare laws. These may be expected to ensure a reasonable level of remuneration, social welfare requirements, and stimulating labor mobility back to the farm sector, especially for young laborers. In this policy scenario, the capacity and efficiency of the government to formulate, implement, and operate is enhanced through the constitution of a unique legal organization called "The Rubber Thailand Act". By 2013, the Rubber Thailand Act was already in place and the council of representatives should effectively enact it. The government passes the law immediately and provides the Act with resources needed for it to perform its functions.

Consequences of scenario II

The policy consequences here are radically different from that of the baseline. The rubber farms are assumed to be dominated by a large proportion of smallholdings with a floor size of 15.6 rai (2.5 ha). Farm enterprise appears to be declining in terms of numbers and level of land concentration. It is expected that rubber will continue to grow in both areas and production. The main reasons for this expected increase are the escalation in new planting and improved productivity. The scenario assumes that new planting will decline in the short run due to the effects of land reform and land zoning. In the long run, new planting will increase, especially new planting in new areas, but it will be lower in the baseline scenario. Levels of rubber price and profitability will continue to attract the growth of new planting. An expansion of new planting in the southern region is expected to decline due to limited availability of land for rubber. It is assumed that because of the effectiveness of land zoning and land reform, new planting will expand in zoning land where soil properties are appropriate for rubber trees. Rubber areas planted in inappropriate land with the lowest productivity will be needed to be replanted with other cash crops. The second reason for the projected increase in rubber production is the fast growth of yield per hectare. It is expected that the annual average yield will reach above 2,000 kg per hectare in the same potential yield. The old clone of RRIM 600 is replaced by new high yield clones. Potential yield depends on effectiveness of measures to encourage intensification in production and new clones.

In this scenario, the policies result in the largest improvement of productivity in smallholdings through measures to encourage the application of new technology and intensification in production. Progressive research and new technology emphasizing new clones and appropriate technology for smallholdings taking place will be properly adopted to sustain productivity. Extension service under the replanting scheme reduces threats for technology adoptions and promotion of appropriate technology for smallholdings will lead to reduction of production costs. The development of the rubber market will increase efficiency and the fairness of price. Numbers of cooperatives and farmers' groups will increase and strengthen for enhancing professionalism in marketing and production. They will dominate in marketing functions for small farms and would increase their influence over rubber industries. This scenario can be seen to potentially increased prices at the farm gate and increased profitability due to the lowest transaction cost in marketing channels and the effective function of modern markets. The rubber industrial products also are expected to continue to grow accompanied by industrialization and the global economic growth. Expansion of rubber industries will have a positive impact on increases in domestic consumption and high value added of rubber product exports, which will stimulate demand on levels of prices in the country.

The rural economy continues to expand at a reasonable pace contributing to the vast majority of people in rural areas who still depend on farm employment and by stimulating the

growth of non-farm activities, which are expected to continue to develop consistent with growing demands for consumer goods and services associated with public and private investment in rural areas. It is recognized that some family members of smallholdings will need to find work in the rural non-farm economy, especially young and educated laborers. Expansion of rural manufacturing may have a role to increase non-farm employment. Rural non-farm employment would prevent the problems associated with mass migration into urban areas. It may be necessary for improving equity and income inequality and might stimulate a positive effect on sustainable investments on-farm.

This scenario is expected to have a profound effect on rubber development to pursue higher real income, to improve competitiveness, and to ensure sustainable economic growth. To compare with baseline scenario, smallholdings are the majority of rubber farmers who may persist in an agrarian structure compared with a large number of farmers who will leave the farm sector for other activities as a consequence of this baseline scenario. Farm employment increases to prevent a large migration to the city. Farm employment will account for a major proportion of population in rural areas. This policy scenario is expected to overcome the main challenges and the current constraints that would fundamentally be able to have increasing farm size, productivity, profitability, and income stabilization. This scenario results in redistribution of landholding, reduction of poverty, and improving rural livelihoods. This would suggest that social polarization, income equality, and their socio-economic effects are expected to be improved. There is a major shift in policy orientations with desirable social welfare, social sustainability, and long-term economic growth. This policy scenario also will gain from the multi-functionality of an agrarian society in future development.

5.3.3 Policy scenario III: Coping with Global Constraints

This scenario is based on policy actions on the supply side to maintain the level of national competitiveness in accordance with expectations of future uncertainties from global development, constraints of resources and budgets, rapid changes in society and economy in rural areas. This policy scenario is an alternative needed to prepare farmers addressing what alternative policy orientations to pursue if the path of development is assumed to be too risky, costly, and uncertain. There is a preparation of the rubber sector to cope with global changes it cannot necessarily influence. This scenario foresees that the challenges and constraints in Thailand and from the global environments are increasing. Uncertainty arising from the global environment and competitiveness are used to build a policy scenario. This scenario is therefore typically pre-active. The vision is that in spite of global uncertainties Thailand is expected to be at the forefront in rubber production and export. Rubber manufacturing and rubber product industries will dominate the rubber sector as high-value production for export orientation. Thus, this policy scenario aims to improve competitiveness and create conditions for coping with uncertainty and for growth.

Scenario III

The scenario was developed to recognize the critical importance in problems and potential challenges in Thailand and the global environment. The main reasons for the foreseen challenges in the southern region particularly and Thailand generally are expected to increase in resource prices and limited availability of resources for the rubber economy. The postulated economic growth leads to a large resource to be allocated for the rubber economy. Land constraints appear sooner to raise costs and limit availability. It is expected that availability of land to be overtaken by other economic activities will gain much more economic growth and profitability, especially manufacture and new cash crops with resource requirement of less land and labor intensive production. Moreover, high growth of the non-farm economy will cause a dramatic shift of population to the non-farm economy and then is expected to see low availability of farm labor. Labor shortages will be a main constraint to challenge the growth of the rubber economy. Then the higher factor price itself is expected to strongly affect low profitability and limited growth of rubber production.

In parallel, the global environment is expected to contribute a profound effect on the future evolution of agriculture in Thailand. The studies identified by FAO (2006), OECD-FAO (2011), and FAO, (2012) were used to develop the scenario and to project the evolution of world agriculture. In the last decades, global agriculture has been characterized by policy induced production surpluses in developed countries and stagnating growth in developing countries. Expansion of rubber was likely to grow in response to the price boom in the last decade, but it was expected to slow down at least in the medium term. Rising costs, growing resource

constraints, and increasing environmental pressures are the important factors to cause slow growth. Demand growth will strongly increase in developing countries driven by growing populations, high income, and urbanization. Prices for agricultural commodities are projected to increase due to slower production growth, demand growth, and supporting a macroeconomic environment (FAO, 2013). Regarding the global rubber market, world rubber production continues to increase mostly due to strong production growth by new planting in several countries that are entering the production stage. The world rubber production appears to be over-supplied and then rubber markets may come under pressure. The world demand for rubber is expected to recover in the short term, be stable in the medium-term, and continue to grow in the long term. Shares of natural rubber in the world demand are foreseen to increase to replace synthetic rubber. Price is expected to be relatively stable at 2.70-2.80 dollars per kg during 2015-2025 (World Bank, 2014). Overall, the growth of rubber production and profit may suffer from high price volatility and uncertainty in the world market, which will increase in terms of frequency and negative impacts. The scenario assumes that the global economy is expected to increase in complexity, uncertainty, and variability. These are compounded by global politics, macroeconomic situations, dramatic technological advance, population growth, climate change, and energy prices. It will foresee that the future global environments are increasingly uncertain and risky and will be difficult to cope with under current policy. These views imply that it is necessary to build a policy scenario in order to capture positive or to cope with negative impacts from global changes.

In contrast with policy scenario II, the policy orientations will shift from one that focuses on extensive production and promoting small farmers to a liberalization approach. The policy orientations begin with a developing competitiveness and thus to generate supply chain of high value added products by promotion of rubber industries. The policy also requires public investment to improve productivity, profitability, and competitiveness. It is expected to have large public investment in the early stages focusing on farm re-structure, improving competitiveness, and creating conditions for the growth of rubber product industries, but it will induce positive impacts on the less fiscal deficits in the long-term. The policy also needs some measures to enable environments for the private sector to invest in rubber production and rubber product industries.

As in the previous policy scenario, the policy requires measures for land zoning and land management, a research policy (research and extension service), and credit policy. Output policy orientations need a strategy for setting modern markets, a trade policy, and policy for promoting rubber industrial products. It is also necessary for the government to invest for rural infrastructure, research and development, increasing skill and knowledge, etc. Public investments are the minimum that would be socially acceptable. The government needs a policy to entirely re-structure rubber production, which will help to promote productivity of farmers and are capable of guaranteeing economies of scale and productivity.

As an aspect of marketing approach, the government needs a measure to promote extensification or land consolidation by medium and large farms and to reduce the number of small size farms and low productivity. The objective is managing farm enterprises and educating farmers (family farms). There is an optimal pathway to high productivity and profitability in the long-term and improving competitiveness when the support and subsidies are removed. The policy requires measures to restrict new planting where it is expected to expand and promote the farmers who hold economies of scale and potential productivity. These are associated with land zoning and land management that will apply to identify appropriate land for rubber trees and expansion of new planting could take place. The policy also relies on the promotion of replanting with other crops, especially if the size of farms is small with low profits, they need to promote both to replant with other profitable crops and to prepare them for moving into non-farm employment. These farms need measures to raise skills and knowledge for employment opportunities in non-farm employment when the farmers would have to leave the farm sector. Family farms which remain in the farm sector therefore need to form and strengthen through cooperatives. Policy thus requires measures to promote cooperatives and strengthen their functions in production and marketing.

In this scenario, the farmers are integrated into supply chain of rubber manufacturing by providing high value added products and raw materials. The industrial supply chain will be promoted by both government and rubber manufacturers in order to improve the processing and quality of products toward increasing value added. The primary propose is rubber that directly meets market demand by cooperatives and farm businesses indicating that the farms incorporate into the industrial rubber supply chain. Public intervention is providing and subsidizing public goods that are necessary to the establishment of supply chains and its effectiveness. These public goods include infrastructure development (roads and ports), market information, and market facilities (central rubber market and stock) which will provide reducing transaction cost and risks in the supply chain. The government can decide to accelerate the development of the supply chain through subsidies and compulsory procurement of rubber industries in the early stage. If the purchases of rubber are large entities with direct access to manufacturing and export, a farm's income will increase due to reduction of transaction costs. Specific programs involved linking rubber manufacturing with cooperatives and farm enterprises will develop. The government will provide an investment fund, technical assistance, credit, and insurance of secure contracts for linking agro-industries. It is expected that a large proportion of rubber products will be consumed by domestic rubber manufacturers, which will reach high value added production for export.

Policy orientations also require measures to promote rubber manufacturing and rubber product industries. The policy thus requires public investment and measures for providing the desirable conditions for the growth of rubber industries including a trade policy and tax policy. The government will provide public investment for infrastructure development, facilitate

infrastructures, tax exemptions, accessibility to credit, and investment funds for rubber industries, especially supporting rural industrial activities through investment programs under the Board of Investment of Thailand (BOI). Rubber manufactures that come from domestic and foreign investment will be promoted to dominate a large part of economic development. Manufacturers will have positive linkage effects for new technology and its adoption to concentrate on quality, processing, and final products with the main attention to meet the world market demand.

Consequences of scenario III

The policies can be expected to have profound implications for growth and structural change. Thailand continues to be at the forefront of rubber production and export. In the main, rubber production increases by growing a large number of farm enterprises and modern farmers that will overcome the decrease in production from small and very small farms. It therefore is expected to be a realistic view that rubber production will concentrate in farms capable of increasing economies of scale, productivity, and specialization compared with the baseline. This competitive advantage is coupled with the increasing market demand for rubber that leads to relative growth. These farmers are expected to have the potential to succeed farm business, positions on competiveness, and integration into the industrial supply chain. This suggests that the number of farm enterprises will increase and land concentration develop considerably. It is expected that the number of farms will decrease by more than that of the baseline. The largest decrease is likely to be found in small and very small farms, and thereby a large number of very small farms will disappear. This situation assumes that polarization will stop. Increasing land concentration will accelerate to reach polarization and stop through market orientation which indicates that most land will be owned by medium and large farms.

An increase in rubber production will be achieved through expansion of new planting and productivity. New planting will increase due to expansion of rubber areas, especially new planting in new areas in which levels of rubber prices will be profitable and higher than other crops. New planting will concentrate on appropriate land and climate conditions for rubber trees in accordance with restriction of land zoning. The existing plantations facing low productivity and low profit will be encouraged to replant with other crops. Yields will substantially increase compared with the previous two scenarios. This is because of replacement of new clones and sustainability of intensification in production.

The farmers will incorporate into the industrial supply chain directly that will positively effect on increasing value added products through processing, quality, and reduction of transaction costs in the supply chain. The linkages between the farms and industries allow them to overcome challenges by price volatility, marketing risks, and resilience to external shock. Competitiveness will increase as the result of economic scale and productivity.

Under this scenario, it is expected that share-tapping will be difficult to stabilize when the structure changes, and declines in the availability of farm laborers are reactive sequences to attack share-tapping contracts. These are reasonable reactive sequences to trigger institutional lock-in of share-tapping. A large number of small farms leaving the farm sector are associated with unavailability of local tappers indicating that availability of farm laborers will be low. This will result in labor contracts laid down on wage contracts based on salary agreements instead of share-tapping. Another reason is a progressive decline in social values and local social networks which will contribute a decline in the prevalence of share-tapping. In parallel, because of the drop in farm labor forces, foreign skilled laborers will be employed to replace local farm laborers to fulfill demand. Regarding this demand, wages may be relative high and will soon be affected by labor and social welfare law. It is expected that farm workers will have a wage comparable with non-farm employment. Because of a drop in the number of the farms, overall farm employment will decrease compared with scenario II.

In this scenario, economic growth in the global market coupled with growing demand for high value added products will positively impact on growing rubber industries in Thailand. Domestic consumption will increase consistent with growing rubber industries in the country, which will stimulate a decrease in exportation of raw rubber and increase high value export products. Expansion of rubber industries will have a radically positive impact on national competitiveness and stimulate to strengthen farm performances. Thailand will become a major rubber exporter of rubber industrial products and would be able to maintain itself as a competitive rubber producing country.

To compare with the previous scenario, the rural economy will be characterized as a bridge between agriculture and rubber product industries. The rural economy depends on farm employment and the rural non-farm sector, which comprises of consumption of goods and services and wage employment in rural factories. The number of farm employment to total employment will decrease and foresees a long-term decrease in farm employment. Thus, the growth of the rural economy will decrease when compared with the second scenario. This also is due to declining population in rural areas and large labor mobility into towns. Migration toward non-farm employment in urban areas is specific to young labor and in particular small farms as a consequence of low income and insufficiency for decent living. However, farm households with higher incomes in rural areas will increase. As well as high wage contracts in farm employment and a well-functioning non-farm sector may contribute to poverty reduction in rural areas. In the long run farms will become larger with high real income and competitiveness. This would also suggest a rapid decline in the traditional agrarian society, which is of course developed according to alterations in new developments of farm structure.

5.4 Implications for the Future Development of the Rubber Economy in Thailand

The three policy scenarios may radically depict the differences in a desired future situation in path dependence of the rubber economy in Thailand. Each policy scenario will guide policy requirements and implementations to reach the vision, and further evaluate policy consequences. These policy orientations need debates, arguments, and opinions by the different stakeholders that allow us to explore the major challenges, the diverse options, and what the future of the rubber economy that Thailand needs. To elaborate and execute the policy scenario, there are needs for major sources of funding, budgets, and dedication by the government. Those combined with the foreseen impacts and possible implications in three policy scenarios will allow the policy makers to make choices for future policy options.

Regarding policy scenario I: "the continuation of present policies" will be chosen because they address the extensive productions and market development based on the current policy and institutional arrangements. This scenario will achieve production and market development as seen in the past. There are a few changes in policy implementation, relevant government agencies, and sources of finance, which mainly come from "Cess". RRIT and The replanting scheme remain as major government agents with a wide range of authority and responsibility for policy implementations. The policy implications appear to be prioritized for promoting new planting in new areas, market development, and the replanting scheme. However, the selected policy scenario will consider a negative impact on polarization and social conflict issues. If the government selects for policy implication, this policy orientation will need to comply with several policies to promote the growth of economic development in rural areas such as promoting manufacturing in rural areas, public investments, social welfare, etc. This is a necessary means to overcome the various risks faced by the vulnerable rural poor and consequences in the policy scenario.

As for policy scenario II "reverting polarization": the reason for choosing this policy orientation is the great attention to strengthening smallholdings by providing a means to trigger polarization and relevant public investments that will consequently stimulate long-term economic growth. The selected land reform policy will act directly toward distribution of landholdings and landownership providing accessibility to productive resources. The policies also require measures and conditions for sustainability of smallholdings. There is also a need not only the re-arranging of government agencies in terms of organizational structure, authority, budgets and supporting systems but also requires strong and committed public investments. The sources of financial aid for policy implementation are the "Cess" and government budgets. Then the policy scenario will be serious about a large amount of finance for public investment and will become the main constraints to select this policy scenario. As well, the countervailing forces of stakeholders opposed to land reform may put pressure on the selection of this policy orientation, but economic growth and a great benefit to long term agricultural development will be attractive

for the selected policy option. The investments in agricultural development will be an engine for robust economic growth to create employment and other achievements as consequences of the scenario. There is a sustained policy preference to promote smallholdings and the economic growth.

The policy scenario III: “coping with global constraints” will be chosen because the policy scenario approaches marketing orientation. The policies will create the basic conditions and empowerment of the farmers in agricultural development and their capacity to be more productive and scaling up. The government will be favorable of minimum interventions and deliver satisfaction of outcomes. These would reduce overall financial burdens in policy implementations that will make society acceptable. The selected policy options could be opposed by powerful interest groups of small farms which may prevent the adoption of policy that aims to remove support and subsidies to small farms. High levels of agricultural protection both in developing and developed countries associated with serious risks and uncertainty in the global market also may heavily influence the decision to select this policy option and policy implementations. The overall performances are more competitive and productive in specific groups of the farms than the other two. The policies might have a positive impact on the overall welfare of social and economic growth less than that of the second scenario.

In order to make an assessment of policy implication, the outcomes of path dependence and evaluations of the policy scenario are important factors used to choose policy implications. The policy scenario is more preferable for the government aspects and would benefit the future of the rubber economy in Thailand. The production growth is the highest in policy scenario I and rather smaller in policy scenarios II and III, respectively. The policy scenario I is far below a sustainable agricultural development and does not have a reverse polarization. The policy scenarios II and III are alternative developments into the future. These scenarios will deliver reactive sequences to trigger polarization. The positive impacts of changes in economic growth and social welfare are the highest in policy scenario II. In policy scenario III, the negative impacts in the short run are high due to the complete withdrawal of support and subsidies. Productivity and more competitiveness based on a marketing approach will be a meaningful direction for agricultural development in the long-term.

Consequently, policy implication will need to consider the scenario’s influences on economic growth, social welfare, and sustainable agricultural development in the rubber sector. Rather than desirability and policy consequences, policy decisions also need emphasis on sources of finance for investment and a burden of financial deficits. In the study aspects, the study findings coupled with a large proportion of small farms to dominate the rubber economy in terms of production and number are the important factors to make policy decisions. It is reasonable to choose policy scenario II for future policy actions. Another important reason is a great expansion of new planting in the northeast and north in which polarization will develop

similar to that in the southern region, if the policy scenario I continues. Policy scenario II will be a negative impact on the potential polarizations in new rubber areas.

5.5 Future Research

The methods developed in this study provide a guide to future research. This methodological approach can be applied to the new rubber areas in the northeast and north, other economic crops in Thailand, and agricultural development in other countries. Typically, the growth of new planting in new areas is urgently needed to be studied by this approach. If the study can be conducted soon then the results will be useful for the determination of problems and will merge for the analysis of policy scenarios. This methodological approach can seek to expand for assessing social and economic development at national and global level such as the world rubber market and trade, which poses a challenge for future research. A methodological framework of path dependence can potentially be applied to understand and assess institutional change and evolution of economic systems.

The study findings also suggest a number of the future research directions. This will need to focus on a deeper understanding of farm trajectories, which can study types of farm trajectories regarding the differences in resources endowment, technological use, capability, livelihoods, etc. In addition, the study does not yet have experiential results on the pathway of farms leaving the sector, new farmers, and intergenerational farm changes. Future research may therefore seek to analyze how farm changes, the key determinants, and their impacts as well as comparing the results of six farm trajectories.

The other important issues are that the study may focus on labor markets, contracts for good understanding of labor market institutions, and the rules used for contracts. The study results would be desirable to create mechanisms for wage agreements and supply of farm laborers. It also would enable to create governance mechanisms and fair value based on share-tapping for tapping contracts. Moreover, it is important to study in more detail causes and consequences of polarization in the overall Thai economy. This makes it highly interesting and will be very relevant to investigate the effect of polarizations on social and economic development in Thailand.

One important direction for future research is to use a theoretical framework of path dependence for understanding and assessing macro-meso-micro institutions, the rules of coordination, and the important institutions in economic development. Path dependence therefore provides theoretical framework and methodology for further training courses and programs in university and research programs.

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Annexes

Annex A

Analysis of the rubber economy in Thailand: path development and policies

The purpose of this literature review is to understand and review a literature related policy, the government interventions along history of rubber development. Guiding by analytical framework of path dependence, six periods of policy structure were identified: 1) the period of 1900-1933, 2) 1934-1946, 3) 1947-1960, 4) 1961-1990, 5) 1991-2000 and 6) 2001-2010 as details following.

1. Policy and the government response between 1900 and 1933

In the early 1900s, rubber was a new crop in Thailand. To originate by the price boom and a great expansion of new plantings in British and Dutch Colonial, the government had learned rubber value in term of new sources of foreign income and potential new planting in Southern Thailand. Three important policies were implemented during the period 1900-1933: trail plantation, promoting new planting and promoting Chinese settlements as detail following.

1.1) Introduction of rubber plantation in Thailand

The first official record related rubber plantation has been written since the reign of King Chulalongkorn as shown by his handwriting to H.M. Damrong Rejanuparb on rubber planting in Java, which concluded that the king said almost large rubber plantations in Java belonged to the government. People have been recruited to be workers in plantations. In addition to rubber plantations belonged to the government, Dutch private companies have invested in rubber plantation in both Java and Sumatra. King Chulalongkorn also stated that "*In the same way of planting rubber in Java, I have paid attention to understand as well and It has been considered carefully about capital, land for planting and labor which were important especially labor that couldn't be recruited easily as in Java*". The pioneer of rubber farmers in Malaysia was Tan Chay Yan who was Chinese grower. He had begun to plant rubber in Malakka in 1895 by using 43 acres of land. Kindersleys brothers have also planted rubber in Selandor by using 5 acres of land. After that rubber farmers in Malaysia have widely planted rubber both Chinese and European. They have had large plantations entirely. This reason made the Chinese in Malaysia and Penang who owned to plant pepper turned to invest in rubber plantation too. At that time, the price of pepper and coffee had gradually fallen. Eventually the investment in rubber plantation of the Chinese in both Malaya and Penang has been spread to the Chinese in the south of Thailand (Karrakarn,1985; Songprasert, 1985).

Phraya Rassadanupradit, who was the governor of Trang Province and Chinese capitalist, had known about rubber plantation and a potential economic crop in Dutch colonial since he had traveled to Java with King Chulalongkorn. In 1900, he went there again to study the highway technology on mountains so that he had a chance to study more about the rubber plantation. He also had had a business of chili merchants in Penang and had supposed to

bring some rubber seeds to Thailand but he couldn't, because the rubber owners both private and public didn't allow exporting rubber seedling. British government in Malaya and Singapore had enacted the law to strictly prohibit someone from bringing any parts of rubber plant that can breed out of the territory. If anyone broke this law, they will be imprisoned for 6 months sentence.

Luang Sophonpalarak (Ong Tiew Hui) who was the custom duty at Kantang port and owned marine line from Kantang to Penang, was the first importer of rubber seedlings from Penang to grow in Trang province. He also was close worked to Phraya Rassadanupradit. He has appointed Captain Seng to bring many rubber seedlings to Kantang. Luang Sophonpalarak allowed Mr. Chuan Tahseng to grow rubber and he didn't let anyone known what he has done. Mr. Chuan grew all rubber plants in the areas of his house which was located at Ban Hua Hin, Tambon Bor Nam Ron, Amphoe Kantang. Luang Sophonpalarak also had invested in 30 rais of new planting at Tambon Born Am Ron. This was the first rubber plantation of Kantang and Thailand. At that time people have called "*Yang Tee Ngor*" for rubber tree. Phraya Phipatkosa who was Ministry of Foreign Affairs also had realized an importance of rubber. He has learned rubber plantation and the method how to grow rubber in Ceylon (Sri Lanka). Hw has brought rubber plant seedlings from Ceylon to grow in Bangkok as a pilot plantation. At the same time he has recorded to the King ChulaongKorn about his project in order that H.M. the king promoted and appointed some agencies to have responsibility to manage pilot plantation. H.M. the King has written a letter to H.M. Luang Thevawongwaroprakarn, the Minister of Foreign Affairs on September 28th, 1901 in response to Mr. Guperus who was Dutchman came and asked for a permission to be a government officer who carried out the rubber planting in Thailand that "*Phraya Phipatkosa, the initiator of the Project of rubber planting has told me about this project because he has seen it in Ceylon so he tried to grow the rubber plants but he was too with his work that caused the project was unsuccessful*" (Karakarn, 1985).

Later on H.M. the King has appointed Phraya Passadanupradit to be the governor of Phuket in 1901. Phaya Rassadsnupradit has assigned Luang Nakhonkitbamroong (Kor Yoo Kied Na Ranong) the Chief Officer Trang District and Mr. Klod Sutthinont to ship 21 sacks of rubber seedlings from Penang to Thailand. Phra Sathon sathanpitak has brought some of them to grow in his garden at Tambon Kantang and then he has expanded 45 rai of rubber plantation. The rest of rubber seedlings were given to people to grow in their land so people called "*Yang Thesa*", "*Yang Tee Ngor Thesa*" (Karakarn, 1985). At that time, people did not know the value of rubber plants, they were neglected them until almost all died. There were only in Phra Sathonsathanphitak's Plantation to stand to be breeding source. Many observations believed that these were the central expansions of rubber and sources of rubber seedling to the farms in later (Stifel, 1973).

1.2) Trial rubber plantation

The first policy was observed by the government to attend the trial rubber plantation project by local government in Monthon Phuket so that they asked to support budget from the royal government. In 1901, H.M. the King has paid attention in rubber planting increasingly when he was motivated by Mr. Gupews, he has told that "*I have considered carefully for the*

rubber, I have thought it was very interesting and there was much empty land for planting so the government had to support that project because it was useful for country" and he has written that "*The trip to Singapore and Java, I had seen the area for planting rubber and found that the climate in that area was not the same as in Ayuttaya and Saraburi even Nakhonratchasima except Dongphrayaphai that I only used to pass by train so I was uncertain to tell that Dongphrayaphai was suitable for planting or not. The area for planting had to be chosen and examined before and it might be necessary to manage the project of rubber planting*" (Karakarn, 1985). However H.M the king hasn't carried out the project according to his argument due to high capital of new planting and risks in capital investment. So he thought that only the government could be managed this project.

In the early 1900s, the local government to recognize strong commitment of Phraya Rassadanupradit launched policy to promote new planting but it wasn't successful because of a lack of technology and knowledge. So, he wanted to set the pilot plantation that would increase knowledge and produce rubber seedling for people. Pilot plantation project is established by the budget from the royal government. He has written to ask for permission to launch the project from H.M. Damrongrachanuparb, Minister of Interior on December 16th, 1901 and to use some budget from Department of mine. At the same time, he also reported in detail of project to promote rubber into people.

On January 2nd ,1901 H.M. Damrongrachanuparb has reported to H.M. the King that "*Phraya Rassadanupradit noted that the area and yield in tin mining decreased continuously so he has thought that the rubber should be promoted increasingly. Climate and soil have been a good quality and condition to grow rubber. Rubber promotion was that the government allowed anyone who wanted to occupy new land for growing crops in proportion, after having harvested, the farmers could ask for rubber planting on their land. If not or if anyone didn't want to grow crops, the government would handle to grow rubber plants in their owned land when rubber plants grew up, the government would allocate that land to people. The government would support rubber seedlings if anyone wanted them the government would sell at the lowest cost. The government should hire Indian experts to advise technology and knowledge, therefore Phraya Rassadanupradit would ask for permission from H.M. the King to use some budget of Department of Mine for this project.*" H.M. the King has written to answer on January,3rd,1901 that he has approved of Phaya Rassadanupradit's rubber project. H.M. the king's letter can be interpreted as the first policy for rubber plantation in Thailand. Rubber plantation introduced to intend a new economic crop where the existed income from tin mining and chili pepper declined in which have made foreign income from export decreased. Moreover, the reform of taxation system in 1873 has affected the interest of monopolistic tax collectors in which had motivated to find new economic opportunities or to generate new sources of foreign income (Songprasert, 1993). In fact, in responded to price boom and growth of demand for natural rubber in the world market, Phaya Rassadanupradit and the Chinese capitalists have begun to grow rubber plant before he has written the letter to H.M. Damrongrachanuparb (Karrakarn, 1985). Rubber plantation is expected to earn good financial return and new source of foreign income. This policy also provided available policy options for path development of rubber economy in next period.

1.3) Policy for promoting expansion of new planting

The local government had a clear idea about policy for promotion of new planting since the early 1910s, which was observed through intentionality toward introduction and promoting new planting of rubber plantation by Phaya Rassadanupradit in Trang and Phaya Sakseni in Pattani. Because of new technology and lack of knowledge, Phaya Rassadanupradit asked for permission from the Malaya government to support training and internship for two Thai staffs; Luan Apirakratcharit (Nok Yoong Wiseskul) and Phra Anajak (Oan Noa Thalang). Phaya Rassadnupradit himself also has travelled to study plantation technology and rubber production at anytime when he went to Malaya and Penang. Later, rubber plantation was established in Tambon Pakchong, Mueng Trang. This plantation seemed like an agricultural school for local officers in Monthon Phuket. Phaya Rassadanupradit has command governors, sheriffs, and chiefs of Tambon to enter training and given rubber seedlings to grow. Some seedlings also had spread into people. Pilot plantation was useful for people, as according to his report to Phraya Thewed-ต่อ Wongwiwat, Minister of Agriculture that "*At this time a trial rubber already planted in Phuket. This project also would be established in Maung Trang where were closed to Nakhon si thammarat. People who have lived there would get knowledge and will extend seed of rubber too*". At an early stage, high production cost was main constraint to concern by the government as the report regarded production cost to H.M. the King by Phaya Rassadanupradit. The first investment was about 5.87 baht. Maintenance cost was 5.66 baht per rai per year, which totally was 28.30 baht per ria for the first five years for tapping.

This reasons caused that Luang Apirakracharit, Chief officer of Agriculture of Phuket, had promoted new plantings to the rich men to grow rubber according to the Apirakratcharit's report to Phraya Rassadanupradit that " *It's necessary to invest too much money and pay too much attention for rubber plantation in order to get high return, the rubber planting must be done carefully if not it would get lost rather than profitable, in other word money made money …so rich men would invite to invest in rubber planting*".

Pharya Rassadanupradit also has invited noblemen and officers who were rich men or capitalist to invest in rubber plantation. The famous noblemen and officers such as H.M. Damrongrachanuparb had owned the rubber plantation at Tambon Chong, Prince Charoonsak Kritsadakorn at Tambon Kantangtai, Khun Nitettawarnkarn (Ied Chongpitak) and Luang Sophonpalarak at Ban Hua Hin, Tambon Bor namron Amphoe Kantang. Other important were Toum Kae Khook, Chig Chew Ha, Chig Chew Hke on Bangruk hill Tambon Tubtiong, and Tien Khui at Tambon Bangmark, Amphoe Kantang. In addition, the rubber plantation at Tambon Bangmark, which called "*Suan Luang*" (i.e. the royal property), was an important plantation to produce seedlings to widespread for people later on. This plantation was more than 2,000 rais , where people could access to pick up seedling or tapping freely as public rubber plantation. Most people who lived in Trang and closer provinces in Southern Thailand usually picked up seedlings from this plantation.

At that time, it seems that local people haven't been known rubber value and new planting was very slow to expand. People have satisfied in subsistent production which had a less important of cash income. Other important reason was high production cost and cost of seedlings. When Phraya Rassadanupradit realized the reason why people didn't accept this

policy, he has handled under compulsion to promote new rubber plants by announcing that family must grow food crops on 10 rai or grow rubber about 20-rai land, who ever could do according to the announcement would get document of exemption of royal labor recruitment. This method had impacted on expansion of new planting in Phuket considerably.

In parallel, rubber had grown in Pattani by Malay people who have brought rubber seedling to grow on small rubber plantation as well as large rubber plantations belonged to the Chinese in Betong and Europeans. British councils (1907) noted on Pattani trading report in 1907 that "*In Pattani, there was only British's rubber plantation which located at Tambon Bangnara. The future of rubber planting in Pattani was possible that Pattani might be the important source of rubber production*". This report also confirmed the entering of Europeans to be rubber planters in Pattani. In Patani, rubber was initially promoted by the local government. Phraya Sakseni, Chief officer of Pattani, has made the policy to promote expansion of coconuts and rubber plantation for export. According to his report to Phraya Wongsanuprapan, Minister of Agriculture on September 12th1911, he said that "I*n this region, the orchard plantations haven't been important in which mostly produced for consumption and exchange in the village. Some of them were important economic activities such as coconuts and rubber plantation. New planting slightly grew because of high cost of rubber seedling which had imported from Singapore. The rich family could buy those seedling but the poor couldn't. However, rubber plant seedlings used to grow instead on their new plantings by showing in lists of year 1908-1910. These implied that rubber planting was one of most important occupation. I myself have thought that I would support money for buying rubber seedlings and sell with low price to the poor family in order to expand new plantings. These plantations would be followed up by sheriff, when the rubber had to return money for buying rubber seedlings further. At this time, I have had a meeting with the governor and district governors about policy to promote expansion of coconut trees and rubber. Whoever has grown at least 500 trees of coconut, he would get document of exemption of royal labor recruitment. The regulation of rubber planting was a using of 10 rais land per 400 rubber plants and that of coconut planting was a using of 15 rais land per 300 coconut trees. Local officers would command to do so on*". This provided strategic method to promote new planting and coconut, reflected that they had showed strong attention to promote rubber plants to be important economic crops in Pattani (Stifel, 1973; Karakarn, 1985). By overviews, the successful of rubber plantation in Malaya in term of export value and high profitable, which people called "*one great money-crop*", have been attracted to rubber growers in Southern Thailand. Chinese and government officers were the pioneering group of rubber planters. So later, Thai people began to find rubber seedlings to grow on their land. Most rubber seeds have come from Trang and spread widely to another parts since 1908. In Pattani, people have got rubber plant seedlings from both Trang and Malaya such as the Chinese's rubber plantations in Betong where could import from Malaya more comfortably.

In 1910, Phraya Wongsanuprapan, Minister of Agriculture had considered that important economic plants were rubber and coconuts. These products have been high demand in the world market at that time. By the meeting of agricultural officers in December, 1910, the government has suggested that officers in all regions of southern Thailand should make the effort to promote people to grow both rubber plants and coconut trees increasingly. Ministry of Agriculture also has made an announcement of the rubber plantation zone in each

region by followings, "*the appropriate area for planting rubber plants and coconut trees should be in Malaya peninsula up to Pranburi*". However, Luang Ratchamitri (Poom Punnasri) has brought rubber seed to grow in east coast of Thailand.

In 1919, Ministry of Agriculture has published the monthly magazine namely "*Prakorb-kasikam (Agriculture)*". The objective was to suggest new crops and agriculture, especially rubber. This magazine may help to introduce rubber plantation into people even it was spread only officers in Bangkok rather than people in Southern. As well, the published book "*Rubber plantation*" was held in 1910 and 1911 that may help to publish knowledge and new technology of rubber plantation into people. These were evidence to indicate that the government was initially concerned promotion of rubber plantation and its expansion. This book was given freely in the exhibition of Agriculture and Commercial at Sraprathoomwan. It was made broadly to give knowledge to people (Patcharat, 1959; Karakarn, 1985).

1.4) Policy for promoting Chinese planters

Chinese were a large number of foreigners in Southern Thailand. The Chinese was the pioneer of rubber growers in Southern of which held capital, new technology and specialization so that Chinese growers had played the most important roles in expansion of new planting across Southern Thailand. In addition, they have had much money and dared to invest risky in rubber planting. These were characterized by a large size and technological use the same as modern plantation in Malaya. Chinese-Malaya labors are employed to manage plantation and to tap rubber trees in order to reach high yield and rubber quality so that they could be sold at high price or exported by themselves. Merchants are established according to a large their volume and accessibility to rubber market and international price.

As overwhelmed by Western empires, the government implemented policy to promote the settlement of immigrated Chinese. The expansion of Chinese's growers would be to against British Empire moving into Southern Thailand. This was due to British Empire had shown the strong desire to expand politics and economics over South region. In 1920, the government had commanded Chiefs of Monthon (regional office) to permit all the Chinese who didn't claim to be people under control of the British or Dutch, could be occupied new land of 100 rais per person for new planting in which should be quickly permission of the requirements within a day. Immigrated Chinese that required holding land more than 500 rais, should submit the approved document to regional officers which should finalize the decision within 2-3 months. This policy was achieved to encourage a large immigration of Chinese labor and Chinese capitalist to be immigrated into Southern Thailand. Some of them were the smallholder and hired labors in plantation. They had commonly settled along the railway line from Yala, Naratiwat, Pattani, Songkhla and Nakorn si thammarat.

Chinese growers had owned either a large size of new planting in Thailand or to hold rubber plantation in Malaya. They come with capital, skill and experience in rubber plantation. Landholding combined with profitable of plantation encouraged them for new planting in Thailand. They could be taken advantage in surplus of land and support of government. Land acquisitions by Chinese were done by occupied land and very low land price from Thai people, especially in Sadoa, Songkhla. They had preferred to purchase from Thai Muslims who have had documents of land right. Size of landholding was about 50 rais

to 3,000 rais which could be accumulated. Company was owned by a 30,000-rai of rubber land. The large individual rubber plantations were Zoong Nguan who owned about 2,000 rai of rubber plantation at Tamon Ta-ngew, Amphoe Mueng Nakhon si thammarat. Chin Pak Jin who owned about 3,000-rai of rubber plantation at Tambon Ta-Chang, Amphoe Haadai Songkhla. Most of Chinese plantation from Malaya located on the border of Thailand which held a thousands rai of landholding. In the end 1910s, the Chinese in "Hog Jew" tribe who used to be worker in rubber plantation in Perak, Malaya, also had immigrated in the south of Thailand. They were settled along the railway line from Nabon to Klong Chandee station Nakhon si thamarat (Songprasert, 1993).

Moreover, the government has jointed venture with Chinese capitalist to establish rubber estate. This Chinese capitalist was the contractors to build southern railway line. The estate was invested about 6 million baht to establish two rubber estates: The Jeng Plantation Co., Ltd., and The Wae Chan Yen Plantation Co., Ltd. in 1917. These companies have employed the Chinese in "Khae" tribe who were employed to construct railway line and didn't want to go back their country and also employed the Chinese in "Khae" tribe from British and Dutch colony as workers. The Jeng Plantation company has held rubber land of 30,000 rais at the border between Haadyai and Ban Klong Ngae Amphoe Sadao. The Wae Chan Yen Plantation company has invested in rubber land of 20,000 rais at the border between Tambon Padangbezar and Amphoe Sadoa, Songkhla. In addition, these companies have occupied other landholding by approval of Thai royal at that time. These companies have consented to spend all expenses for those workers and allocated half of area of plantation to Chinese workers each (Songprasert, 2005).

In addition, the western investors also have recorded for landholding of rubber plantation in Southern Thailand as well. By the obvious evidence, there were 3 people. The first was the one from Denmark who came to ask for permission from officers to grow rubber plants at Amphoe Yeengor, Naratiwat during 1902-1903. The second was Mr. Greham, the counselor of Kelantan has asked for permission to hold a 800-rai land in Pattani to grow rubber plants in 1906. He has got the royal permission from H.M. the King Chulalongkorn to hold land at Tambon Bargnara, Ra-ngae. In addition, he owned another land which was the royal permission to hold land at Amphoe Yee-ngor with the total of land approximately 1,500 rais. Later, he has established the company namely "Bangnara Capital Limited Company" to grow rubber plants. Until 1910, the total of landholding approximately was 768.75 rais. The last one was Mr. Henry G. Scott has asked for permission to invest in rubber plantation in Phuket with 10,000 pounds. Government has give permission him to grow rubber at Tambon Mai-khouw, Amphoe Talang, Phuket (Karakarn, 1985). It appears that the western investor was limited to invest rubber plantation except one has been personality to close with the government. This is because the un-confidence and serious problems between Thai government and the western empires.

The expansion of Chinese plantation has slowed down in response to decline of price after 1932. Rubber price at local market has dropped from 1.22 baht per kilogram in 1927 which was the time of world economy drop to 0.13 baht per kilogram in 1932. Rubber price has seriously slowed down since 1927. It made the serious problems to the Chinese planters when high cost of production remained to pressure their business and led to lose profit too much. Some of the owners has temporally stopped their business or had sold some of rubber

plot for their expenditure (Taanthai, 2002). After WWII, the Chinese have begun to expand rubber plantation again in consistent with the increasing rubber price. Landholding was increasing through accumulated money from merchants and new occupied land.

1.5) Thai planters

In the past, the traditional cultivation of people in southern Thailand was subsistent production for home consumption to dominate by rice cultivation and traditional orchard. When Chinese began to occupy land for new planting, people remained to cultivate subsistent agriculture. The achievement of the Chinese's rubber plantations in term of cash income and a better standard of living were key factor to inspire new planting to Thai people. They began to adopt modern plantation technology into simple technology. The study found that simple technology was characterized by *"Tam boon Tam Gam"*. People have grown rubber plants in the manner of "*Tam boon Tam Gam*" because the lack knowledge, lack of technology, and scare capital on rubber planting. This was able to disorder conditions of rubber plantations. "*Look Yang (seedling)*" which collected from rubber trees in Chinese's plantation had pulled into an associated crop with fruit trees randomly. Other method was dig a deep hole and drop rubber seedling into space of the existed tree, which mostly mixed to associate with fruit trees. There was random planting without specific line and number of tree per rai which mostly depended on space between rubber and other trees. This random planting has been widespread across the areas. Eventually, the rubber trees have mixed with other traditional orchards; its condition was "*Pa Yang (Jungle rubber)*". This method was characterized by agro forestry plantation that caused to disorder rubber growing and low yield. The average of rubber age for beginning tapping year was about 10 years and production was much less approximately 100 tree per sheet or 40-60 kg per rai. "*Tam Boon Tam Gam*" has grown without a maintenance and application of fertilizer so that rubber has not treated anymore. When rubber tree grew just enough to tap, they will clear a path between tree for stand of rubber tree and convenient to tap only.

Other method was that the famers started on occupied land with burned and cleared land for rice cultivation in the first year and then planted rubber tree in the second year or third year which rubber mostly are grown and intercropped with many fruit trees. Another reason was that rubber plantation used to claim landholding. This plant had high density of rubber per rai and regular space of tree line. Farm maintenance was low due to high fertility of soil and may be needed pruning and weeding control between stand of rubber tree. This plant could be tap within 7-10 year. Plantation will clear only weeding around of rubber stand for convenient of tapping and collecting latex. All of them were finally characterized "*Jungle rubber*". Due to new plantation, the disease was absence except "*Pluak Daeng*" (red termite) has eaten rubber roots that caused rubber plants to die. The solution of this problem was putting salt around foot of rubber plants in order to kill "*Pluak Daeng*" (Karakarn, 1985).

After starting to tap rubber tree, they learned tapping skill, purchased tapping knife and processing equipment from the Chinese planters in the villages. The Chinese who owned large plantations haven't tapped themselves. The Chinese workers from Malaya are employed to manage rubber production due to tapping need skilled labor. If rubber is tapped with un-skill, the yield was low and shortage economic life span by high exploitations of tapping

panel. With this reason, the rubber owners usually have trained to tap rubber by neighborhood and Chinese laborers for a month, especially the Chinese growers have preferred to train tapping skill and farm practices for Thai people. This method was kept interest of each other. When smallholding produced rubber, they have sold their rubber to the Chinese who were the rubber owners and merchants at the same time. Tapping knife and processing tools also have been imported from Malaya such as tapping knives and acetic acid. Some of tools which the rubber owners could make themselves such as spoons for getting latex, trays, latex cup and filters for removing unwanted substance. The tapping knives were used only 3 types. The first type was similar to chisel, the second type was similar to hook, the third type was common used to the present called "*Jebong*" knife which was created by Jebong rubber plantation in Malaya, and later, it could be produced in the south of Thailand (Taanthai, 2002).

Often the rubber owners wanted to tap high frequency for maximum latex as much as possible. High frequency tapping system then used commonly that caused high damage panel and exploitation rubber trees. However, this practical experience has helped them to have knowledge and improved skill in rubber production increasingly. Moreover, the farmers haven't known the appropriate time for tapping, sometimes they have taped many times a day. As the learning process, later rubber trees were tapped only after mid night to early morning because they have known that rubber could produce high yield at this time. Tapping time depended on number of trees, if they owner many rubber tree, they must start to tap at midnight after that about two hour was collected latex and made rubber products.

At that time, two rubber product forms are: "*Yang Kon*" and "*Yang Peun or Un-smoked sheet rubber (USS)*". The first method was mixed latex and acid in the tray, leave haft hour for coagulation and then made it into rubber ball which called "*Yang Kon*". It will put in the sunlight to day off. Due to shape of ball and very thick, it did not dry and smell awful when it was kept in the longtime. It has worse small so that could be called "*Yang Nouw*". The second was the rubber sheet. Latex and two fold of water will pour in tray, put acetic acid, and used small piece of wood to stir slightly. A half or hour rubber would coagulate then taking it to machine for making a thin sheet of rubber, which called "*Yang Paen*". There was un-smoked sheet rubber (USS). To produce USS, the farms needed to invest sheeting machine which was high price in that time. So, USS was commonly produced by large farm. In smallholding, they couldn't purchase sheeting machines. They have adapted the way to make a thin sheet by using bottle pressed on rubber until it became a thin sheet which could be called "*Yang Khuad*" before put it in the sunlight to dry out. "*Yang Khuad*" has had less quality than the rubber sheet that made by machine, it was a raw rubber sheet as well so that it could be sold at higher price than "*Yang Kon*" (RRC, 1967).

Other important simple technology to adapt by small holding was acid for coagulation rubber. There are many kinds of acid such as formic acid, acetic acid, sulfuric acid, pyroligneous acid that were imported from abroad and quite expensive. It was difficult for the small farms to buy them so that they have tried to produce substitute acids. The new substitute acid were commonly used consisting of fermented acid from palmyra sugar, coconut sugar, pineapple juice, coconut juice, sommuang juice, fermented sommuang leaves, lemon juice ash solution. The use of these acids was resulted low quality of rubber, however they could be sold as well (Songmaung, 2002; Taanthai, 2002).

Thai people couldn't own the large size like the Chinese. Most Thai people have owned the small size since the mid 1920s because they would have to plant rubber as a mean for income generation to satisfy traditional agrarian society. This also is due to the first introduction of cash economy in the village. In the past, the farms never have any cash crops or gear with market economy. Scare capital and new technology are important factors to constraint expansion of new planting. Rubber plants were new which they haven't had knowledge about planting and production so they were not known how much value of rubber plants could give outcomes. Due to scare of capital, they have used family labor and rubber seeding which could be collected from Chinese plantations. Simple technologies associated with family labor are the key factor for expansion of rubber to dominate by smallholding.

In period of rubber slump in 1934, the expansion of rubber areas in Thai people has been slowed down in response to declined price. Thai planters have temporally stopped tapping rubber. They have had their owned food cultivations such as orchard, rice, livestock and wild hunting that could earn supplementary for farm living comfortably. Then, when rubber price was very low, they just stop to tap, farm maintenances, and fallow (Stifel, 1973).

1.6) The expansion of rubber areas during introduction of plantation

In the first decade of the 20th century, the expansion of rubber concentrated in Monthon Phuket where was pioneered the rubber planting. The rubber owners were the Chinese who were occupied tin mines in Phuket and who were traders in pepper traders in Trang. It seems that the first plot began to tap in late 1906 when the first official record of rubber export was about 44.64 tons with price of £ 78.62 U.S. cents. High level of rubber price was an important incentive to invest by the overseas Chinese plantation. It also was associated with the government policy to promote settlement of immigration of Chinese. These caused high expansion of rubber thereafter the 1920s (Songprasert, 1993).

Table 5-1 shows that the expansion of rubber areas was rapidly increased from the estimate of 109,000 rai in 1917 to 2.71 million rai in 1941. The first phase of the expansion of rubber was very slow, especially before 1917. Thereafter, the expansion of rubber areas grew gradually regarding level of price and policy for promoting new planting by Chinese settlement. As well as, southern railway has linked to Malaya in the 1920s that further had strongly impacted on a large immigration of Chinese labor and their expansion of new plantings. By the estimation of available statistics, the expansion of rubber areas substantially increased to 0.886 million rai in 1928 with the average of 64.8 percent per year. The third phase of high growth was during 1934-1941 even new planting controlled but it did not affect on the rapid growth of new planting, which rubber areas has increased from 0.886 million rain in 1928 to 2.71 million rain in 1941 with the growth rate of 205 percent.

Table 5-1 The estimated new planting and total rubber areas during 1900-1941

Periods	New planting (rai)	Total rubber areas (rai)
1904 – 1917	109,000	109,000
1923 – 1928	778,000	886,000
1934 – 1941	1,824,000	2,710,000

Source: Ingram, 1971; RRC, 1971

1.7) Rubber price and trade

Table 5-2 shows the average price of RSS#3 and the estimated rubber production and rubber areas during 1901 – 1933. These data presented only quantities of export and total price of rubber products which was shipped at port of Bangkok but there were large quantities of export which had shipped through port at Songkhla, Kantang, Phuket and Naratiwat especially port of Kantang. This indicated that there was underestimation of production and rubber areas as in Table 5-2.

Thailand began to export rubber in 1906 which the rubber exports gradually increased. In 1910, rubber price in southern Thailand was about 8 baht per kg and trended to decrease continuously to 2 baht per kilogram until the end of WWI. The price has moved according to the price in New York and London market (RRC, 1971). Although the price has decreased, the expansion of rubber has substantially increased about six time of the first decade. During 1919 to 1921, rubber price continued a trend downward from at average price of 1.45 baht per kg in 1919 to 0.52 baht per kg in 1921. After 1922 to 1925, rubber price has recovered from 0.60 baht per kg to peak of 2.26 baht per kg in 1925. There was short period of increasing price before slum trends between 1926 and 1932. However, the average rubber price of 2.0 baht per kg during WW I was higher to compare with other crops and cost of living at that time that led to continue to expand new planting. The expansion of rubber areas has steadily increased from the estimate of 90,000 rai in 1919 to 140,000 rai in 1925 and increased to 878,000 rai in 1930. The export substantially increased from 54.7 tons in 1919 to 4,200 tons in 1925 and reached to peak of 5,617 tons in 1929 and then showed slowdown trend between 1929 and 1932. At that time exported rubber were exported to Pinang and later dominated by Singapore market after 1914. At the period of 1906 to 1917, the major destinations were British, Denmark and Singapore for re-export (RRC, 1967, 1967, 1971; Karakarn, 1985)

After 1926, rubber had rapidly dropped from 1.54 baht per kg in 1926 to 0.70 baht per kg in 1928 and continued a slump trend to the lowest price of 0.13 baht per kilogram in 1932. The export has steadily increased during 1926-1929 and fallen thereafter as in Table 5-2. The export has increased from 4,300 tons in 1926 to 5,617.0 tons in 1929 and fallen to 3,439.0 tons in 1932 that was agreeable to the lowest price.

At the local market in Hatyai, rubber price has fluctuated in the trend of decline since 1925. For such, in 1929, the price was in a stable level at 1.02 baht per kg from June 2nd,1929 to August 31st 1929, and dropped to 0.63 baht per kg on September 1st,1929. This price was stable until October 20th,1929 and continues slump down to the lowest of 0.13 baht per kg in 1932. There was lowest level of price since introduction of rubber plantation. This situation had heavily affected on large farms and share-tappers rubber to leave plantation out or converted it into other crops. So, the expansions of rubber areas have slowed down and stopped of relevant business (Tannthai, 2002). The study should be noted that there was no evidence of domestic consumption during 1900-1933, indicating that rubber production was the first export orientation.

Table 5-2 The estimated rubber areas, production and price during 1901-1933

Year	Estimated production ('000 ton)	Estimation rubber area ('000 rai)	New York ($)	Thai (baht/kg)
1901			1,124.4	
1902			1,090.6	
1903			1,390.2	
1904			1,559.8	
1905			1,667.4	
1906	44.6	n.a	1,733.3	
1907	19.7	n.a	1,599.7	
1908	9.2	n.a	1,291.7	
1909	3.5	n.a	1,858.9	
1910	13.1	n.a	2,267.2	8.00
1911	64.0	n.a	1,828.7	5.00
1912	103.1	n.a	1,771.9	4.35
1913	93.2	10	1,441.4	2.76
1914	56.6	10	1,080.9	2.09
1915	84.6	12	1,095.0	2.28
1916	41.8	34	1,297.4	2.61
1917	43.2	67	1,260.6	2.57
1918	29.7	67	988.6	2.04
1919	54.7	92	885.6	1.45
1920	321.2	103	943.4	1.26
1921	452.0	103	360.5	0.52
1922	1,120.2	103	382.3	0.60
1923	2,100.0	103	651.5	0.99
1924	3,600.0	103	574.3	1.26
1925	4,200.0	140	159.5	2.26
1926	4,300.0	329	1,088.2	1.54
1927	5,461.0	671	833.6	1.22
1928	5,106.0	671	492.2	0.70
1929	5,617.0	671	451.5	0.66
1930	4,412.0	878	225.8	0.39
1931	3,505.0	878	134.9	0.20
1932	3,439.0	878	75.6	0.13
1933	11,535.0	878	130.1	0.21

Source: IRSG, 1966; RRC, 1971, 1974

1.8) Rubber markets and market development

In this period, rubber market initially developed through networks of Chinese's planters, merchants and exporters. The Chinese who owned large plantations became the merchants to purchase rubber products from the local farmers and brought to trade with the merchants in town and exporters. Some merchants have purchased and exported themselves. The important exporters were Seng Hin Co., Ltd. in Trang, East Asiatic Co., Ltd. and Bangnara Capital Co. Ltd. in Pattani, and etc. All of them achieved to setup market networks through Chinese planters and Chinese's merchants across region (Songprasert, 2005).

Rubbers were sold in forms of rubber sheets and somewhat have sold in form of scrap rubber which called "*Khee Yang* or *Yong Koan*". Merchants would buy all raw rubber forms without grading. It appeared that rubber market was characterized by oligopolistic market; i.e.

a small number of merchants, the difficulty to access market and imperfect of market information. In some areas, famers had brought their products to sell in the town where distance of walk was about 10.0 km then they should walk and carry all rubber by over night or to sleep at night at market for sell their products in the morning. The prices depended on market prices that should be sold because they have no choices. They also faced with marketing tricks regarding to under weighting scales, percentages of moisture, and un-grade. If farmers wanted to sell their raw rubber sheets in high price, rubber sheets should be smoked so that some rubber planters has built a small smoke plant to do that. The farmers whose couldn't build a smoked plant, were willing to pay for that of service at 0.05-0.10 baht per sheet. Rubber market and trade increased competition and developed after WW I because of the higher price and a large number of purchasing shops and merchants. Merchants in each local area have purchased rubber products and exported at ports in the south and port at Bangkok. (Karakarn, 1985; Songmaung, 2002; Taanthai, 2002). During the 1910s-1920s, Trang was possible the first center of rubber trade in this period with regarding to the center of rubber production and port in the west south coast (Stifel, 1973). In the 1930s, when rubber planting spread all over south regions, the center of rubber had changed from Muang, Trang to Hat yai, Songkhla where was the center of trade on east coast with regarding to high development of transportation, infrastructures and growth of rubber production (Songprasert, 1993).

Several witness stated that rubber market can be classified into three levels of merchants: village level, middlemen in town and exporters (RRC, 1968; Stifel, 1973). Thee market levels integrated and have been closely relationships in terms of financial, credit, and marketing information. For such, exporters and merchants in town might have a credit and special loan for the village merchants in order to purchase rubber products for them. All merchants included in the market networks of exporters in which would regulate the prices for all level of merchants to purchase from the famers. Three level of marketing channel were;

1) Merchants at the village level consisted of merchant peddlers and merchants with the shop in the village

1.1) Merchant peddlers: this merchant was Chinese merchants who have traveled to buy rubber products where produced in remote areas and uphill. These products re-sold to small shops at the village or town. Farmers would disadvantage to peddlers because they haven't known the real market prices. Peddlers have less invested, they have had only a bar weighting and money approximately 300 baht. They could have a return approximately 0.10-0.20 baht per kg. Because the farmers haven't trusted in peddlers whom were not local people, they had sold their rubber in cash. Pricing derived from the purchasing price of merchants in the village or town plus the cost of travelling, marketing cost and their expected profit so that they could determine the purchasing price at daily. Price will vary based on the distance and level of profit. Most of peddlers served in the areas around of the village and not very far away because limit by their bicycle and capacity of weight. Price will be the same level of pricing by shop and merchants, when they would have to offer the farmer in the village. Many farmers argued that weighting scales was serious trick to compensate with the increase or loss of profits. The local shop has set purchasing price in order to ensure that

peddlers would sell their products to the shop and will be offered price to the farmers similar or not different from the peddlers.

1.2) Merchant in the village: this merchant was Chinese who owned small shops in village. They would buy rubber products from farmers and peddlers, and trade their products with merchants in town or exporters. In addition, his shop also was daily grocery goods that provided daily foods, basic home staples and rubber planting tools. Farmers could have to borrow money or daily consumption goods from these stores, and then sold their rubbers to these shops. The part of money will pay his debt and other will buy other daily goods for family consumption. So the price depended on market pricing by merchants and the attention to keep the relations among merchant and the farmers.

2) Merchants in town: these merchants whose have been middlemen to link business between merchants at the village and exporters. It was characterized by a large business and financial investment to purchase all kinds of rubber products to resell to exporters. They purchased rubber products from the merchants and farmers and then sold it to smoked factory or exporters. In this period, these marketing actors (smoked factory and exporters) have to regulate that merchants have to sell rubber products to smoked factory, would firstly get 80% of purchasing price at that day in advance after that rubber products would be smoked in order to grade, then results of smoked rubber products would be calculated the rest of the money 20%. This method has been used until the late of 1960s.

3) Exporters: exporters were established company to purchase all kinds of rubber products from the farmers and all merchants. They have to build a smoked factory to process raw rubber into various rubber forms depended on the needs of markets such important as rubber smoked sheet (RSS) and rubber crepe. RSS#3 was used to determine rubber pricing in daily trade, reflecting the expected price to deal with the consumers in the world market. Rubbers are exported from local ports in southern to Malaysia or Singapore market and sometimes directly exported from port of Bangkok to countries of destination without passing Singapore market. Exporters were classified as the first level of rubber trader. Exporters have regulated market pricing base on the market prices in London and New York market which were main rubber consumer markets. Since September 1911, Singapore rubber market established which was the most importance rubber market in Southeast Asia. Singapore market was traded by the rubber producers in Southeast Asia. This market was producer market. This price based on RSS price in Singapore and Malaya.

To make market pricing, for such, rubber price in the Thai market derived from RSS#3 of Singapore minus cost of marketing cost, their expected profits, the expenses of duty and tax away, and then regulated price of RSS#3 at the local rubber markets. The price volatility and an exposed risk at the world market led to apply of 80:20 payment systems to trade rubber between factory and merchants. In case of RSS#3 already smoked by farmer or merchants, the factory or exporters would check quality of RSS by random sampling, after checking they would purchase the price at delivery date.

In this period, the international rubber markets from Thailand were Pinang, Singapore and Malaya in which rubbers re-exported to British and other western countries. Somewhat has exported directly to European countries. During 1906-1933, most rubbers were traded to British colonies especially Singapore, Penang and Malaya. Rubber trade depended on Singapore, London and New York Markets. Exporters have used the daily price of rubber

products from these markets to be pricing the rubber prices in Thailand. There was liberal trade at local market and international market without the government intervention. Government will have exemption of tax and duty when price has rapidly dropped.

Songprasert (2005) argued that rubber trade in Thailand was characterized by oligopolistic markets since the WWI. Chinese capitalists have held the roles of leader to perform the world rubber markets beyond West companies in "The Straits Settlements" and later had successfully to expand market networks to Thailand. Penang and Singapore were port of integrated market for collecting and distributing rubber products into The world market after WWI. Indeed, Tan Kaki group has dominated domestic market and export by establishing three companies in the same time: Nam Siem Co., Ltd. (Southern Siam Co.Ltd), TaiTong Co., Ltd., Nam Tai Co., Ltd. (Southern Tai Co. Ltd.). These companies were build a large capacity of factory in Naratiwat, Yala, Trang and Hatyai and linked networks of merchants to purchase rubber products from the farmers. They had expanded business rapidly and coordinated with Headquarters in Singapore and Penang firmly. These companies have expanded branches of company and broker companies anyplace that grew rubber plantation and could be procured a large share of rubber products into their factories. They provided a large amount of credit to merchants with long period of time that caused other companies couldn't compete to have market shares from these three companies through the period of pre- and post-WWII. These companies later had merged to be "Tek Bee Hang Co., ltd (Southern Thai Rubber)" in 1975. These companies had developed strongly based on network of trade and the weakness of market development in Thailand. They could seek high level of profit from the differences of purchasing price at the local market and international market. With a large share of export, pricing was depended on their profits as well as demand for rubber in the world market. They could build price as their interest that led to high fluctuation of price and much gap of price between Thailand and Singapore. These power markets have influenced to local market until the 1990s.

1.3) The tax of rubber

In this period, the government has collected many kinds of tax from planters such as land tax, trading tax and customs duty. For land tax, the government had exempted land tax to promote new plantings in the early period including the period of price slowdown. Many kinds of tax caused people have had trouble so the government has collected only trading tax and customs duty. However, if the price has dropped, the government has exempted these taxes. In the early period, the government has made an announcement of tax for all of rubber on December 11th1902 which will pay at rat 10% of weight so that the farmers have complained that they would lose the profit and un-reasonable to new planters. This made Ministry of Finance agreed with the planters' complaint so it has exempted tax for promoting new planters until 1919. Due to declined price since 1920 including the complains by estate in response to new tax, H.M. the King Chulalongkorn have had royal command to make an announcement about a stop of tax on May 5th1920 in regions of Nakhonsithammarat, Pattani, Surat and Chantaburi, temporarily. For custom duty, rubber was paid at rate of 3 percent since the beginning of rubber export according to Bowring Treaty. In 1920, the price had rapidly dropped that caused to exempt custom duty and trade tax during 1920-1925 in order

to increase level of price in the country. In 1926, the government has begun to collect custom duty at 3.0 percent and exempted trade tax until 1930. In 1930, department of customs has made an announcement about new rate of export tax by the following; raw rubber sheet at 0.20 baht per kilogram, yang kon and yang nouw at 0.10 baht per kg and latex at 0.50 baht per liter (Karakarn, 1985; Custom Department, 1990).

2. Rubber control between 1934 and 1946

2.1) International Rubber Regulation Agreement

The quota of production and market interventions were not new. As consequences of rubber crisis in the world market after World War I, the rubber prices at the London market dropped rapidly. Therefore in 1918, the rubber planters, which most of them were British companies collaborated to establish "*The Rubber Growers' Association Agreement*". The objectives were to solve problems in the rubber growers and to gain agreements in rubber production and trade. These members produced about 70 percent of the world rubber products where had planted in British territories in Malaysia and Ceylon. In order to deal with price slump down, the government of British established an organization to control rubber production called "*The Stevenson Scheme*". The government of Holland invited to joint but they had refused. The British continued their plan that was able to raise the prices but it still couldn't solve the problems in the world market (Barlow, 1978).

Due to unintended consequences by the great depression in the U.S.A, the rubber price rapidly declined since the early 1928. There was the lowest price in history of rubber market. These reasons caused the major rubber producing countries agreed to limit supply of rubber in order to raise rubber price. In the first stage, the scheme did not invite Thailand as members of the association. Thailand has a little production and less effected to the rubber prices in the world market. As a result, the scheme has less affected on the prices in which slightly increased about 35 to 40 cents per kg in 1928. These caused the British government and the British colonies in South East Asia have to invite the Holland and France into the scheme. British government had also invited all the rubber producing countries, especially Thailand to join them.

In 1930, British government had established the project called "*Rubber Quota*" pursued to improve market situation and rubber price. This project was organized as the following: 1) to limit the exportation quota 2) to control the rubber productivity quota and 3) to limit the rubber production quota. A meeting was set up for all the producing rubber countries to discuss the matter. There was much discordance and disagree by both producers and consumers which had caused the project to end. As a result, rubber price continued to drop from 94.2 pounds/ton in 1929 to 29.9 pounds/ton in 1932. These had made British called for a meeting all of the rubber associations of planters from many rubber producing countries on the 24th of April 1933.The purpose of the meeting was to decrease the rubber stock in order to maintain it at a normal level and to regulate international trade by balancing supply and consumption of rubber in order to maintain rubber price at the faire price and remunerative producers. Because Thai government just started new government after democratic revolution, Thailand had sent a representative to join the meeting as observers

(McFadyean, 1944). Thereafter, British government had decided to send two representatives from Malaysia who were Mr. Egmont Hake and Mr. James Robertson, to discuss and to invite Thailand to join the associationon the 26th of March 1934. The Prime Minister of Thailand understood the importance of this association and had agreed to be member of the association on the 8th of May 1934. The government stated that the important factors for joining this association were:

1) The rubber producing countries in the colonies of British, France and Holland considered the great impacts of market deterioration and falling price that needed to have rubber control agreements. They agreed that rubber producers should not produce or export rubber more than the rubber quota assigned by the agreements. This restriction pursued to improve the stability of the price. If there were any country that did not comply with the rules, the project would be a failure.

2) The rubber was an important occupation in southern which could generate a large amount of foreign income. If the price of rubber was very low, it would have an overall effect to stagnate the entire regional economy. The government understood the quota of the rubber production did not mean that the farms must stop producing but it was only production quota to clarify the precise amount of the rubber production. The quota depended on the rubber production of the previous year. The associated countries could not produce more than the quota without permissions. The expansion of new plantings was limited as well. All the countries should not expand without permission. Thailand was quite confident that by joining this association would have made the price of rubber will increase.

Moreover, Thailand did not have its owned rubber market, if they did not join the association: i.e. rubber production depended on the Singaporean market and the Malaya market. This scheme may be threatened and bargained Thai rubber production into the world rubber market. The government also considered by emphasis of the national interest and the needs to maintain relationships with international organizations (Karakarn, 1985). Due to lack of statistics, the British representatives had offered the quota in the first stage as the following: 1) in the first year, Thailand could export 8,000 tons and 2) in the second to the fifth year, Thailand could export 12,000 tons. The Thai representatives thought it was very low quota, so they negotiated for 15,000 tons per. The details of the negotiation were as the following (McFadyean, 1944):

1) To quota for the exportation of 15,000 tons/year
2) To assure the lowest limit of exportation: it should not exceed 50 percent in the first year; 75 percent in the second; 85 percent in the third year; 90 percent in the fourth year and 100 percent in the fifth year.
3) Thailand could have unlimited domestic consumption.
4) By the IRRA, the associated countries could not grow new rubber plantations but Thailand could have new plant of 31,000 acre/year or 77,500 rai.
5) The associated countries must pay a fee according the rules of the scheme but Thailand had requested to pay the fees only for the trading between Thailand and the associated countries and had not paid for the representatives or committees and their inspection costs due to a little production and small country.

Thailand signed the International Rubber Regulation Agreement in 1934. Other rubber producing country members of the IRRA were Malay, Brunei, Holland, Lanka, India,

Burma, Indonesia, China, France, and North Borneo. The meeting was signed "*International Rubber Regulation Agreement*" in London. The government had presented the agreements and that of negotiation to the Council of representatives (To quota of export of 15,000 tons/year) for ratification. The Council did disagree with the quota as they claimed that the amount was ridiculously low. The Prime Minister of Thailand had decided to resign. It appeared that it had a negative outcome. After the signed agreement, the government agencies have informed that statistics of export was error. The decision to join the IRRA had given Thailand many disadvantages due to the lack of statistics and exportation information before the decision was taken. In facts, Thailand could export 24,000 tons/year and not 5,000 tons/years. The mistake was in handing in the incorrect information to the representatives for the negotiation which had put Thailand in a disadvantage position.

The news related the limitation of exportation had spread rapidly through southern causing much agitation among the farms and traders which were made the notices to disagree with this quota to the government. These agreements may be the possible negative effect on the farms and the local market when the amount of production would possibly produce about 30,000 tons per year. In 1934, based on the limitation of 50 percent of 15,000 tons until September, they could export only 7,500 tons. Rubber was still leftover productions of 22,500 tons in domestic market. The price was at 588 baht/tons that might cause the loss of export about 13,230,000 baht. The quota also will negatively affect on about 30,000 of tappers and another labor in plantation about 15,000 jobs. This information was the petition of the scheme which had caused the government understands that they had failed. This agreement which were given by IRRA to Thailand must be accepted by the Council of parliament before they could be enacted, but the council had been disagreed to this agreement that had caused the resignation of the Prime Minister as well.

The new set of government had made new negotiations by requesting a higher quota based on new statistics surveyed from the 15th of December 1933 to the 31st of January 1934. Rubber areas were 728,152 rai which could produce about 41,292,121 tons of rubber. The average of rubber production in 6 years (between 1933 and 1938) could be divided into 52,920 tons/year. Therefore, the government claimed that Thailand should get a quota of 44,678 tons of exportation within four years but the requirement of quota would set 48,000 tons. The result of the negotiation was that the quota should not exceed 40,000 tons. This agreement was effective from 1st July 1934. The IRRA had set the minimum insurance as the following: the exportation should not exceed 30,000 tons in 1935, for 34,000 tons in 1936, for 36,000 tons in 1937 and for 40,000 tons in 1938.

By the IRRA requirements, Thai government declared to enact "*Rubber Control Act*" on the 1st of July 1935. These laws were the first rubber laws regarding the rubber production new plantings, and trade. The main details of the law were:

1) The farmers must request an authorization for new planting, production, and the trade.

2) Rubber production and trade both domestic and international must follow the quota that had been set to each of farms.

3) The farmers must not stock more than the quota.

The enactments of Rubber Control Act indicated that rubber policy had reformed from free plant to rubber control. There were the law to enact to be controlled new planting,

production, and trade that the farms and traders should require to authorization and must be followed.

2.2) Rubber Control Act 1934

According to Rubber Control Act, rubber division was established under Ministry of Agriculture in 1934. There has authority in order to comply with Rubber Control Act. The duties of rubber division were:

1) To organize officers at the different levels: committee of evaluation at provincial and districts, controllers, committee of prevention and correction, and local officers. Firstly, assistant agricultural officers in each district employed them to be the local officer responsible for the post office. Furthermore, theses officers were recruited from School of Elementary Agriculture, which have controlled the issues of coupon and trade, which called "*Nai Yang*".

2) To created ministerial regulations and related enactments according to Rubber Control Act in 1934. They should publish the law for the understanding of the people and operate it correctly. Importantly, rubber division had organized all documents for the entire requirements regarding the rubber control such as the coupons for the farmers and the purchasing documents for traders. There were many new documents and forms (number by ย) belong to Article 63 which 27 forms were used as request forms for authorized production and trade. The request form for rubber owners was ย.1, presenting by coupons for production and new plantings. For exporters and merchants, the request form was ย. 6 that was used for the purchasing documents. The fee was 50 satang of the coupon and 75 satang of the purchasing document (100 satang = 1 baht).

3) To identify custom post in different locations for the exportation. The decision had been taken on the 6 June 1935. These locations should be situated in Bangkok, Phuket, Kantang, Pattani, Songkhla and Narathiwad.

4) The criteria of quota for the famers were as following details:

4.1) The period of quota was twelve months in 1935; it would start from the 1st of January 1935 to 31st of December 1936.

4.2) According to Article 7 of Rubber Control Act, the quota depended on rubber areas and number of rubber trees. The rubber owners should be request in hand to local officers by the request form (ย.1). The officers have reported to the commission about the request to calculate the quota. For the first quota, they should hand in the request within 45 days since the law had been taken into enactment. For the rest of the other quota, they should hand in one day before the period of the quota to terminate in 90 days. The quota was calculated by the commission and then replied its to the officers that would take the following procedures:

(1) The rubber plantation which owned more than 50 rai or more 2,000 rubber trees: the officers must fill in the forms with details in number of quota and period of quota in the request form (ย.2) before deliver it to the rubber owner.

(2) The amount of the plantation area and number of rubber trees as (1) should fill in the form of control coupon (ย.3) and hand it with coupon to the rubber owner.

The rubber owners could produce rubber only after they had received the authorization and the quota. The government would keep a proportion of quota belong to Article 6 that would have to facilitate administration of quota. As a result, this Act was enacted to control production, new planting and trade. The rubber owners must hand in the amount of quota for his farm and should not produce over the quota. They must hold the coupons for the selling their productions. The legal buyers (merchants) would only buy from the rubber products which held the coupons. The buyers must ask permission to trade as well. The rubber owners must also get permission to expand new planting. There was a fee for all the requests mentioned above. The rubber control was found a great negative impact on the farms and consequently complicated on the stocks, the coupons, and the need of authorizations for all activities in rubber production. A fee for each request was also burden to the farms.

Consequently, the enactment of the Rubber Control Act negatively affected on production and trade due to poor administration and corruption, especially there were many complains in enactments and in handling the authorizations from the farmers, merchants and local officers. The main problem was distribution of quota which did not follow the regulation. The farmers did not require the coupon for their productions and selling as illegal rubber. Traders also could buy coupon and a purchasing document from the black market. This implied that poor administration and reluctant implementation were high. Indeed, some observations argued that the officers would misevaluate the rubber with different amount and give more coupons than the need. They had cooperated with the provincial officers in the village and the rubber owner. They would lie about the amount of rubber products by claiming that they had more. Some of the provincial officers did not have any rubber but they had coupons for tons of rubber production. These coupons will sell to the merchants or the framers who did not had permission to have rubber quota. As well, the rubber owners could find coupon from merchants and the rubber owners who held it exceed. Merchants also can buy rubber from the farmers who did not get any coupon and then could export their illegal product with the help of the custom post and tax officials such as the case study of custom post at Tak Bai, Naratiwad. The government also concerned these problems to solve counterfeits through remaking coupons every six months.

In other hand, the farmers who had complied with all the regulations, had handed in all the requests for the quota but they were not by the commission. The rubber owners who had only very small areas had received more coupons than they were supposed to get. Those farmers who had more rubber plantation had only received few coupons and they also had to share these coupons with their tappers because the tappers could not request the quota by themselves. The rubber owners could appeal if the quota was not underestimated. Most of the owners appealed due to the expensive fee for such as those owners who had more than 50 rai, the fee would be 50 baht and 20 baht more. In addition, some of the rubber owners whom just begun to plant rubber also requested for the quota due to the young rubber trees which were not mature enough to tap rubber. The officers often prosecuted against these rubber owners. The rubber owners also appealed on the officers in handing out the quota such as the report to against between the rubber owners and the officers in Thalong, Phuket. These rubber owners claimed that the officers did not hand out quotas as regulations and had made to obtain it impossible to trade the rubber products. As mention above, there were the defect of the law

and related enactment so the government had proposed to revise the laws, repealed certain provisions, and cancelled some of the procedures in 1937, 1938, and 1940. Corruption still continued to increase due to inefficient implement and lack of statistics. The observers argued that the government never surveyed number of farmers, rubber areas and tapping areas as well as poor administrative never concerned and solved that had made it even easier to corrupt (Stifel, 1973; Karakarn, 1985; Taanthai, 2002).

The extension of International Rubber Regulation Agreement

International Rubber Regulation Agreement in 1934 – 1938 has expired on 31st of December 1938. The IRRA committee held a meeting on 25 January 1937 to extend these laws further from 1938 to 1943. Thai government had requested to increase the quota of 60,000 tons/year and new plantings of 5 percent of total rubber areas. Thai government also requested the exportable percentage as Table 5-3. The government also would have to import high yield for breeding and expansion of new yield in Thailand.

The representative of the IRRA, Mr. J.G. Hay, was negotiated with government in the 25th of January 1937.The negotiations were:

1. The new quota of rubber exportation as Table 5-4
2. The lowest rate of exportable rubber between 1939 and 1943 was 41,000 tons/year.
3. Thailand could expand the new plantings of 31,000 acres or 77,500 rai.

Table 5-3 The requirement of rubber quota by Thailand during 1939-1943

Year	Exportable percentage	Expected rubber quota (tons)
1939	70	42,000
1940	75	45,000
1941	80	48,000
1942	90	54,000
1943	100	60,000

Source: McFadyean, 1944

The ministry was satisfied with the negotiations and decided to extend the contract on the 4th of January 1938, authorized by General Phiboon Songkram who was the new prime minister. This new contract not only extended the duration of the law but it also adjusted some of the negotiations. It had been handed it by the 5th of January 1938.

Table 5-4 Rubber quota by IRRA for Thailand during 1939-1943

Year	Exportable rubber (tons)
1939	54,500
1940	55,300
1941	55,700
1942	56,000
1943	60,000

Source: McFadyean, 1944

The comparison between the quota of Thailand and other countries in the IRRA shows that Thailand had received fewer quotas than the other countries such as Holland and Ceylon. In

the past from 1934 to 1943, the export of Thailand was lower than the quota. During 1939 and 1943, rubber still exported less than the quota. Therefore, even if Thailand had received fewer quotas but it did not take disadvantage. The second contract was used in 1938 and ended in 1943. In 1939, World War II began and then the rubber control Act had ended.

2.3) The revision of Rubber Control Act

Rubber Control Act in 1938

The IRRA had been extended for 5 more years, from 1st of January 1938 to 1945. The circumstances had changed and the government had to replace the law by using the Rubber Control Act in 1938. The government considered that the Rubber Control Act of 1934 and of 1936 were inappropriate for the current situations. Therefore, the Rubber Control Act of 1938 was used to instead. This law has the same to the one of 1936 in the all articles except for one point. The only difference was that this version did not include all procedures and administrative of rubber control. There were some adaptations in this Act, such as the procedures, the requests for the trading, the exportation rubber, the tasks of officers and the fees. This law was used since 13th of January 1938. This version had no affect on the rubber owners and traders. The changes existed only to clarify all the procedures and appropriate level of fee (Karakarn, 1985; Taanthai, 2002).

Rubber Control Act in 1940

After two years to apply the Rubber Control Act of 1938, there was more revision again as enactments by Rubber Control Act (No.2) of 1940. This revision was edited the text in Article 22 from "one satang per kilogram" to "not more than five satang per kilogram". Other articles were the same as the Rubber Control Act of 1938. This law was effective on 24 December 1940.

2.4) Establishment of Rubber Division

When the government agreed to participate with the IRRA, rubber division is established under Department of Agriculture and Fisheries to authorize and enacted according to the Rubber Control Act in 1934. Rubber Division also proposed to develop production and quality. With regarding to the growth of rubber production and more responsibility covered 17 provinces, rubber division has expanded by rubber decree as "O*ffice of rubber division*" in November 1938 and also changed official from Department of Agriculture to Department of Forestry. Moreover, Elementary School of Agriculture is established in 1933 in Kor-Hong, Songkhla which concentrated on rubber research and experiment in rubber production, processing and plantation technology. There was the first center of research and development which later developed to be "*Rubber Research Center*" in 1965. By authority and functionality of rubber division, the government began to develop human resources and allocated budgets to support rubber development. For example, many the officers are enrolled for trainings at the rubber experiment station in Kuala Lumpur,

Malaysia and also recruited rubber division's officers whom graduated from Elementary School of Agriculture (RRC, 1975).

2.5) Impact of rubber control on production and market

In 1932, the world economic crisis had heavily depressed the rubber prices. Rubber price sharply dropped from 2.57 baht/kg in 1917 to the lowest of 0.13 baht/kg in 1932. The rubber farms were in trouble. Some of them had stopped plantation and left the rubber until stand of forest. This situation led to participate with the IRRA in 1934. This agreement was affected on the government intervention through the quota of production, new planting, and trade. Free new planting and trade in the past were ended. The government had involved to control all stages of rubber production. To enact by Rubber Control Act 1934, it seems that the famers could not proceed if there were authorized by the officers such as new plant, production, trade and export. The farmers who needed to replant or new plant would have to fill request form of ย.24 and ย.25 and presented only document of land right (Title deed or N.S. 3). They should be able to prove that they were the landownership themselves. These documents requesting the permission must be presented and proved by local officers before a quota will issue for each of farmers. By these procedures, the farmers who owned only S.K 1 do not allow them to grow new planting but many new growers did not have the authorization. Thus, rubber production had changed clearly due to enactments of the rubber control Act but this law also has a beneficial effect on the farmers themselves regarding improving the level of prices.

Furthermore, several local officials are established to be functioning the rubber control in all districts and provinces. These officials had recruited officers who graduated from Elementary School of Agriculture in Korhong, Songkla. These officers were called "*Nai Yang*". The officials' behaviors and working procedures had created many problems on the use of coupons for controlling production and trade, leading a wide range of corruptions and black market. For the smallholding, the procedure for requesting coupons was difficult due to the postpone of the receiving date by the officers. If they were a large farmer, the officers would quickly hand them the coupons in return for bribes. These had caused much discontent between the small holdings which later would not request for any authorization to quota and new plantings. Some of them had grouped together and made an appeal towards these officers. The trade of much illegal rubber products was consequently high. The merchants would purchase the rubber at very low price which was 35 to 40 satang/kg while the famers with the legal coupons could trade their rubbers at 85 to 90 satang/kg. The different price was at 50 satang/kg which had caused much problem for the smallerholding (Karakarn, 1985).

Furthermore, many responsible officers have corrupted in coupon which has cooperated with the local officers at the village and the famers. They had claimed a large quota more than what they really had. Some did not own a rubber plantation at all. These rubbers called "*Suan Lom*". The corrupted officers would hand out coupons to these cheaters without checking or any inspection in real production and rubber areas. Later, these people would bring the coupons to sell in the black market which was purchased by smallholding and merchants who did not have coupons. This could create return without the need to invest

at all. The merchants could buy low price on the illegal farmers because they did not held coupon. Furthermore, these corrupted officers were helped exporters to export rubber products without custom duty or tax causing the loss of return to the country. It appeared that the government has already known about poor administrative and the need to repeal the law. Rubber Control Act of 1934 are revised in many articles in 1938 and 1940. These revisions proposed to improve the weakness in administration and procedures in enactment of the law. There were nine more rules added to the Rubber control Act in 1938 (Karakarn, 1985; Taanthai, 2002).

In contrast, Karrakarn (1985) argued that perhaps the rubber quota did not cause much constraint to the farms and trade. Most farmers did not feel any difficulty in complying with the law. This is due to the facilities and the simplicity in handing requests even if some corruption had widely occurred. For such, if the farmers did not hold any document of land right to present the officers, they were required to simply verify landownership by the provincial officer in the villages or teacher that could issue the coupons accordingly. When the farmer got these coupons, these coupons simplified to trade and increase the prices as well. Often the merchants had increased the prices by the value of coupons, not only for the products. Merchants would even purchase rubber that did not have any coupons which meant that these products were illegal. For those farmers who did not comply with the law which meant that they did not request for the quota. Most of these farmers had owned small size; i.e. the estimated size was below 30 rai. These farmers did not proceed according to the law but they still traded just like any other farmers. They would trade at a lower price the merchant would buy the rubber even though there were no coupons. Accordingly, the expansion of new plan still grew as in the past. Officers could not inspect and verify new planting, rubber production and rubber areas by themselves. These plantations were remote areas and difficult accessible to rubber areas. Moreover, people did not know about enactment of the law and did not comply with it. They were not prosecuted by the law. But seriously, the officers and the provincial officers were corrupted but most farmers did not prosecute against them or often ignored (Stifel, 1973; Taanthai, 2002).

Table 5-5 New plants and re-planting that reported to IRRA

Year	New planting (rai)	Replant (rai)	Total (rai)
Total permitted during 1934-1938	77,500	141,377.5	
1934	-	-	-
1935	20,015	-	20,015
1936	52,000	-	52,000
1937	5,400	40,393	45,793
1938	-	-	-
Total permitted during 1939-940	77,500	No limit	-
1939	-	112,950	112,950
1940	55,000	35,000	90,000
Total	132,415	188,343	320,758

Source: McFadyean, 1944

As a result of IRRA, the rubber price has steadily increased from 0.4 baht per kg to 1.0 baht per kg in 1940. The price did not drop until World War II. The expansion of rubber areas continued to grow in response to price stability. The average of new planting was about 100,000 rai of forest land that were converted into plantation in each year. Karrakarn (1985) argued that underpin reasons were encouraged to plant rubber due to the fact that the government regulated to stop "*Chewing Mak*". The government had forced to stop the plantation of "*Ploo*". The farmers who owned Ploo plantation were in trouble and converted rubber instead. Table 5-5 shows the new planting and re-planting to report the IRRA. These statistics were lower than the reality expansion of rubber areas. The IRRA have reported only statistics in 1940 due to the outbreak of war in 1941 (Taanthai, 2002).

Table 5-6 shows that after the Rubber Control Act 1934, the rubber areas had expanded from 878,000 rai in 1937 to 1,816,000 rai in 1941. The average growth of expansion was about 13.35 percent per year. The stable of rubber area between 1934 and 1937 is due to lack of confidence in statistics and the survey. Rubber price had steadily increased continuously from 0.40 baht/ kg in 1934 to 1.30 baht/kg in 1941. The increasing price coincided with the exporter which had increased from 23,180 tons in 1934 to 47,006 tons in 1941. The rate of production growth was about 11.1 percent per year before the beginning of World War II.

Table 5-6 The estimated rubber areas, production, export and price during 1934-1944

Year	Rubber area ('000 rai)	Production ('000 ton)	Export ('000 ton)	Price at local market (baht/kg)
1934	878	23.180	23.180	0.40
1935	878	31.190	31.190	0.56
1936	878	35.291	35.291	0.74
1937	878	36.122	36.122	0.88
1938	1,154	42.284	42.284	0.64
1939	1,430	42.420	42.420	0.84
1940	1,706	45.222	45.222	1.02
1941	1,816	47.006	47.006	1.30
1942	-	11.900	11.900	-
1943	-	4.970	4.970	-
1944	-	1.610	1.610	-
1945	-	-	-	-
1946	-	13.750	-	4.89

Sources: RRC, 1967, 1971; Reed, 1969

After Japan had invaded many countries in Southeast Asia in December 1941, the governments under the control of Japan were Thailand, Indochina and Malaysia. These countries could not continue IRRA. A few countries were left which were England, India, Netherlands and East Indies until 1943. The agreement was renewed and extended to the 30th of April 1944. Thereafter, there was no need to continue the IRRA due the increasing demands in the world market.

Table 5-7 The rubber production, export and export values during 1934-1944

Year	Production ('000 ton)	Export ('000 ton)	Exported values (million baht)
1934	30.0	23.18	9.305
1935	40.0	31.19	13.22
1936	40.0	35.29	23.53
1937	40.0	36.12	22.67
1938	40.0	42.28	25.12
1939	54.5	42.42	30.19
1940	55.3	45.22	26.54
1941	55.7	47.00	58.57
1942	56.0	11.9	10.08
1943	60.0	4.97	3.07
1944	-	1.61	0.95

Source: IRSG, 1966; RRC, 1967, 1971

During the period of quota from 1934 to 1944, Table 5-7 shows that the exportation of Thailand had exceeded the quota only in 1938, which had exceeded the quota at the rate of 2,284 tons. The exportation in other years had been less than a given quota by the IRRA. There were two reasons. The first reason was that the quota received from the commission was higher the rate of Thailand's rubber production. These reasons related with lack of statistics regarded to rubber areas, tapping areas, and production. All of data were roughly estimated that led seriously the negotiation of quota with the IRRA. The second reason was the highest illegal rubber exports. These products were exported throughout the southern such the incident in Amphur Thakbai, Narathiwad. However, the government had implemented the rubber control through the whole country even though there was not enough staff and budgets which had allowed the farmers to avoid complying with the law. These sequent events were important causes for the growth in rubber production, export and exported values. This period also was found the great expansion of new planting which could be tapped before the outbreak of war (Stifel, 1973; Karakarn, 1985; Taanthai, 2002). Because rubber is strategic material in war, each country must be imported as possible as so the export substantially increased to 47,006 tons in 1941. The value of export was 58.57 million baht which was doubled from 1940. This was the second exported value while rice export was the highest values.

2.6) Impacts of Rubber Control Acts on Rubber Market and Trade

In this period, rubber markets both domestic and international market were the same as the last period. In the domestic market, marketing system consisted of three types of merchants; merchant peddlers, merchants at the village, districts or city and exporters. The first type was travelling merchants and dealers. The government was controlled in every stags through controlling purchase and trade legally. These measures were to assert facilities for both the famers and the merchants. In order to quota of export in accordance with the IRRA, the merchants must authorize to trade and export following procedures of Article 3, purchasing rubber, and Article 4, import and export of rubber as the Rubber Control Act.

In the farm level, the farmers would sell their products to the merchant peddlers or the merchants at the village and transferred to the merchants in the city and the exporters, respectively. If the merchants owned a smoked sheet factory, rubber would process into smoked rubber and trade its with the exporter. For the large farms, they mostly have been a smoked sheet factory that could be traded with the exporters. This implied that the markets were multistage levels of marketing channel, the less development of markets, and the difficulty to accessible market. The farmers must give coupons to the merchant for the trade. These coupons must be the same amount as the amount of rubber. There were 4 types of coupons. Each type represented different amount of weight: 5 chang (ย.4ก), 10 chang (ย.4ข), 15 chang(ย.4ค) and 1 hab (ย.4ง). These coupons were not suitable due to the measurement which normally dealt in kilogram. The farmers complained to weighting of coupons and the authorities causing the cancellation of the 4 types of coupons and replaced it with new coupons in 1935. These coupons were divided into 1 kg, 3kg, 10 kg and 30 kg.

Moreover, the number of authorizing traders in regions and Bangkok increased from 139 traders in 1939 to 199 traders in 1944, reflected that the rubber trade grew substantially until World War II (RRC, 1970). The rubber trades were directly exported to international rubber markets in Malaysia, Singapore, Pinang and Hong Kong. About 94 percent of rubber was traded pass through these markets in 1938 and had increased to 99.0 percent in 1939, reflected that rubber market in Thailand depended on those of re-exported markets. In the period of the outbreak of war, Thailand began directly to trade with The U.S.A. The purpose was to reduce dependent London market. In 1939, World War II had started but Thailand was not undertaken. Rubber was one of the war materials for that led to shift demand in many countries especially in America and London. These two countries had collected much rubber for stockpile which became very unusual but it had increased the trade (Robert 1990).

At the beginning of war time, rubber trade did have much obstacle. Thailand was trading with America, British, all western colonies and Japan where demand was growing. Rubber price substantially increased. Thailand had taken advantages by a large trade of rubber and tin in this period. About 75 percent of rubber was imported to the U.S.A in 1941 according to extreme demand by stockpile of America. Japan also tried to purchase all of rubbers from Thailand, but it did succeed due to Thailand's refusal. After 1941, Thailand had been occupied by Japan. The trading rubber with America and England was complicated and rapidly decreased. During World War II, the rubber market had closing down as well as the domestic rubber market (Stifel, 1973; Karakarn, 1985; Taanthai, 2002).

2.7) Tax of rubber

After Thailand had participated with IRRA in 1934, the Ministry of Financial had suggested the government to collect tax for export in order to increase the government revenues and to expense the fee for IRRA. Because price did not increase as the government had expected it to be, the tax policy had begun later. In 1935, the rubber price was 0.38 baht that was still made much problem for the farmers. This had caused the government to adapt the tax rate for the exportation on the 21st of March 1935 as in Table 5-8. As positive consequences of the rubber control, rubber price had steadily increased. The export tax

became one of the main the government revenues. The government had adapted the export tax rate at 7 percent of the market price of rubber on 19th, February 1938 (Stifel, 1973; Karakarn, 1985).

Table 5-8 Customary tax during 1935 and 1938

Year	1935	1938
Rubber sheet	2.0	7.0 % of market price
Scarped rubber	1.0	7.0 % of market price
Latex	0.5	7.0 % of market price

Source: Department of custom, 1935, 1938

3. Policy reformed and institutional setting between 1947 and 1960

After the WW II, Thailand has undergone economic crisis due to terminated exports and trade with foreign countries. The government revenue has declined and showed a trend of deficits in trade. The government then emphasized on an increasing foreign income and the government revenues in the short run. Regarding an important rubber export to generate the foreign income, the government implemented policy for promoting extensive production, new planting, and promotion of rubber export. The government then focused on promoting expansion of new planting and supporting rubber production. The government begun with the revision of Rubber Control Act, the establishment of "Rubber Estate organization (RES)", "Rubber Nursery Plots" and "Rubber Experiment Station" as well as "The replanting scheme". In the outbreak of the Korean War in 1950/1951, price boom had profound effects on a great expansion of new planting. As well, the expansion of rubber processing factory also increased. Importantly, the policy approach has changed from nationalism to serve liberalism based on the popular stereotypes of the United States.

3.1) Revision of Rubber Control Act in 1947

In the post WW II, most rubber areas did not registry either to be offence against the law or expire authorization in production belong to Rubber Control Act in 1938 so that Council of representative had offered to revise the Rubber Control Act in 1947, allowing the legal registration in the six months after the Act enacted. This revision also can be interpreted that the government intended to compromise the farmers to legally practice. However, the government remained to reluctant implementation because of limits of officers and to refuse by many farmers. The farmers were usually refused to follow the law, especially in the remote areas and also local officers cannot inspect accordingly. Farmers still planted and produced rubber to sell in the illegal. This act has not completely solved all of problems but it was affected on several reasons. First, this act presented that even IRRA has already been terminated, the government still emphasized to enact the law in 1938. Second, this act would have to present expansion of rubber arbitrarily and to encourage the occupied land for rubber area with legally. This act helps to increase encouragement of farm to expansion of new plantings.

3.2) Rubber experiment station and rubber nursery plots

During 1950-1960, the government established about 20 units of rubber nursery plots and rubber experiment stations as below. The objectives were to promote the expansion of new plantings, to support the use of high yields and to promote the improvement of rubber quality. In addition to this, the rubber nursery plot and experimental station have strongly been an encouragement to the farmers in the commitment of government. These rubber stations also proposed to transfer knowledge and new technology related rubber productions into the farmers. Indeed, rubber experiment station at Kor-Hong, Songkhla was an important station affecting the path of rubber development.

1) Jan Di rubber station, Chawangm nakorn si thammarat
2) Khoa Chong rubber station, Muang Trang, Trang
3) Nai Chong rubber station, Muang Krabi, Krabi
4) Kok Pri Meng rubber experiment, Sihaipadi, Naratiwat
5) Wang Yang rubber experiment, Tai maung, Phang Nga.
6) Bang phro rubber experiment, Takua Pa, Phang Nga.
7) Kor-Hong rubber nursery, Hatyai, Songkhla.
8) Rubber nursery in Pa-thium, Chumphorn.
9) Rubber nursery in Punpin, Surattani.
10) Rubber nursery in Tungso, Nakorn si tammarat
11) Rubber nursery in Talaang, Phuket
12) Rubber nursery in Maung Satoon, Satoon
13) Rubber nursery in Sa-dao, Songkhla
14) Rubber nursery in Kok Pho, Pattani
15) Rubber nursery in Bun nang sata, Yala
16) Rubber nursery in Maung Yala, Yala
17) Rubber nursery in Roa Soa, Naratiwat
18) Klongtom rubber station, Klongtom, Krabi
19) Bajoa rubber station, Bajoa, Naratiwat
20) Tanto rubber station, Bannang stat, Yala

Agriculture station of Khor-Hong is established to promote expansion of agriculture in southern and later had changed to be rubber experimental station in 1952. The objectives were rubber experimental plots, adoption of new technology, and promotion of rubber industry. Most of rubber experimental stations and nursery plots located in remote areas and new settlement areas. These stations have been demonstrated how to use new technology and a good practice in plantation that provided a mean to transfer new technology to the farms. Furthermore, these rubber stations have influenced to accelerate a rapid expansion of new plantings around locations of rubber stations as well as the widely use of new variety. The other government agencies and some estate also have been cooperated to demonstrate and to train practices and the use of new technology to publish such as rubber plantations in Suansaranron hospital, Surattani, School of agriculture in Siyaim Tungsongm Nakorn Si tammarat, and some estate in Songkhla, etc (Bunphiban, 1989).

3.3) Rubber estate organization

During 1939 – 1941, Phraya Anuwatwararak, head of the division of rubber, has been a certain amount of money from Minister of Finance to purchase land for rubber plantation in Na Bon and Chang Krang, Nakhonsithammarat. The purchased land was about 450 rai and 170 rai of waiting for sale. To survey the purchased land, he found that a large new planting grew in the illegal areas where land reclamation was not lawful. Total land was about 12,000

rai consisting of new planting on approximately 6,000 rai and 6,000 rai of forest areas. These areas were refused to hold the land right by Department of provincial land. In 1941, the government has issued royal decree to ban the right of these areas. In 22 March 1949, the government agreed to establish "Rubber estate organization (RES)" that would able to perform these estates for the government revenue. RES also proposed to be a trial plantation, to be a center of technological transfer, training and internships, and to produce high yield of planting materials with low cost. The government has been to support the budget about 3.4 million baht for investment and operation cost in 1950. In related to these, RES launched several projects to support the rubber development and the replanting scheme such as expansion of new clone about 5,500 rai, experiment plot of cocoa in 300 rai, experiment of coffee in 700 rai. RES also emphasized to develop primary processing factory to produce RSS, STR, Crepe and Con-latex. Ministry of Agriculture has enacted an ordinance establishing RES as estate enterprise in 1961, which have been operations and management within the scope of the objectives laid down in Royal Decree in 1961 under the Ministry of Agriculture. The new objective was extended as following (RES, 2012);

1) To business on estate plantation and to produce nursery and plating material
2) To produce RSS, Crepe. Con-latex. STR and others
3) To produce rubber goods and rubber parts
4) To produce and distribution of energy for RES and their activities
5) To trade and business with their products and by products under article 1, 2, 3 and 4 and agricultural equipment
6) To serve and facility of government and publish involving rubber

RES have currently reclaimed land of 41,800 rai in ChangKlang and Krungyai, Nakorn si thammarat (RES, 2012). RES played important roles for transferring knowledge and technology to people in upper southern. Like the establishment of other rubber experimental stations, a large expansion of new plantings around RES was observed. RES also strongly encouraged to expand new plantings and diffusion of new technology in the closer provinces (Songprasert, 1993).

3.4) New technology and promotion of new rubber varieties

The Rubber Division intended to promote new plantings and the replanting with high yield since 1943. Because of high cost and difficulty to import high yield varieties, rubber division began to breed rubber variety through selective breeding, propagation and breeding at Rubber Experiment Station at Kor-Hong and other rubber stations. Tjir1 and GT1 were selected to test in the experimental field at Kor-Hong rubber station. Once rubber experiment station at Kor-Hong is established in 1952, reflected the attention of the government to develop new rubber variety. High yield varieties are imported from Malaya which started to test breeding and propagations at Kor-Hong rubber station in 1953. Due to lack of knowledge and limit of experts, this experiment was very slow in progress. About six year later, Kor-hong rubber station has achieved to develop rubber varieties which could identify 50 rubber varieties to test for conditions in Thailand.

During 1953-1965, about 300,000 seeds per year of Tjir1, GT1 and several rubber seeds are imported by the rubber division for experiment in field plots and for distributing to the farms with low price. These seeds were purchased from estate which has certified by the Malaya government. These seeds were selected as a breeder to find breeding hybrid that was appropriate with weather and conditions in Thailand ever more. As a result, the rubber division could distribute high yield seed and rubber stock (green budding) with low price to the farms. For such, price of high yield rubber stock (green budding) had decreased from 200 baht per meter to 4 baht per meter. Rubber seedling was about 0.10 baht per seed and high yield seeds were 1.0 – 2.50 baht per seed. Cost of rubber seed was about 100-200 baht per rai that would encourage the expansion of new plantings with the selecting seeds more than in the past. In 1955, the survey showed that the rubber area was totally 2,090,000 rai, out of which was planted with high yield about 6,000 rai or about 0.29 percent. In 1959, Kor-hong rubber station provided the first training of green budding in which the clone that used green budding could have high yield. This method enabled the farmers to access the high yield varieties with low cost and helped to accelerate the distribution of high yield varieties at the farm level (Pattanakul et al., 1980).

After the Korean War, high prices and its profitable still motivated people to expand new plantings and conduct as the main occupation. The farmers paid more attention in every stages of rubber growing even more from the selection of rubber varieties, planting, farm maintenances, and processing to rubber sheet in order to improve yield and more profits as well. In case of Sadoa district, the knowledge related plantation technology relied on the wisdom of the Chinese. Chinese also helped to diffuse technology of green budding to Thai people. Because Malaya was prohibited to export any rubber stock of green budding, the farmers would possibly get from their relatives to help smuggle rubber clone (high yield), especially RRIM 605 and RRIM 623. Through learning and improving technique of green budding by the farmers, this technique was able to expand new planting with high yield to imitate to neighboring farmers and widespread in rubber areas. In 1959, this technique was well known to expand high yield clone after Kor-Hong rubber station began to train to the farms together with supporting rubber stock of green budding (Taanthai, 2002).

3.5) Establishment and development of rubber cooperatives

In the early 1950, the government began to support the establishment of cooperative in order to improve rubber production and quality. Department of cooperative had invited small group of farmers to form a cooperative. Each of cooperative would have 50-120 of farms, which owned totally 2,000-3,000 rai of rubber areas and have about 12,000 – 18,000 of rubber trees. The government supported a loan for building and equipments to produce rubber smoked sheet. The first cooperative was “Na Tham limited assets and cooperative industrial rubber” and “Ban Pho limited assets and cooperative industrial rubber” in Muang Trang. Table 5-9 shows the cooperatives were established by the support of department of cooperative (Wasuwat, 1983). In addition, the government has supported special loan for operations and the investment in the early stage as in Table 5-9. Kor-Hong rubber station also provided one-month training to cooperatives’ member and staff in order to increase performance in rubber processing and make rubber quality. Moreover, department of

cooperatives have also established many factories of rubber smoked sheet across region such as at Khok Pho district. Pattani, Yala, Songkhla, Phatthalung and Thung Song district, Nakornsithammarat (Karakarn, 1985).

Table 5-9 The first rubber cooperative and budgets for those of establishments

Province	Name	Budgets (baht)
Chantaburi	Plubpla cooperative	205,000.0
Trang	Na-taam cooperative	474,307.66
	Banpho cooperative	743,011.65
	Khong bor cooperative	302,796.32
	Yantakwa cooperative	655,000.0
Pattani	Naphradoo cooperartive	709,118.52
	Moamawee cooperative	425,000.0
Naratiwat	Yeengo cooperative	420,000.0
	Tonyongmas cooperative	565,000.0
Songkhla	Wangpring cooperative	381,480.46
	banprik cooperative	355,000.0
	Nam noi cooperative	75,000.0
Yala	maong Yala cooperative	650,000.0
Pattalung	Tung ai to cooperative	150,000.0

Source: Karakarn, 1985, Bunphiban, 1989

As well as, rubber division also began to establish small scale factory of rubber smoked sheet in order to improve rubber quality. In this case, rubber division supported equipments for factory and invited farmers' group to make rubber smoked sheet. However, cooperative and processing factory by rubber division could be operated in short run. They faced several problems and terminated due to price fluctuation, lack of expertise in technology, and lack of understanding concept of cooperative. There was the first time to implement cooperative systems at the village**.** As well as, smoked sheet factory by rubber division also have many problems regarding to limit of officers, lack of emphasis by farmer, low production, and low marking bargaining power. Even these policies were suspended and failed for establishing cooperative at the farm level, there was the first policy that had implemented at the farm level and enabled to access by the farms (Bunphiban, 1989).

3.6) Policy to promote domestic industrial rubber products

During the WW II, Ministry of Industry had set up rubber factory to produce several rubber products of which were war strategic reasons to meet domestic demand. In the post war, the government realized an importance of industrial rubber products and then would have to expand production capacity. Therefore, the government had approved the government's rubber factory to have a new loan about 3.5 million to invest equipment for producing vehicle tires and tubes. After the installation has been completed, the factory was able to produce tires for the first time in the country. It also produces several rubber goods. In 1950, the domestic consumption was less than 1,000 tons per year, or less than 1.0 percent of total rubber. In 1952, because rubber price has declined, the government implemented policy for promoting industrial rubber products that would help to stabilize rubber price. In 1952,

the General tire company from the U.S.A was approved to set tire factory. The government has assigned the Ministry of industry in this regard. Other rubber manufacturers were owned by Chinese which were a small factory to produce bicycle tires, footwear and rubber band, etc.

Table 5-10 Number of rubber manufactures and domestic consumption during 1957-1960

Year	Number of rubber manufacture in Bangkok	Number of rubber manufacture in Regions	Total domestic consumption (tons)
1957	62	68	2,087
1958	77	83	2,118
1959	99	105	2,163
1960	101	117	2,178

Source: Ministry of Industry, 1966

Table 5-10 presents that domestic consumption has steadily increased. During 1957-1960, the domestic consumption was about 2.0 percent of total rubber and 98 percent exported to international markets (RRC, 1969).

3.7) Establishment of the Thai Rubber Traders Association

In 1950, rubber traders and exporters have been meeting by organize of the government. The propose was to improve quality to meet international standards and to maintain reputation of rubber production from Thailand. The consumers have been several complains in rubber standard and claimed in damages from Thai exporters. They also have reluctant to trade rubber from Thailand or to purchase with low price. By consultations between the government and Trade Company in several times, the meeting agreed to set up "*The Rubber Traders Association of Thailand*" on March 5, 1951. The objectives were to serve as the central organizations to foster co-operation between producers and traders as well as to act the central entity for government agencies to contact groups and discuss or negotiate about matter of common interest. At the beginning, the main purpose was to solve problems due to the non-regulated trade that lacked any rules and regulation. Indeed, there were problems of poor quality and difficulties of trade contract which led to dispute and harmed the trade. This association also formed with the prime objectives to eliminate unfair trading and to support honest trading members in accordance with trade rules and regulation. In 1968, this association called "*The Thai Rubber Traders' Association*". It also served information on the market, rubber marketing, and trade situations in both domestic and international markets including co-operation with the government and international organizations (TRA, 2012).

3.8) Cooperation with International Rubber Study Group

Since termination of the IRRA in 30 April 1944, the rubber producer and consumer countries agreed to establish International Rubber Study Group (IRSG) in 1944. The first meetings held in Washington in January 1945. There was international forum for the discussion of matters affecting the supply and demand of rubber. The main objectives were:

1) To compile statistics of production of natural rubber, synthetic rubber and their consumption and then present to the members
2) To study a broad application of rubber
3) To advice and help resolve in difficulties that occurred within the member countries as possible to alleviate depression
4) To arrange a meeting between the members and organizations involved production and consumer periodically

Government agreed to be the member of IRSG in June 9, 1949. Because of the growth of rubber production and competitions among rubber producers, this organization would have to benefit in international trade and rubber development in the future. In the meeting held on 7 May 1950, Thailand was enrolled as a member of IRSG. One of the important reasons was the problem of statistical data and its precise that was still serious problem in Thailand. This participation was extremely useful to country when it was able to understand precise data and statistics according to price, areas, production, trade, marketing information and market situations in the world market. There was the supporting information for policy decision in the country (Petchanthron , 1972.).

3.9) The origin of the replanting scheme

After the WW II, The U.S.A had influenced to guide social and economic policies in Thailand to orient liberalism. In 1950, the government signed the memorandum of understanding (MOU) in cooperation of economic and educations between Thailand and the United States of America. Thereafter, Thailand was aided by the United States through various agencies that were set up to provide assistance to Thailand. Agriculture sector has been the large aid and assistances in new technology. The government created policy of agricultural development during 1950-1952 which the U.S. has supported such a policy through setting up "*Committee of the economic and technical assistance program of the United States*", in which Mr. Austin F. Flegel and colleagues have been surveyed social and economic status in Thailand during 20 to 28 July 1951. This committee has been surveyed various occupations including the rubber plantations in the South. By Thai side, the government has set up a committee called "*The committee for collaboration and implementation of economic and technical assistance program of the United States (K.S.W.)*". M.L Dach Sanitwong was chairman and committee composed of Phra-prasahkakorn, Mr. Intri Junthronsatid, and Mr. Wiboon Satiticrat, ect,. This committee was surveyed rubber plantation and primary processing factory in Songkhla. As a result, Food and Agriculture Organization of the United Nations (FAO) cooperated with the United States have supported several aids and grants for agricultural development through the Office of the United States economic and technical assistance to Thailand in 1953 (Karakarn, 1985). In addition, FAO has assisted in the establishment of a rubber factory for the production of rubber at Khor-Hong rubber station in Songkhla (FAO, 1974).

Moreover, the World Bank was an important international organization that has supported loans and helped to initiate national plan and policy for social and economic development since 1950. The World Bank had surveyed Thai Economy during 1957-1958

which provided the important report to criticize Thailand's economic development. The economic survey team consisted of nine experts leading by Mr. Paul T Elsevier in chief and Mr. G. H bacon in agricultural advisors. They have strongly recommended that Thailand in the past was ineffective in social and economic development and less emphasis to play roles of government in social and economic development. This recommendation provided based on the report of "*A Public Development Program for Thailand*" in 1959. The recommendation had become a principle of the draft of national plan which was applied in all of "*National Economic and Social Development Plan (NESD)*". National Economic and Social Development Office was established by pressure of the World Bank and the Unite State which has changed system of aid and grants from projects by projects to the long-term economic plan in order to ensure policy continuity (World Bank, 1959).

Importantly, this report stated that the government should play important role in occupational development in each of region. For southern, the report has focused on the rubber development was one major of national economic policy. If the government will have serious attention, rubber will become the sources of foreign revenue, no less than rice. The report also pointed out that in the past, the government has been a less attention for rubber development which was observed by at least half of the land which was possibly suitable for growing rubber remained available, and the growing of low yield rubber.

They suggested the government to create "*Project for rubber occupational development in southern Thailand*". This project will periodically implement in 1959-1963. The propose would have to promote new planting and the re-planting with high yield and also to promote expansion of estate. The first phase should emphasize to encourage small farmers to expand rubber areas and to promote new planting with high yield. The second phase should find a mean to promote a number of estates. The third phase should be to promote the re-planting with high yield. They also suggested the action plan as following (World Bank, 1959);

The first phase: the implementations required in 3 years,

1) To increase number of rubber nursery and rubber breeding plots across region and their improvements to meet the requirements and demand for the new planting and the replanting

2) High yield should be purchased from abroad, as had been the practices to supply until there was enough the demand in the country

3) Establish a central experiment station to demonstrate planting, farm maintenance and training staff to be expertise. These staffs should be worked closer to the farmers, particularly small rubber replanting according to advice planting and farm maintenances.

4) To distribute high yield without charge to the farmers and to apply a criteria of high yield for considering new plant in public land.

5) To promote a large farms by Thais people or by foreign investors and to reject the law to limit landholding not exceeding 50 rai per farms.

6) To promote estate by rent for long-term or selling with cheap land to private investment which could be payment when rubber will be tapped. If the buyers or tenants do not comply with regulation or planting standard, the government should take measures to cancel the deals.

7) Government should support the lands for agricultural colonies where are suitable for planting rubber that could be governed the use of high yield in new plantings. The government can continue to support cleared forest, build road and land protection accordingly.

8) This survey suggested that rubber institutes from Bangkok should move to set in extensive rubber areas which would facilitate to implementation and control projects.

The second phase: there was the continuation of the first phase.

1) To establish community settlement (farm colony) of rubber farmers
2) To develop a road to connect the settlement in order to facilitate transportation to market
3) To establishment a central unit for clearing forest.
4) To measure for controlling water, to prevent soil erosion and their effects.
5) To measure preventing Malaria
6) To establish new organization responsible this project and coordination between several government agencies.

The third phase will focus on the expansion of rubber areas in the agricultural colonies and the replanting with high yield.

The government agreed to implement the recommendations of the survey through the replanting scheme under Rubber Re-planting Aid Fund Act in 1960 as following section.

3.10) Rubber Replanting Aid Fund Act

Since mid-1937, Thailand had recorded about the replanting. Rubber division began to control the replanting areas according to the IRRA. There was the replanting in definition of the Rubber Control Act in 1934 and 1936 which called "*Repairing plant*". The government has abolished this law and used Rubber Control Act 1938. This law has changed the definition from "*Repairing plant*" to "*The replanting*".

For the establishment of "*Rubber Replanting Aid Fund*", there was the proposal of the World Bank survey that need to have special organization with a strong responsibility and flexibility in the replanting. As well as, IRSG suggested that the natural rubber producing countries should promote the replanting with high yield that would increase productivity and reduce production cost since 1954.

In 18 May 1955, Rubber Replanting Aid Fund was presented to council of representative by the rubber division. The proposal of this law would collect the "*Cess*" from the exporters for the replanting fund. The draft Act has been suspended by the government at that time (Prime minister, Por Piboon Songkram) due to time close to a period of election. The government has taken to consider in the parliament again on 7 July 1956. It was appeared to have controversial within the party when *Cess* will collect from merchants that further adversely deduct in the purchasing price at the farm gate. Subsequently, this draft Act was revised that the government budget was a source of fund for the replanting offering to Prime Minister, Por Piboon Songkram again. But it is likely that the government did not have enough budgets to be allocated to the replanting. This Act has been suspended many times

due to political conflicts, council interest, and conflicts in the financial fund for the replanting that should support by budget or *Cess*.

In 1960, the government of General Sarit Thanarat agreed to implement "Rubber Replanting Aid Fund Act of 1960" which was the effective date on 5 December 1960 (Karrakarn, 1985). There was the significant event to determine the path of rubber development through policy constitutions and a given institutional arrangement. The recommendation based on "*A Public Development Program for Thailand*" by the World Bank was found the great influencing the effective of this law. At that time, the World Bank was a loan provider to stipulate pressure on the government to follow its recommendation. Moreover, the policy makers who were economic advisors mostly agreed to follow national social and economic development plan by the World Bank that led to launch the replanting Act.

This Act was reformed a mean for the replanting with high yield. Financial fund come from the *Cess* which collected from the exporters in a certain level of price and then will pay back to the farmer when the replanting with high yield will occur under the replanting scheme. This fund is likely saving money for the replanting by the farmers and then the farmers did not return to the government. After the promulgation of this Act, the government has setup "*Office of Rubber Replanting Fund*" and "*Committee of Rubber Replanting Fund*". The main duties were as following; 1) to operate the replanting scheme, 2) to administrate the replanting scheme and financial fund to carry out the replanting scheme by approve of the Cabinet and 3) to manage "the Office of the Replanting Rubber Aid Fund" according to Ministry of Agriculture has approved. This committee began to promote the replanting since 1961 (ORRAF, 2012).

3.11) The expansion of rubber plantations and production

After World War II, the rubber market recovered rapidly in both the world market and the domestic market. Rubber price substantially increased to 4.89 baht per kg in 1947 and rose to 6.26 baht per kg in 1949. These were high levels of rubber prices at profitable and satisfactory as in Table 5-11. The rubber production increased from 53,900 tons in 1947 to 96,144 tons in 1949, reflected that rubber production recovered slowly and tended to full potential production in 1950. High level of price was encouraged to the farmers to recover fallowed plantation and began to expand new plantings again. As in Table 5-11, the expansion of rubber areas substantially increased from 1.763 million rai in 1947 to 2.011 rai in 1949 and rose to 3.0 million rai in 1960 with the average growth of 5.04 percent per year.

In the outbreak of the Korean War in 1949, rubber price increased dramatically. Because rubber was war strategic materials, the stockpile was made by the U.S. and the UK that bought a great demand of rubber into stockpile regardless of whether price was high one. The prices rose from 4.83 per kg in 1947 to 17.29 baht per kg in 1951, price boom about 257.97 percent in four years. Price boom had profound influence in a great expansion of new planting.

Table 5-11 Rubber area, tapping areas, production, export and price during 1947-1960

Year	Rubber area ('000 rai)	Tapping area ('000 rai)	Rubber production (' 000 tons)	Export (' 000 tons)	Price (baht/kg)
1947	1,763	1,216	53.90	53.40	4.89
1948	1,918	1,366	95.70	95.20	6.53
1949	2,011	1,486	96.14	95.90	6.26
1950	2,106	1,629	114.50	114.00	14.88
1951	2,203	1,678	111.10	110.60	17.29
1952	2,302	1,693	99.90	99.40	8.63
1953	2,400	1,755	97.60	97.10	5.63
1954	2,501	1,831	112.10	111.60	7.07
1955	2,597	1,918	132.80	132.30	12.06
1956	2,688	2,011	136.20	135.70	9.88
1957	2,772	2,106	133.00	132.00	9.13
1958	2,853	2,203	140.60	139.60	8.04
1959	2,929	2,302	161.00	173.00	10.78
1960	3,009	2,400	171.80	-	12.92

Source: IRSG 1966; RRC, 1967; FAO, 1976a

Table 5-12 shows that the number of farmers increased from 75,000 farms in 1944 to 91,447 farms in 1950, an increase over 21.9 percent. These farms consisted of 96.0 percent of smallholding, 3.7 percent of medium farms and 0.3 percent of large farmers. By comparison in each group, a number of medium farms increased by about 73.9 percent, 20.5 percent of smallholding and 13.1 percent of large farms. Landholding of medium farms has increased from the average of 91 rai in 1947 to 146.0 rai in 1950. Landholding of small holding has increased from 10.0 rai in 1944 to 15.0 rai in 1950. Large farms tended to decrease landholding which the average of landholding has decreased from 784.0 rai in 1940 to 674 rai in 1950 (Ingram, 1971).

Table 5-12 Number of holding and rubber areas in 1944 and 1950

	Number of holding		Area in holding		Average size of holding	
	1944	1950	1944	1950	1944	1950
250 rai and over	213	241	167,000	156,000	784	647
50-249 rai	1,970	3,426	180,000	502,000	91	146
Less than 50 rai	72,817	87,780	755,000	1,316,000	10	15
	75,000	91,447	1,102,000	1,974,000	14.7	21.6

Source: Ingram, 1971

To characterize farm structure in Songkhla, Table 5-13 shows that total farmers in 1954 was 12,495 farms constituted by 11,480 farms of smallholding or 91.88% and 1,015 farms of large farms or 8.12%. In Phatthalung, total rubber farms was 1,132 farms accounted by 1,090 of small holding or 96.28% and 42 of large farms or 3.72% as Table 5-13 (RRC, 1968). This data indicated the dominant of smallholding and increase of smallholding after World War II.

Table 5-13 Number of farms by farm size in 1954

Provinces	Large farms	Small holding	Total
Songkhla	1,015	11,480	12,495
Pattalung	42	1,090	1,132
total	1,057	12,570	13,627

Source: RRC, 1968; FAO, 1976

Table 5-14 shows that the Chinese or Sino-Thai generally owned large size more than 50.0 rai. Thai people held about 72.9% of total rubber areas and 25.8% belonged to Chinese. However, Sino-Thai may include group of Thai people because of the changes in the new nationality system which the Chinese people born on the mainland of Thailand was Thai nationality. Ingram (1971) stated that the China mostly owned large farm more than 50 rai with an average of 25 rai and 7 percent of farms holding less than 50 rai. Thai people were smallholding.

Table 5-14 The number of farmers and rubber areas by ethics in 1949

	Holding under 50 rai		Holding over 50 rai	
	Number	Areas	Number	Area
Thai	77,845	1,058,507	1,716	267,934
Chinese	5,752	143,050	1,858	326,638
Others	151	2,503	67	20,368

Source: Ingram, 1971

During 1950/53, average new planting was approximately 196,000 rai per year. People in southern region were fashioned to occupy new land for new planting. Even rubber price has declined to 8.63 baht per kg in 1952, but the expansion of rubber still grew by about 97,000 rai per year thereafter. After the Korean War, rubber prices has declined in the short term, from 8.63 baht per kg in 1952 to the lowest level of 5.63 baht per kg in 1953 and increased again to 12.06 baht per kg in 1955. Thereafter, price was stable at remunerative level. These stimulated to high the expansion of rubber areas during 1955-1960.

Table 5-15 The estimation of rubber areas and a number of farmers in 1960

Size of landholding	Rubber areas		Number of households	
	Areas	Percentage	Number	Percentage
below 6.0	595,141.0	18.5	15,633.0	5.7
6-15	944,917.0	29.4	65,967.0	24.2
15-30	884,410.0	27.5	89,672.0	32.9
30-45	422,712.0	13.1	48,598.0	17.8
45-60	193,262.0	6.0	25,110.0	9.2
60-140	163,183.0	5.1	24,474.0	9.0
over 140	11,181.0	0.3	2,875.0	1.1
Total	3,214,806.0	100.0	272,329.0	100.0

Source: Reed, 1969

As a result, the expansion of rubber areas increased from 2.4 million rais in 1953 to 3.0 million rai in 1960 with the growth of 452.8% as Table 5-15. The number of planters increased approximately from 91,447 farmers in 1950 to 272,329 farmers in 1960 with

growth rate of 197.8%. Rubber production increased from 114,500 tons in 1950 to 170,800 tons in 1960 with the growth of 49.2%. New planting grew continually thereafter.

3.12) Rubber markets and trade

Table 5-16 shows the growth of rubber exported value in the total agricultural export. Rubber was the second exported value in total agricultural export in Thailand. The export value share was about 2.15% of total agricultural export in 1925/1934, and rose to 12.9% in 1935/1939. After the WW II, rubber exported value has increased from 7.4% in 1947 to 20.2% in 1948 and reached 30.8% in 1959. The growth rate of exported value was 5.46 percentage per year as Table 5-16.

Table 5-16 Percentages of agricultural export and mining by major product

Year	Rice (%)	Rubber (%)	Tin (%)	Other (%)	Values of total exports (million baht)
1947	38.8	7.4	1.8	52.0	968.4
1948	45.2	20.2	2.5	32.1	2,076.2
1949	49.2	15.3	9.5	26.0	2,776.7
1950	48.0	20.8	8.2	23.0	3,472.6
1951	41.3	33.2	4.2	21.3	4,412.9
1952	56.9	21.8	4.8	16.5	4,618.7
1953	64.9	13.0	5.1	17.0	5,771.8
1954	49.9	17.9	6.0	26.2	6,177.0
1955	44.2	25.1	6.2	24.5	7,120.5
1956	41.3	22.1	7.3	29.3	6,923.2
1957	48.0	18.7	7.1	26.2	7,539.5
1958	46.1	20.6	3.9	29.4	6,446.6
1959	34.1	30.8	5.7	29.4	7,560.4
1960	29.8	29.9	4.2	36.1	8,614.3

Source: Calculated from data, Annual statement of Foreign Trade of Thailand 1947-1960

To compare with rice and tin, the export value of rice and tin declined continuously. Rubber export value was increasing and showed high volatility depended on prices and demand in the world market. The growth of exports made rubber was the main source of foreign revenue. Rubber was the largest export value in 1960.

Table 5-17 Rubber export by major destination of importers during 1957-1960

Year	Singapore (tons)	Japan (tons)	USA (tons)	Malaysia (tons)	UK (tons)
1957	7.67	0.05	119.90	4.30	0.92
1958	17.18	0.36	96.70	4.70	10.70
1959	25.68	16.57	103.30	10.40	4.20
1960	19.49	40.71	59.00	15.70	5.00

Source: RRC, 1967

Before the WW II, rubber products mostly exported to Malaya for processing and re-export into Europe. Table 5-17 shows that the USA was the major importer from Thailand after the WW II, which accounted about 90.83% of total exports and later the share of export

decreased to instead by Japan as Table 5-17. The export's share from Japan was increasing and become the major consumers after 1960.

3.13) Rubber marketing system

During the post war to 1960, RRC (1968) stated that merchants in the South were the same as the former period which include three level as following; 1) merchant at the village level 2) merchants in town or province and 3) factory or exporters. At the village level, peddler merchants have travelled to purchase rubber in remote and uphill areas where had difficult to access by market or the transport vehicle was not accessible. Capacity of purchasing rubber was about 0.5 ton per month which would be sold to middlemen in the village who held the shop or merchants in the town. Peddlers may have credit in advances from other merchants being a commitment that rubber must be sold to them for payback the credit in advances. These peddlers consisted of Thailand people and the Chinese people.

The shop in the village mostly purchased directly from the farmers or peddlers to sell their products at the shop. Capacity of purchasing rubber was about 1.6 tons per month. These products will sell to merchants in the town or factory/exporters.

At the merchants in the town or provinces, they had purchased rubber from several merchants and the farms and will sell to factory or exporters. The average of trade was about 12.0 tons per month. These merchants accounted about 51.0 percent of total merchants. Generally, the famers had popularly sold their product to merchants in town or provinces rather than merchants at the village due to high prices.

RRC survey (1968) stated that most merchants were Chinese or Sino-Thai whom were members of trade networks and held merchant's relationships from the village to the export. At the village, only 15 percent of merchants were Thai people which accounted about 6.0 % of total rubber. It meant that 94% of total rubbers were purchased by Chinese or Sino-Thai.

In 1949, the authorized exporters were 35 companies but a large of exported share dominated by five companies: Thai Pak Tai Co. Lt., Siam Commercial Rubber Co. Lt., Hmaung Yang Sin Thai Co. Lt., Sakun Thai Wattana Co. Lt., and Hauy Chaun Co. Lt. These company have been set up many branches and factories in every extensive rubber areas enable to collect a large volume of rubber. In this period, Hatyai was a center of rubber market and trade where concentrated by many companies and factories. Other rubber markets were Trang, Yala, Naratiwat, Phuket and Bangkok.

3.14) The tax of rubber

During 1946-1954, custom tariff was fixed for all kinds of rubber at 7.0 percent of rubber price for custom declaration. In 1955, customs tariff decree (No. 4) has changed the export tariff by kinds of rubber: smoked sheet rubber, latex, scrap rubber, yang kon, and yang phon din, in order to increase government revenue and reducing inflation. Custom tariff of rubber smoked sheet is presented in Table 5-18. Other rubbers were fixed at 7.0% of rubber prices.

Table 5-18 Customary tariff and tax of RSS

Rubber price (baht.kg)		Tax rate (%)	Rubber price (baht.kg)		Tax rate (%)
Min.	Less than		Min.	Less than	
	5	5	13	14	16.5
5	6	7	14	15	17
6	7	8	15	16	17.5
7	8	9	16	17	18
8	9	10	17	18	18.5
9	10	11.5	18	19	19
10	11	13	19	20	19.5
11	12	14.5	> 20		20
12	13	15.5			

Source: NESD, 1966

4. Self-reinforcements between 1960 and 1990: expansion of new planting, growth of production and the replanting scheme

Overviews of National Economic and Social Development Plan (NESD)

Before 1960, the national development strategy depended on the government policy that may be inconsistency and changed from time to time. Thai economy relied on the agricultural sector in terms of employment and sources of foreign income. About 70% of populations were employed by the farm sector. The important agricultural exports in term of foreign income generation were rice, rubber, maize, and teak (NESD, 1961).

Since 1960, NESD plans (the National Economic and Social Development Plan) were developed through guiding framework of development and funding by the U.S.A and the World Bank. The first and second NESDP aimed to provide basic infrastructures and restructuring government organizations in term of authority, budgets and functionality. Thailand has successful for improving infrastructure to have a large network of road, electric, and irrigation. Increasing the emphasis on agricultural development was achieved extensive production, growth of commodity exports and improving productivity regarded to abundant of land and the growth of the world demand. Thai economy was treated as the most achievement of economic development, thus investment and capital accumulation were increased to achieve at these end. However, these NESDP were criticized to ignore the rising poverty, income distribution, social warfare, and environmental degradation. It appeared that the NESDP implementation focused on economic growth and its stable, and threatened by political instability.

The third NESD plan concentrated on the reduction of population growth and the increase of income per capita, reduction of income disparity by giving the priority to laborers, wages and employment opportunities. At the end of period, decline in population growth appeared to have successful. The third NESD also had paid attention to both the economic growth and the internal economic stability regarding to the first oil crisis to induce the serious inflation. In addition, policy for promoting industries oriented export at the beginning 1972. This policy aimed to strengthen Thai economy regarding low labor costs and sources of agricultural commodities in producing the industrial goods and services to have high

competitiveness in the international market. Thus, this NESDP has successful to increase sources of export from agricultural commodities into more value of industry goods.

During the fourth NESD plan 1971-1981, NESD implemented during the period of political instability and oil crisis. This plan firstly concerned an important of environment problems but it was still a low achievement into operational measures. Thai economy had to confront social and economic problems such as income distribution and poverty, etc., that had been rose up for a long time in many areas. Trade deficit and fiscal deficit were high due to oil crisis and high inflation according to global uncertainties and risks.

The politics in the fifth NESD plan 1982-1986 were stable. The government considered emphasis on economic stability and the growth of foreign investments as well as the improvement of efficiency in industrial production. The agricultural policy retained the same as in the fourth plan but it began emphasized to improve productivity. The first devaluation of Thai baht in 1984 was occurred accordance to trade deficits and helped to promote export economy (NESD, 2012).

In the sixth NESD plan 1987-1991, the economic and political conditions were the same as those during the fifth plan. The economic structure depended on export and international markets. The overall growth rate of the Thai economy was high at an average GDP of 10.5 percent per annum. The high growth rate has led by the export sector, investment and tourism regarding low wage and competitive advantages in the natural and human resources. The plan aimed to maintain the high growth of economics at least 5.0 percent per annum in support of the increase of labor forces. This plan also emphasized to improve general standard of living and the quality of human resources by reduction of income distribution and an improvement of education systems. Environment and its degradation were initially incorporated in this plan. But these plans still ignored social development, environments, and natural resources and other aspects that still raised several economic and social problems (NESD, 2012).

Thai economy continued to expand at high growth rate during the seventh NESD plan 1992-1996. This plan aimed to maintain the targets of continuous growth rate and the economic stability, to distribute income and development between rural and urban areas, and to improve human and natural resources, quality of life and environment. The consequences of the seventh NESD were quite successful in the growth of Thai economy. The impressive rate of economic growth was by about 8.09 percent per annum but it has remained to concentrate in Bangkok and the surrounding provinces. Poverty reduction and the low unemployment helped to transform the Thai economy to a newly industrialized country. However, the imbalance growth in terms of income distribution and benefits among stakeholder was high. These served problems affected the quality of life and rising serious social problems. The depletion of natural resources and deteriorating environmental condition were increased which have become major concerns from the rapid economic growth and ignored other aspects. There have a discernible negative impact on quality of life.

In order to sustainable development, the eight NESD plan 1997-2001 emphasize on human as the center of development. This plan focused on the stability of economic and the improving human well beings. It also gave the importance of interrelation between economic and other dimensions by a great participation of people to develop this plan. However, Thai economic crisis began at the beginning of the plan that led to devaluation of Baht in July

1997 along with other major problems to slump economy down such important as high interest rate, the Bankruptcy of Thai Commercial Banks, the speculation on Thai currency and its attack that led to have serious restructure the finance and banking sectors by following the advice from the IMF and other foreign financial institutions. In 1999, the Thai economy began to recover from the financial crisis but it was quite slow due to the chronic effects of bad loan, weakness of Thai Banks, and the slow growth rate in the global economy.

The eight NESD plan was modified in 1999 to deal with the past economic crisis. Additional strategies were emphasized to the economic restructure through the productivity improvement in both farm sector and manufacture sector, balances between economic and environmental preservation, an increase of the potential services sectors, development of science and technology and infrastructure. There have the adjustments of overall economy in line with the change in economic situations. Thai economy was survived and gradually recovered during the second haft of the eighth plan.

After the economic crisis, the ninth plan 2002-2006 was adopted the sufficiency economic philosophy to guide the development and administration of the country coupled with the holistic approach to people-centered development the same as the eighth plan. This plan has been priority to solve problems arising from the economic crisis and aimed for balance development with respect to people, society, economy and environment in order to achieve sustainable development and the well-being of Thai people. For such important objective are the strength and the stability of Thai economy by target of economic growth at average 4-5 percent per annum, by providing the sustainable and self-sufficient development, and by solving poverty. This plan was quite successful which the growth rate of economic was by about 5.7 percent per annum. The stability of the economy improved which come from the strong domestic consumption and export. The quality of life of people improved as a result of expansion of health service covering a majority of population. However, the Thai economy still faced with vulnerable and instability from the global environments as well as the prevalence of unsolved problems such as poverty, income distribution, quality of education, property, and transparency in government administration.

During the tenth NESD plan 2007-2011, the philosophy of sufficient economy was applied extensively in Thailand's development strategy. The objectives were to promote the development of human quality, to strength community and society, to reform the structure of the economy for balances and sustainability, to conserve the environment and natural resources, and to promote good governance. These resulted in a great resilience in various aspects of Thai society and enabled to cope with the impacts of the global economic crisis in 2008. There have achievement for strong economic performance, high employment, strong communities and family ties. Quality of life has been improved due to the better access to various economic and social security measures following to gain poverty reduction. However, the major problems still unsolved such important as political unrest, low education quality, drug problems, and environment and ecological degradation (NESD, 2012).

Accordingly, NESD guided agricultural policy structure and implementation in accordance with the NESD plan in each period. During the first to sixth NESD plan, the policies focused on the expansion of cultivation areas through open of new land, development of infrastructure in rural areas and the improvement of productivity by several government programs coupled with promoting agricultural export and agro-industries regarding low cost

and competitive advantage in the world market. During the seventh to tenth plan, the policies were modified to emphasize productivity and balances between agricultural production growth and other dimensions such as agrarian society, sustainable development, and multi-functionality.

Ministry of agriculture and cooperative and related government agencies have been authorities and responsibility for agricultural plans, budgets and their action courses which the reluctant implementations or cancellation of a policy without reasonable were often observed. The agricultural plans were targeted production, trade and the overall pictures of the country by Office of Agricultural Economics (OAE). It was included processing, markets and price support in order to control agriculture output to be balanced the demand and more competition in the world market. The proposal will be approved by the Committee of policy and development of agriculture and cooperatives and then used as a framework to be projects, measures, budgets and actions in each of government agencies.

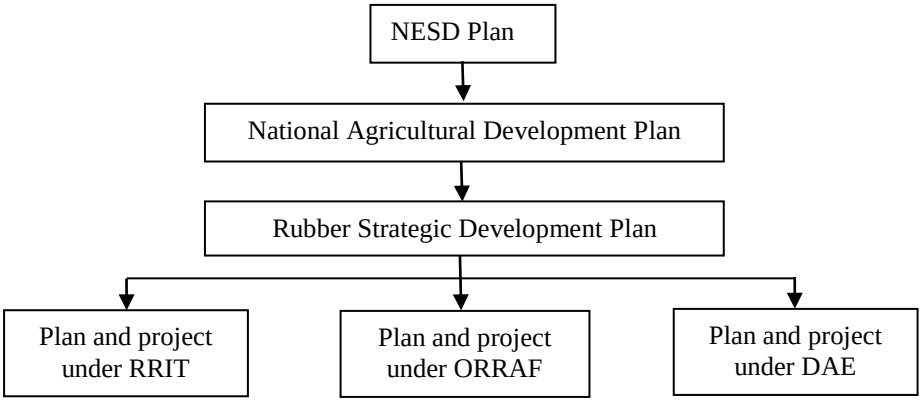

Figure 5-1 Relationships between NESDP, National agricultural plan, Rubber plan, plan and projects

For rubber policy, department of agriculture, rubber research institute of Thailand (RRIT), office of the rubber replanting aid fund (ORRAF) and department of agricultural extension (DAE) were involved to structure policies, implementations, budgets and action plans. Rubber strategic development plan was undertaken by guiding of NESD plan and agricultural development plan by OAE. In facts, proposal of rubber policy was developed by the participations of these government agencies. In the beginning of the eighth NESD plan, the government launched the first rubber development plan which plans and projects were delegated by authority and responsibility for RRIT, ORRAF and DAE as Figure 5-1. However, it should note that instability in political reason was an important factor to make inconsistency, the continuity and the change in rubber policy in Thailand. Those of policies have been paused, suspended or adopted by political reasons or political interests. The gaps between policy courses and implementation were high. Thus, the reviews focused on rubber policies that were actually implemented and their impacts on observations of rubber development.

Since the first NESD plan 1960, rubber policy is guided by the NESD plan, a giving importance as source of foreign income and economic development. Each of NESD plans remained emphasis on policies for extensive productions, new planting and the replanting scheme. RRIT, ORRAF and DAE were play important roles for implementations and actions in the courses of NESD plan. In this period, the main policies were: 1) policy for productive production emphasizing expansion of new plantings and promotion of productions, and 2) the replanting scheme.

4.1) Policies for promoting new planting and expansion of production

4.1.1) Expansion of rubber areas in Southern and East region

After the post WW II, rubber became a major occupation of the people in southern and east region. High rubber price during the Korean War also remained to attract Thai people to convert deforest and new land into new planting. Because of abundant land and labor, expansion of rubber areas during the 1960s-1970s was the highest. Table 5-19 shows production targets in each of NESD plans which the basis production was about 17,000 tons in 1960. The production target was about 210,000 tons in the first NESD plan and rose to 250,000 tons in the second NESD plan. The production target has increased by about 46.2 percent to compare with the basis production. In the third NESD, the production targets was 397,000 tons and substantially increased to 466,000 tons in the fourth NESD plan, which increased about 172.5 % of the basis. Yield was firstly targeted about 66.0 kg per rai in the fourth NESD plan. These evidences indicated that the policy structure focused on expansion of new plantings and the growth of production through policy for promoting new planting and supporting production during the first – fourth plan as Table 5-19 (NESD, 1990).

Table 5-19 Rubber production targets according the NESD plan

	1960	First plan (1961-1966)	Second plan (1967-1971)	Third plan (1972-1976)	Fourth plan (1977-1981)
Production target ('000 tons)	171.0	210	250	397.0	466.0
Yield target	-	-	-	-	66.0

Source: NESD, 1961, 1967, 1972, 1977

Moreover, the heavily development of road network to connect remote area and main road combined with the successful to control Malaria and accessibility to heavy farm machines also have influenced on a great expansion of new plantings. As a result, a large deforests area rapidly converted into rubber areas. Other important factor was high growth of population associated with growth of market economy after the WW II pressured on the need to have more farmland and source of cash income generation. Especially, people from the intensive paddy field faced with land pressure and low available of rice land. These were forced them moving into unoccupied land for new plantings.

Table 5-20 New planting area and total rubber land during 1904-1970

Periods	New planting (rai)	Total rubber land (rai)
1904-1917	108,594	-
1923-1918	777,719	886,313
1934-1941	1,824,151	2,710,464
1950-1952	1,229,502	3,939,966
1955-1957	1,135,695	5,076,661
1958-1959	1,107,122	6,182,783
1960-1966	1,573,379	7,756,163
1967-1970	629,837	8,386,000

Source: Reed, 1969; FAO, 1973

RRIT (1980) stated that the increase of new plantings has been peak in 1954-1964 according to periods of high prices. The average new planting rate was about 318,910 rai per year during 1958-1964. New planting increased from approximately 1.107 million rai in each period during 1958-1959 and rose to 1.573 million rai to plan during 1960-1966. The annual rate of new planting has declined to approximately 157,000 rai per year during 1965-1970 as Table 5-20.

Table 5-21 Forest areas and deforest areas in 1979

Provinces	Total area (‘000 rai)	Forest area (‘000 rai)	Deforest area (‘000 rai)
Chonburi	2,726.87	190	191.25
Rayong	2,220	131.25	181.25
Juntaburi	3,961.25	2,228.75	581.25
Trad	1,761.875	393.75	306.25
East region	**10,669.995**	**2,943.75**	**1,260**
Chomphon	3,755.63	1,070	65
Ranong	2,061.27	850	55
Phung-nga	2,606.81	755	497.5
Phuket	339.396		37.5
Krabi	2,942.8	247.5	677.5
Trang	3,073.4	225	
Surattani	8,057.17	3,145	510
Nakhorn si tammarta	6,214.1	897.5	137.5
Pattalung	2,140.29	402.5	
Satun	1,549.36	307.5	
Songkhla	4,621.18	532.5	
Pattani	1,212.72	70	
Yala	2,825.7	1,530	
Naratiwat	2,747.14	450	
Southern region	**44,146.966**	**10,482.5**	**1,980**
Total	**54,816.961**	**13,426.25**	**3,240**

Source: RRIT, 1980

Then, rubber areas in 1970 were totalized 8.386 million rai. It should note that the gap between survey results and agriculture census was observed. The expansion of rubber areas decreased after 1970 regarding limits of deforest areas and the announcement of conservation area as Table 5-20. Accordingly, the growth rate of farm land was about 4.0 percent per annum during 1960-1981, out of which comprised of paddy field 84 million rai and tree crops

63 million rai in 1981 (RRIT, 1980). New farmland was a major factor to increase the growth of production in this period. The open of new farmland has been the edge of conservation area and forest zone in the 1980s.

In 1979, the RRIT proposal has been to promote expansion new plantings in south and east region. This project has expected to be expand rubber areas about 1.98 million rai in southern region and 1.26 million rai in eastern region. Table 5-21 shows the deforest area in which have been possible to convert into rubber land. Somewhat subsidy has been to encourage the expansion of new plantings come from the replanting scheme (RRIT, 1980).

In 1966, the rubber area has precisely surveyed by the satellite image as Table 5-22. The second satellite survey was taken in 1978. The rubber area has increased about 1.11 million rai or 14.3 percent. The expansion of rubber areas was high by about 15.1 percent in southern and 7.4 percent in east region. High expansions of rubber areas were Satun, Naratiwat, Chomphon, Songkhla, and Surat tani. The growth rate of rubber areas in Thailand was 14.3 percent. In 1986, total rubber land rose to 10.7 million rai, which comprised of 9.65 million rai in south and 1.075 million rai in east region. The rubber areas grew by about 21.0 percent to compare with 1978.

Table 5-22 Rubber land according to the satellite survey during 1966, 1978, 1986 and 1990

Provinces	Rubber area at 1966	Rubber area at 1978	Rubber area at 1986	Rubber area at 1990	Growth 1966/1978 (%)	Growth 1978/1986 (%)	Growth 1986/1990 (%)
Chonburi		963.0	27,501.0	23,143.0	-	-	-15.8
Rayong	296,722.0	299,822.0	397,816.0	601,690.0	1	32.7	51.2
Juntaburi	292,448.0	314,206.0	396,918.0	263,237.0	7.4	26.3	-33.7
Trad	176,252.0	207,901.0	253,361.0	183,126.0	18	21.9	-27.7
East region	**765,422.0**	**821,929.0**	**1,075,596.0**	**1,071,196.0**	**7.4**	**30.9**	**-0.4**
Chomphon	53,314.0	65,747.0	145,739.0	188,942.0	23.3	121.7	29.6
Ranong	9,583.0	21,177.0	26,599.0	75,804.0	121	25.6	185
Phung-nga	368,399.0	426,654.0	553,415.0	485,464.0	15.8	29.7	-12.3
Phuket	111,299.0	91,641.0	106,559.0	110,634.0	-17.7	16.3	3.8
Krabi	488,907.0	535,988.0	645,357.0	507,078.0	9.6	20.4	-21.4
Trang	827,779.0	911,786.0	963,425.0	1,061,592.0	10.1	5.7	10.2
Surattani	633,327.0	782,895.0	1,117,510.0	1,325,183.0	23.6	42.7	18.6
Nakhorn sitammarta	1,155,852.0	1,215,377.0	1,467,727.0	1,466,229.0	5.1	20.8	-0.1
Pattalung	400,625.0	443,464.0	522,066.0	556,740.0	10.7	17.7	6.6
Satun	94,505.0	143,896.0	254,779.0	256,058.0	52.3	77.1	0.5
Songkhla	121,3231.0	1,400,798.0	1,623,704.0	1,650,244.0	15.5	15.9	1.6
Pattani	253,903.0	302,252.0	354,450.0	245,689.0	19	17.3	-30.7
Yala	756,872.0	875,550.0	934,308.0	907,545.0	15.7	6.7	-2.9
Naratiwat	623,872.0	826,746.0	935,591.0	870,973.0	32.5	13.2	-6.9
Southern region	**6,991,468**	**8,043,971**	**9,651,229**	**9,708,175**	**15.1**	**20**	**0.6**
Total	**7,756,890**	**8,865,900**	**10,726,825**	**10,779,371**	**14.3**	**21**	**0.5**

Source: RRC, 1969, 1971, RRIT, 1988, 2000

The growth rate of new planting was at the annual average 3.0 percent. Growth rate of new planting in southern region was about 20.0 percent which highly contributed by Surattani, Songkhla, and Nakronsitammarat. Eastern region also grew over 30.0 percent or at annual average of 4.4 percent. This increase also included about 96,230 rai from the project of rapid replanting rubber in traditional cassava areas. This project has been funded from both Thai

government amount 200.0 million bahts and Funding of Europe amount 43.0 million bahts for implement project during 1987-1991.

By the survey of satellite image in 1990, the expansion of rubber areas presented slowdown by the growth rate of about 0.5 percent according price slowdown trend. Total rubber areas steadily increased to 10.779 million rai, out of which shared by 9.708 million rai of southern and 1.071 million rai of east region. In southern region, the growth rate of 0.6 percent was low to compare with the past expansion even the total rubber area still grew to 9.708 million rai. Rubber areas still increased in some provinces such as Ranong, Trang, and Chomphon. However, the reduction of rubber areas was observed in east region regarding the growth of non-farm sector in that area. The reduction of rubber land was about -0.4 percent to compare with in 1986 (RRIT, 1992).

Table 5-23 shows that targets of rubber areas and yield grew until 1996 even the government has not supported for new plantings since 1994. Regarding price decline trends and foresees recession of global economy, the government launched rubber policy to reduce and maintain rubber areas on the level of 12.5 million rai during 1997-2001. Rubber area is expected to control on the level of 12.5 million rai of which could be produced rubber output over 2.0 million ton during 1997-2001 in consistent with the expectation of the world demand.

Table5-23 Target rubber areas, production, yield during 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Rubber areas (rai)	11.92	12.06	12.24	12.50	12.50	12.50	12.50	12.50
Production (million tons)	1.69	1.75	1.84	2.08	2.11	2.17	2.28	2.43
Yield (kg/rai)	164	175	180	197	198	202	213	221

Source: RRIT, 1993

In addition to this, the re-planting has widely promoted to re-plant rubber with oil palm and fruit trees, which has expected to reduce rubber areas. The further trial new planting has created in new areas (North-east and North region). This evidence showed that after the policy for promoting expansion of production was implemented long time since 1961, the government had showed intentionality to reduce rubber areas in 1997, even reluctant implementation was observed.

4.1.2) The expansion of new planting in new rubber areas during 1989-1999

In 1978, RRIT trial new planting was initially introduced in agricultural colony in Surin, Hnongkan and Buriram in north-east region. The project aimed to study rubber plantation in north-east region, which have satisfied rubber growing and level of yield as expectation. Regarding these results of trial plantation, three projects implemented to introduce new plantings in new areas during 1987-1999.

Table 5-24 Budget and targets of new plant in new areas

Year	Thai Government Budget (baht)	Europe Budgets (baht)	Total budgets (baht)	Targets of new plants (rai)
1991-1992	2,000,800	-	200,800	5,500
1993	1,075,400	-	1,075,400	5,500
1994	3,661,900	16,110,000	19,672,900	5,500
1995	2,500,000	12,303,000	14,803,000	5,500
1996/1997	242,600	28,806,000	29,048,600	5,500
Total	9,485,700	57,120,000	66,605,700	297,000

Sources: DAE, 1995

The first project was launched by Department of Agriculture Extension (DAE) during 1991-1997. This project named "Introduction rubber plantation for income distribution in North-east region", which proposed to increase farm household's income in land reform zone in Udon thani, Knongkan, and Nakorn Phanom. The rubber area target was about 5,500 rai per year. This project also has subsidized rubber clone, fertilizers, and promoted rubber group. The main budgets come from both Thai government and Europe project as Table 5-24.

The second project was implemented by Agricultural Land Reform Office (ALRO). This project has promoted to plant rubber in land reform areas in north-east during 1990-1997. Table 5-25 shows rubber area and number of farmers in each year. Total rubber area was about 31,511 rai. RRIT also was cooperated to support technology and knowledge, even they faced with the difficult to diffuse technology and less farmers 'participation because of low confidence in possible successful of the project.

Table 5-25 Targets of farmers and new planting under ALRO's projects

	1995	1996	1997	1998	1999-2001	Total
Farmland (rai)	3,4071	15,268	13,000	7,000	12,000	
Farmers (Nb.)	3,183	1,236	1,300	700	1,200	7,619
Rubber land (rai)	9,790	8,550	6,421	2,250	4,500	31,511

Source: ALRO, 1995

The third project was launched by ORRAF under "Supporting rubber plantation for non-rubber farm in new area project". This project divided into two periods: the first period during 1989-1993 and the period second period during 1997-2001. Table 5-26 is presented target of rubber areas and budget in each period (ORRAF, 2002).

Table 5-26 Targets of new planting and budget for project of supporting rubber plantation for non-rubber farm in new areas

Period	Target of new planting (rai)	Budget (million baht)
1989-1993	156,250	419.866
1997-2001	200,000	1,024.706
Total	356,250	1,444.572

Source: Bureau of the Budget, 1998

The government argued that this project proposed to increase household income and improving standard of living for non-rubber farm in both old areas (south and east) and new area (northeast). However, the government has gave more opportunities to participate the

project by the farmers in northeast region, in which would promote new planting in new areas where cheap land was available. The basis requirements were owned landholding not less than 2 rai and have never been the rubber owner. Project will subside only 15 rai per farm, totally cost about 4,621.50 baht per rai during 7 years. This included knowledge and training according to plantation technology such as planting, farm management, production, and markets.

During 1989-1993, the project concentrated to expand new plantings in northeast region, totally 156,250 rai and budgets of amount 419.866 million baht. Moreover, rubber areas under DAE and ALRO are transferred into this project in order to control technological use and subsidize production costs. Then, total rubber areas belonged this project were carried out about 292,138.55 rai; 255,464.40 rai of north-east or 87.4% and 33,197.15 rai of southern or 12.6%. The government also subsidized additional budget amount 495.381 million bahts for carry out those of farms until 7.5 years during 1995-2004 (RRIT, 2002).

Table 5- 27 New plantings and farmers in northeast region during 1989-1999

Year	Farmers (Nb.)	New Planting (rai)	Total Rubber areas (rai)
1989	394	4,920.40	4,920.40
1990	1,734	18,034.75	22,955.15
1991	3,065	30,710.80	53,665.95
1992	6,222	58,913.30	112,579.25
1993	8,494	78,839.55	191,418.80
1994	4,142	36,419.45	227,838.25
1995	5,431	55,632.05	283,470.30
1996	952	8,669.25	292,139.55
1997	641	6,421.00	298,560.55
1998	-	-	-
1999	1	28.4	28.4
Total	31,076		298,588.95

Source: RRIT, 2002

In the second period (1997-2001), the target of rubber area was 40,000 rai per year, totally 200,000 rai. A budget was amount 1,024.706 million bahts. Because many farmers presented the attention to join this project with recognition the government subsidy since 1997, then project has operated during 1997-1999. ORRAF stated that projects under implementation of DAE and ALRO have been less achieved in rubber area and yield due to less expertise in rubber extension and plantation technology to compare with ORRAF. Table 5-27 shows the rubber areas and number of farms in North-east region during 1989-1999. Rubber land has increased from 4,920.40 rai in 1989 to 22,955.15 rai in 1990 and rose to 298,560.55 rai in 1997, which grew at the annual average of 40,000 rai per annum during 1990-1995. Thereafter, rubber area in this region increased substantially from both private investment and government projects (ORRAF, 2007).

4.2) The replanting scheme

The replanting scheme began to implementation in 1961 even it was rarely implemented job function. This scheme aimed to replant old seedling with high yield clone,

to subsidize factors of production and to give knowledge and relevant technologies. Eventually the replanting scheme was organized by recognitions in structure and characteristics of rubber farmers in Thailand that were characterized by smallholding, scare capital, and use of simple technology, which had impacted on low productivity, high cost of production and low product quality. The scheme would support money for fallen old rubber trees, subsidize both cash and materials in planting and farm maintenances until tapping year, raise skill and give knowledge relevant technologies for production, tapping, processing and markets.

Table 5-28 Rubber area and yield during 1951-1960

Year	Immature and non-exploitation areas ('000 rais)	Old tapping areas ('000 rais)	Growing tapping areas ('000 rais)	Total rubber areas ('000 rais)	Yields (kg/rai)
1951	1,226.0	1,607.0	370.0	3,203.0	66.2
1952	1,264.0	1,656.0	382.0	3,302.0	54.3
1953	1,301.0	1,706.0	393.0	3,400.0	55.9
1954	1,340.0	1,756.0	405.0	3,501.0	65.3
1955	1,377.0	1,804.0	416.0	3,597.0	69.5
1956	1,411.0	1,850.0	427.0	3,688.0	68.0
1957	1,444.0	1,892.0	436.0	3,772.0	67.4
1958	1,474.0	1,933.0	446.0	3,853.0	67.9
1959	1,504.0	1,971.0	454.0	3,929.0	69.9
1960	1,534.0	2,011.0	464.0	4,009.0	71.6

Source: FAO, 1973, 1974

Thailand began to promote the replanting by subdivision of rubber under Ministry of agriculture and cooperative since 1937 but it was less progressive in the replanting areas due to budget constrains. The World Bank has strongly recommended the government to promote the re-planting project with recognition to a large old rubber area with low yield as Table 5-28. About 55 percent of rubber areas were old age rubber trees or low yield areas that needed to replant with high yield as soon. Rubber thus would able a sources of foreign income and social and economic development (World Bank, 1959). The World Bank also stated that the government should be emphasis on the expansion of new planting with high yield by smallholding and also should encourage an increasing number of estates. Thus, the government must consider to be established the rubber scheme for replanting old seedling with high yield. The replanting scheme must be specific institutions to organize and budget in authority, functions, flexibility and responsibility for the re-plantation program. In response to the World Bank report, the ORRAF is established and the Rubber Replanting Aid Fund Act 1960 was enacted for the rubber scheme since 1961. The Rubber Replanting Aid Fund (ORRAF) was independent statutory organization under ministry of agriculture and cooperative to be administration by ORRAF's Board, which were representative officers from ministry of agriculture and cooperative, director of ORRAF, ministries of interior, ministry of commerce, ministry of industry, ministry of finance, MOAC, RRIT, DAE, DOA, NESD, representative farmers and a manufactures, and rubber specialist.

The later edited ORRAF Act in 1987 was revised to extend the grants for non-rubber farms. The farmers who have been qualified to apply for the grants must own landholding not

less than 2.0 rai and below 15.0 rai in which must present their the land rights. The rubber tree was old aged more than 25 years at minimum density of 25 trees per rai. Land must have suitable soil and topography for rubber growing. The applicants who meet these requirements will be selected to serve basis grants and collaboration with ORRAF. ORRAF also provided knowledge, training and technologies as farmers' requirements.

Table 5-29 *Cess* and rate of *Cess* during 1960-2010

Year		Rubber price (baht/kg)	*Cess* (baht/kg)
1960	31-May-1988	less than 10.0 baht	0.50
		> 10.0	10.00%
01-June-1988	20-Dec.-1989	all price	1.70
21-Dec.-1989	20-Jul.-1990	n.a	n.a
21-Jul.-1990	31-May-1991	all price	0.60
01-Jun.-1991	31-Mar.-2003	all price	0.90
01-Apr.-2003	30-Sep.-2010	less than 30.0 baht	0.90
		30.0 - 35.0	1.20
		> 35.0	1.40
01-Oct.-2010	December 2012	less than 40.0	0.90
		> 40.0 - 60.0	1.40
		> 60.0 - 80.0	2.00
		> 80.0 - 100.0	3.00
		> 100.0	5.00

Source: ORRAF, 2012

Sources of the replanting funds were: 1) *Cess* on rubber export, 2) the government annual budget and subvention, 3) foreign loan and grant from international program, and 4) interest income on deposits. *Cess* came from the rubber exports which was the most important financial source as stated that the *Cess* given to the rubber planters under this Acts shall be exempted from any taxes, duties and fees. Those of revenues (Cess) for the replanting might pass directly to the Rubber Replanting Aid Fund. *Cess* has been changed overtime in response to economic situations, rubber prices and demand for the replanting as Table 5-29. *Cess* could be modified in accordance with the resolutions of ORRAF's Committee and further certified by Cabinet. By the Act modified in 1987, *Cess* must allocate following circumstances: 5.0 percent was the expense for research and development in rubber pass through Department of Agriculture to finance of RRIT. 10 percent was the expense for the administration of office of the rubber replanting aid fund. 85 percent was to be used for the grants. However, if amount of *Cess* is not enough, the government should pay an addition budgets as necessary budgets. In fact, the government has to support additional budget or subvention regarding the new projects, the rapid replanting project, and the low level of *Cess* (ORRAF, 2012).

The grants supported the re-planters consisted of cash and materials which were paid to farmers in 7 installments over of about 6 years. Each installment should be applied in conditions and completion of specified tasks to certify by ORRAF staffs. Material inputs were planting materials, fertilizer, and chemicals in amounts determined by agronomy and economic considerations, of which were sufficient for potential high yield and modern plantation technology. The cash payment was supported somewhat costs of land clearing and

labor costs that may be earned for household income during the temporal short fall rubber trees. These cashes were necessary to induce incentive to replanting by smallholders who depended on rubber income for their household livelihood. The replanting scheme also has supported the grants to replant with other tree crops. Table 5-30 shows the grant in each period time from 1961 to 2008 which the amount of grant has increased overtime in accordance with increasing costs of production and amount of *Cess* that simultaneously related with increasing volume of the rubber export. The initial grant was 1,500 baht per rai in 1961 and increased to 11,000 baht per rai in 2008, which has been a large increase about seven time of the basis grant in 1960.

Table 5-30 The grants for rubber and other tree crops re-plantation under replanting scheme during 1961-2008

Period time	Rubber (baht/rai)	Other tree crops (baht/rai)
1961- 30 Apr. 1966	1,500.0	1,500.0
1 May. 1966 – 31 Dec. 1967	1,850.0	1,500.0
1 Jan. 1968 – 31 Dec. 1975	2,000.0	1,500.0
1 Jan. 1976- 31 Dec. 179	2,800.0	1,500.0
1 Jan. – 31 Dec. 1980	3,900.0	1,500.0
1 Jan. 1981 – 21 Oct. 1982	4,250.0	1,500.0
22 Oct. 1982- 31 Dec. 1989	4,800.0	3,500.0
1 Jan. 1990- 28 Feb. 1992	5,200.0	3,500.0
1 Mar. 1992- 30 Sept. 1993	6,800.0	4,900.0
1 Oct. 1993- 30 Sept. 2004	6,800.0	6,800.0
1 Oct. 2004- 10 Oct. 2007	7,300.0	7,300.0
11 Oct. 2007- 14 May. 2008	9,000.0	9,000.0
15 May. 2008 – December 2012	11,000.0	11,000.0

Source: ORRAF, 2012

Table 5-30 shows that the ORRAF has also supported the grants to replant with other tree crops in which the grants of 1,500 baht per rai has kept constant during 1960-1982, increased to 3,500 baht per rai during the October 1982 – 1992, and were comparable amount of the grant for the replanting of rubber since 1993. It appeared that the amount of the grants supported the replanting with other tree crops would encourage the converting rubber areas to other tree crops even it was less achieved in implementation (ORRAF, 2010). The important play roles of ORRAF were: 1) the replanting with high yield, 2) the expansion of new plantings as discussion in 4.1.2 and 3) the market development as discussion in 5.2, 5.3, and 5.4.

The replanting areas, yield and production

Table 5-28 shows that the total rubber area in Thailand was about 4.00 million rai in 1960, out of which was old aged rubber approximately 2.011 million rai that needed to enter the replanting scheme. The rest areas were planted with low yield rubber. Figure 5-2 shows that the rate of replanting areas was low during 1961-1970. The total replanting area during 1960-1962 was 24,436.87 rai or 1,311 plots, constituted by 21,741.83 rai in southern due to the difficult to attract the farmers entering the replanting scheme and incompletion in

function of ORRAF. During 1962-1968, the rate of replanting was 36,350.6 rai per year, which the ratio of actual replanted areas to the total qualified areas was below 10.0 percent, which was considerably low to compare with the basis old aged rubber in 1960. In 1967, the first replanting rubber has been tapped about 4,436 rai in 292 plots, which presented the successful of the replanting and further induced the farmers entering the replanting scheme.

In 1969, the satellite survey showed that rubber areas in Thailand was totalized 7.76 million rai, constituted by 1.77 million rai in immature areas and 5.99 million rai in mature area. The forecast of replanting scheme must be up to 300,000 rai per year. These caused to implement the rapid replanting projects in which were necessary to support a large amount of grant and expansion of ORRAF office in regions, provinces and districts. In 14 October 1969, the government launched the rapid replanting rubber project, which has targeted to replanting rubber 1.0 million rais. The government also has supported the additional budgets together the revenue from *Cess*. It was associated with the extension of ORRAF's offices into districts and province across southern and east region. The replanting rubber area has increased from 37,943.5 rai in 1968 to 68,054.8 rai in 1969 and rose to 80,652.7 rai in 1971.

Table 5-31 Source of budget for the rapid replanting projects

periods	Cess (million baht)	World Bank's Loan (million baht)	CDC's Loan (million baht)	Government budget (million baht)	Grant's UNDP (million dollar)	Total replanting areas (million rai)
1977-1980	1,782	10,000	140	400	1.0	1.0
1982-1985	2,394	3,250	445	75	1.5	1.20
1987-1990	4,629	1,663	348	228	-	1.21

Source: ORRAF, 2009

In 1972, the rapid replanting project still implemented with strong commitment by NESD plan. This project aimed to goal the replanting rubber about 644,000 rai during 1972-1976. The funding of replanting came from the *Cess* amount 1,584 million baht and the government budget amount 645.0 million baht, totally 2,229 million baht. The first year has targeted to goal the replanting area of 104,000 rai and 135,000 rai in the second to fifth year. At the end 1976, the total replanting area was 715,350 rai. Total of the replanting areas during 1961-1976 was about 1,189,750 rai, accounted about 20.0 percent of total rubber areas. In order to reduce operation cost, cost of planting materials, and the operation cost of replanting scheme, nursery plots of planting materials are established under the ORRAF and later extended into the intensive rubber areas in southern and east regions since 1977.

In order to completion of the replanting with high yield, the government launched three specific replanting projects during 1978-1990 as Table 5-31. The first project was targeted to replant about 1.0 million rai during 1977-1980. The government pursued the rapid replanting to be able covering completion of mature rubber area over 7.0 million ria. The replanting fund came from *Cess* amount 1782.0 million baht, 1,000.0 million baht from World Bank's loan, 140.0 million baht from Common wealth Development Cooperation (CDC), and 400.0 million baht from government budget. This project also has been grant amount 1.0 million dollar from United Nation Development Programme (UNDP). This grant used for the expense of expertise and researchers from international institutions, who given

advisory of ORRAF's administration, and research and development at Rubber Research Center. This project has goaled to replanting areas about 1.0 million rai with the rate annual average 257,799 rai per year.

In the second phase, the rapid replanting project was still implemented during 1982-1985, which the grants came from three sources together with the grants from UNDP as Table 5-31. The replanting area at the end of project was 1.20 million rai at annual average of 295,124 rai per year. In the third phase, the project remained to implement at the target rate of replanting of 300,000 rai per year during the 1987-1990. Typically, the rate of replanting in this phrase was about 244,000 rai per year and the total replanting area has highly achieved about 1.21 million rai.

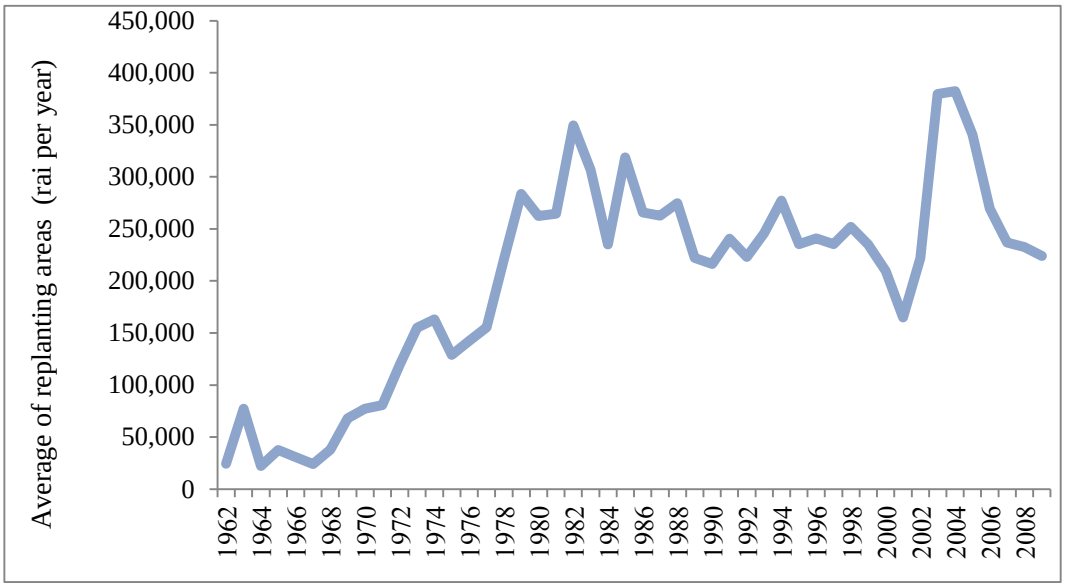

Figure 5-2 The average areas of the replanting per year
Source: ORRAF, 2012

During 1977-1990, the rate of replanting area was about 268,000 rai per annum, which 3.70 million rai are replanted, accounted 50.0 percent of total rubber areas in 1966. During 1991-2002, the rate of replanting area decreased to 231,000 rai per annum and rose substantially to the rate of annual average of 367,500 rai per annum during 2003-2005 in response to promotion of the replanting rubber where located in un-land right areas. The rate of replanting dropped again at the annual average of 240,000 rai per annum during 2006-2011 as Figure 5-2 shows.

In 2003, agricultural census shows that only 1.9 percent of rubber areas planted with seedling variety (low yield) and about 98.0 percent of the rubber areas were planted by high yield even they did not collaborate with the replanting scheme. RRC (1968) argued that the smallholding in situation dependent rubber income was key factors to determine the longer period of the replanting scheme. The farmers did not realize why the replanting and new technology were necessary for them. Also, people did not believe in the commitments of the scheme and possible advantages of the replanting with high yield. They mostly concerned the loose of income during the replanting period, thus the replanting year will retard or delay as long as it could be. In case that they could divide their rubber plots into small plots before

applying for the grant, farmers can replant a part of plots and leave other plot to generate income for their living. After the first plot could be tapped, farmers will apply the other for replanting. In 1981, ORRAF stated that the ratio of the repeated farm to new entrants to the replanting program increased from 1:13 in 1977 to 1:1.33 in 1981, which can confirm this phenomenon (RRC, 1971; Jiranakorn & Tipyakul, 1974).

In order to understand the distribution of the grants and who could take advantages of the scheme in the early period of the replanting, RRC (1974) stated that the grants mostly distributed to the large farms rather than the small farmers in the a few decades of replanting scheme. This is because it was easily to induce the large farms to join with the replanting scheme. Typically, these rubber owners were characterized capitalist and modern technologies. Some of them experienced either existed modern plantation or will plan for the replanting with high yield. Due to large size, some plots could be available plot to replant. RRC (1975) surveyed 3,588 of the re-planters who applied the replanting during 1961-1970 across south and east region. The survey showed that the first re-planters were dominated by large farms. The average of landholding was 51.14 rai. 46.3 percent of total farms owned landholding size above 100.0 rai, 9.17 percent holding 61-80 rai, 12.19 percent holding 41-60 rai, 17.16 percent holding 21-40 rai and 8.81 percent holding 1-20 rai.

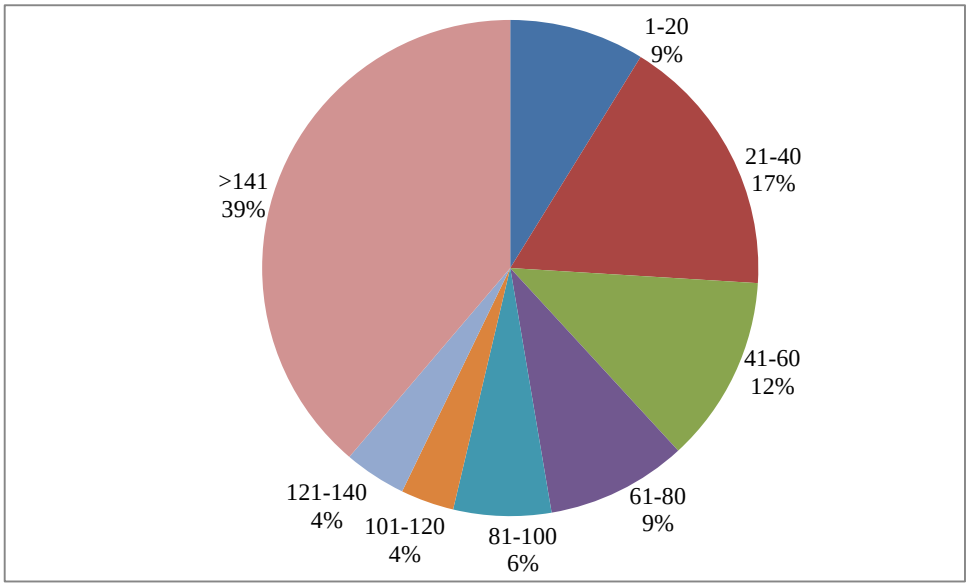

Figure 5-3 Percentages of the re-planters according to farms owned landholding during 1961-1970
Source: RRC, 1975

Figure 5-3 shows that large farms could take advantages of the replanting scheme rather than the smallholders. However, the small re-planters have substantially increased as stated by ORRAF that about 70% of re-planter have holding varying from 12.5 to 62.5 rai in 1986, indicating that most small farms to participate the replanting during the period of rapid re-planting projects. Importantly, the replanting scheme had profound effect on improvement of productivity, reduction of production costs and more resilience to price risks.

During the 1960-1980, rubber yield has stable at the annual average of 400.0 kg per ha during 1960-1969 and shifted to 1,016 kg per ha in 1990. Yield continued to increase to

the peak of 1,815 kg per ha in 2004 and then fell to below 1,600 kg per ha after 2009 as Figure 5-4. Production has also been the growing patterns the same as yield. Production rapidly increased from 0.186 million tons in 1961 to 1.40 million tons in 1990 and rose to over 3.0 million tons in 2006. Thailand becomes the largest producers since 1991. The replanting scheme was one of key factors to determine successful of rubber development in terms of improving productivity and high growth of production. New technologies and high yield clone under the replanting scheme further diffused to private farms' investment and new plantings the same as the farms under the replanting scheme.

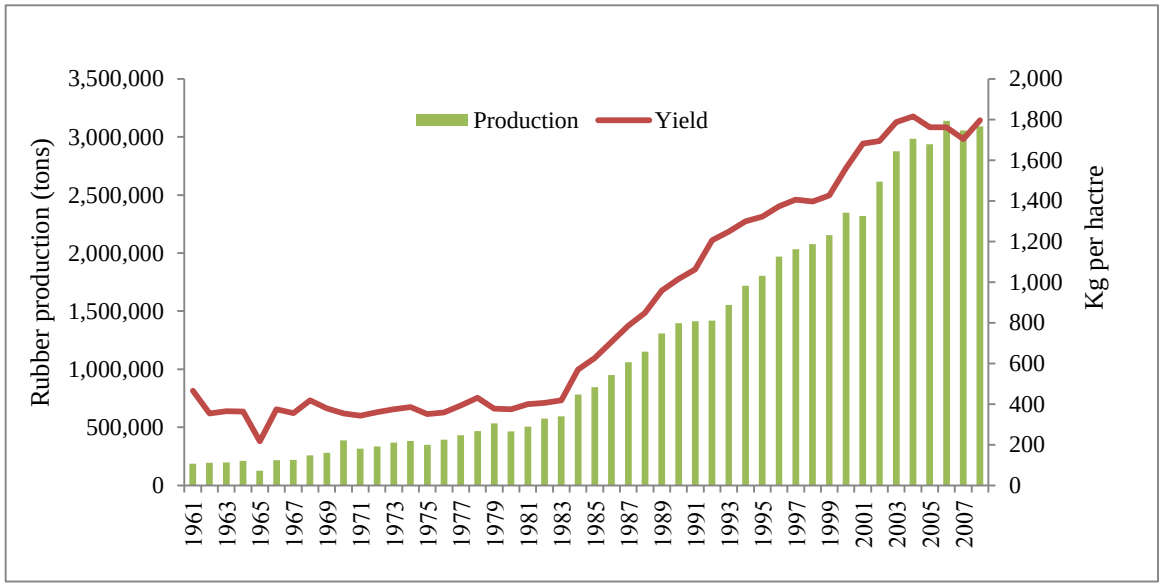

Figure 5-4 The evolution of rubber production and yield during 1961-2011
Source: RRIT, 1971-2012

4.3) Rubber research and development

One of important factors to determine the successful of the replanting scheme was the research and development conducting by RRIT and RRC. Since 1961, about 5 percent of *Cess* was supported funding for rubber research and development in RRIT. The rubber research firstly focused on new clone and adoption of plantation technology and later has served several field researches from soil, fertilization, farm maintenances, production, harvesting, processing, markets, and rubber industrial products. The establishment of Rubber Research Center (RRC) through cooperation and technical assistances by the United Nation Development Program (UNDP) in 1965 helped to accelerate research and development and further to support the replanting scheme and the development of rubber industry. Under UNDP rubber development project, the research and development divided into two phrases. The first phrase during 1965-1970 focused on the improvement of rubber research projects in several fields, training officers and staffs, project planning and the establishment of working plans which would serve the development of rubber industry. The second phrase during 1970-1976 concentrated on research and development in new clone, clone breeding, soil, disease, pest, tapping system, stimulation, fertilizer, intercropping, farm management, quality improvement, primary processing rubbers, promoting technology and transferred knowledge

to ORRAFs' staffs and famers. The first clone's recommendation in Thailand was introduced in 1968, which mostly evaluated by comparison clone in pilot plots with the significant clones in Malaysia, comprising of GT1, PR255, RRIM600, PR261. Clone's recommendation was frequently noticed every four years. In the decade of the rapid replanting project, RRC also produced planting materials and supported technical supports regarding farm maintenances, plantation technologies, and certified planting materials. They also provided training courses for ORRAF's staffs, farmers, and related government agencies.

After the end of the grant from FAO in 1976-1980 and UNDP in 1980-1982, the research and development has declined due to budget constraints and uncertainty of policy in rubber research including several plans for promoting rubber and extension transferred to department of agricultural extension (DAE). In addition, the research and development have continued to support from the government of Japan in 1977-1980. This project aimed to develop processing techniques in primary rubber factory in order to improve rubber production and quality. The European also supported the grants during 1972-1978. This project has attention to increase productivity and income in old-aged tree by promoting stimulation application before the period of fallen tree. During 1980-1990, RRIT has extended rubber research and development centers through more establishing rubber research center in Surat tani, Cha-cheongtra, and Khong-kan, out of which were developed from rubber experimental station. These were served the area-based research and development and also responded to expansion of new plantings in new areas where RRC located (RRIT, 2010).

Since 1960, RRIT was only institute to serve and to be responsible rubber research and development from downstream to upstream. The research and development can be grouped into three dimensions: farm production, manufacture, and markets. First, research related farm production emphasizes on several variables influencing planting, growing rubber trees, plantation, farm maintenances, intercrops, and harvesting rubber as following:

1) Land and planting: this research gave an important result for expansion of rubber in suitable soil and topography such as where zone of northeast and north region have been to be suitable for rubber. It was also evaluated level of suitable areas and soil for rubber across country, which could be supported the discussion by policymakers and farmers.

2) Clone breeding: this research concentrated an improvement of clones and new breeding. The objectives were to develop high yield, resistance to disease and pest, and appropriate plant physiology with regarding to soil, topography and conditions of weather.

3) Culture rubber: this study focuses on planting, fertilizer and plantation for growing the different clones in about 250 types of soils in Thailand. Productivity could significantly increase by the recommendation of fertilizer.

4) Plant protection and tapping system: these researches concentrate on control of disease, pets and the application of appropriate tapping systems.

RRIT would highlight the recommendation of clone in every four years and annual technique report.

Second, the research and development involved manufacturing and rubber industrial products highlighted by processing and industrial technique attempting to increase productivity and value added. The research mostly co-operated research project with

manufacturers, technique advisory and promoting investments in rubber product industries. Moreover, RRIT was government agency to certify and inspect rubber quality, industrial standards and finished rubber goods.

Lastly, the rubber research focused on rubber markets and prices through price analysis, market analysis and the global environments to be reported at daily, weekly, monthly through several information systems and a broad media that could be useful for government agencies, farmers, manufacturers, and traders. RRIT has been progressive market research to serve market development in the late 1990s.

However, the study found that the farmers complained RRIT has been less progress in new high yield clones and new technology. From 1960 to 2003, clone used in Thailand was originally from RRIM series (Malaysia) and other aboard. RRIT 251 was the first recommendation's clone in 2003 to be yielded at the annual average 2,957.5 kg per ha or higher about 49.5 percent than of the annual average of RRIM 600. This clone has historically improved through clone selection from native farms in Natawee, Songkhla. RRIT (2010) also gave priority to promote RRIT 251 to replace RRIM 600. These will result in 10 percent of production growth with the current rubber areas.

5. Self-reinforcement and consolidation of market policies between 1991 and 2000

During 1960-1992, the government has not developed adequate policies to help rubber market development, approached on free market. Fallen price due to recession of the global economy combined with political pressure in 1991 were serious pressures forcing government to find appropriate solution in response to unintended consequences. The government rapidly responded through price support policy and market development. It appeared that government emphasized price support in order to increase price at the farm gate and to stabilize farm income. The government did not realize to price stabilization by INRO (see detail in next section) and claimed that for lack of effectiveness to rise domestic rubber price in Thailand. Central market, local auction market, and farmer institutes were promoted that would use to support implementation of price support program. These policies were achieved to develop modern market and a tremendous development of markets in the next decade.

5.1) Establishment of central rubber market

As unintended consequences from the global economy combined with inefficiency and lack of rubber market development, the government thus implemented policy for market development and price support. In facts, rubber price had shown decline trends in the late 1960s. Exemptions of tax and customary tariff are applied: 1) canceling the *Cess* of 0.10 baht per kg for exported rubber, 2) revised export tariff of rubber from 0.46 baht per kg to 0.40 baht per kg, which has been announced using the Royal Custom Degree rate dating November 2nd, of 1967, 3) dismissing 4.5 percent of trade tax dated on November 2nd, of 1967, 4) dismissing the commission charges in the export rubber coupon according to the Rubber Control Act 1938 of which the government must collect it from the rubber exporter, dating January 1st, 1969. This would increase the prices to a certain extent. Furthermore, the

government cooperated with the Association of Natural Rubber Producing Countries and the Rubber Manufacturers Association have been the required cooperation from the United States of America to reduce the release volume of rubber from the stockpile. The government also implemented a special project to drastically increase jobs in the southern region through roads construction and to allow mineral mining for rubber farmer and tapper in the province of Songkhla, Yala, Surat Thani, and Chumphon. These were purpose to increase income and to reduce dilemma coming from the price dropped.

During 1979-1981, the oil crisis was made a recession of the world economy. Automotive industry and tire industry have been shrunk to be reduced demand for rubber, presenting a downward trend of rubber prices. In response to these recessions, the government had been reducing the export tariff on all types of rubber in July 29th, 1981; reducing the export duty of 2 baht per for RSS, 1.80 baht per kg for STR, 1.70 baht per kg for crepe, and 1.2 baht per kg for scrap rubber.

Regarding the economic crash down caused by the crisis of New York Seed Exchange, rubber industries in industrial countries were unable to expand and reduced the rubber consumption. Prices rapidly dropped between 1989 and 1991. Therefore, the government has responded the following actions: 1) exempt export tax on all types of rubber on December 21st, 1989, 2) exempting personal income tax at 7.5 percent during December 17th, 1989 – December 31st, 1991, 3) buying rubber price intervention on December 17th, 1991.

RRC (1980) argued that market structure in Thailand was characterized by a buyer market. The farms has been low bargaining market power to be justified from the middlemen to buy lower purchase priced, however the sale must proceed for life subsistence. Middlemen composed of multistage levels of markets; merchants in the village, merchants in the districts and provinces, and exporters or factory. Multi-levels of marketing channels caused to increase marketing cost and higher market margin that then affected on low price at farm gate and less the price fairness. Moreover, the farmers were not grouped to be formed cooperative and farms' groups, they sold their products individually. They also lacked improvement of product quality, accessibility to markets and marketing information. In addition to this, Thailand did not have less influence on rubber pricing in the world market and the vital leading producing country. Thus, the domestic prices depended on the world market prices and did not reflect demand and supply of rubber in the country.

By these reasons, the government launched market policies for promoting central rubber market and strengthening marketing function at the farm level. The first rubber central market was established in the Rubber Research Center, Songkhla in August 1st, 1991. The primary objective was to provide a central market where buyers and sellers come for mutual business of buying and selling under international regulation of auction market. It would have to create the fairness for the buyers and sellers under the rules of the market where all parties agreed upon. Precedents as follows, the sellers bring in the entire volume of rubber to the central market. The central market processes the rest of the procedures from grading, scaling, auctioning, payment and receiving of money until delivering rubber to the auctioneers. The buyers will be able to bid the rubber items through auction procedures automatically. The central market will execute the transactions in rubber and financial for seller and buyers.

With regarding successful of the central market in Hatyai, the second central rubber market was established in Surat Thani on January 15th, 1999, and the third central rubber

market in Nakhorn Sri Thummarat on June 3rd, 2001, in which the project used the budget of 408.52 million baht for building and initial operation costs. Procedures and auctions based on the international regulations practice to be acceptable the buyers and the auctioneers. As soon, the central rubber market affected on improving rubber quality, reduction of market channels, and the fairness prices at the farm gate. The rubber price that the auctioneer bided depended on rubber quality, encouraging the farms to improve the quality of their rubber constantly. The local merchants also would purchase only graded rubbers to be sold at central market, which affected to accelerate improvement of the rubber quality (RRIT, 2004).

Table 5-32 The average price, quantity and local price at each of the central rubber market

Unit: price = baht/kg, quantity = kg

Year	Hatyai			Surattani			Nakorn si thamarat		
	Price	Quantity	Local market price	Price	Quantity	Local market price	Price	Quantity	Local market price
1991	16.99	1,878,061	16.42	-	-	-	-	-	-
1992	18.45	5,111,281	17.48	-	-	-	-	-	-
1992	17.64	5,948,598	16.49	-	-	-	-	-	-
1994	23.91	13,611,595	22.89	-	-	-	-	-	-
1995	34.47	18,649,624	32.55	-	-	-	-	-	-
1996	30.63	14,623,778	27.99	-	-	-	-	-	-
1997	25.54	16,314,668	23.6	-	-	-	-	-	-
1998	25.68	18,764,679	23.35	-	-	-	-	-	-
1999	19.77	35,053,039	18.56	19.7	11,704,914	19.04	-	-	-
2000	23.41	33,904,026	22.33	23.35	28,023,090	-	-	-	-
2001	22.53	21,221,507	21.45	22.46	27,114,836	21.33	21.74	10,473,333	20.47
2002	29.15	21,795,076	27.87	29.14	44,273,804	-	29.14	32,296,859	27.72
2003	40.17	17,014,485	38.86	40.15	49,220,812	38.78	40.23	44,283,386	38.58
2004	46.66	16,008,942	45.47	46.69	40,698,151	45.48	46.73	52,412,635	45.13
2005	55.19	21,408,357	53.54	55.23	47,950,573	53.57	55.32	29,742,800	53.19
2006	72.12	21,526,057	69.9	71.99	22,979,042	-	72.11	23,539,424	69.22
2007	72.15	14,283,356	70.23	71.99	14,329,983	-	72.21	14,041,986	69.72
2008	79.95	10,174,758	77.86	79.75	9,510,927	-	79.92	15,659,838	77.29
2009	59.46	8,378,991	57.75	59.19	5,712,303	-	59.48	14,117,458	57.48
2010	106.3	9,008,337	104.55	106.63	4,962,524	103.98	106.53	7,845,862	103.73
2011	132.43	13,197,034	129.94	132.65	3,627,648	129.44	132.85	8,886,739	128.15
2012	93.82	9,239,587	91.11	93.98	19,022,039	91.1	93.78	6,942,135	90.19

Source: RRIT, 1991-2012

In 1992, the average prices at central market were higher than the average local market in Songkhla by about 0.51 baht per kg. The average auction price was 16.85 baht/kg. Local rubber price in Songkhla was 16.24 baht/kg, Yala 15.34 baht/kg, and Krabi was 15.04 baht/kg. The auction prices varied and depended on the different specific grades of rubbers. High prices were encouraged the farms to improve rubber quality considerably. Until now, the central market prices were used as reference prices for the farms and the merchants in local market. When the farmers and merchants who held a large volume and quality of rubber brought their products to be sold in the central market directly, reduction of the number of merchant levels was observed in the local markets, especially merchants at peddlers and the

village disappeared. Multi-levels of market channels rapidly decreased. Cooperative, farm's group, community enterprise and farm enterprise increased in term of number and trade volume to participate in marketing systems, using the rules of central market as common regulations. Volume of trade has increased continuously in each of the central market as Table 5-32 (RRIT, 2004).

The auction prices were higher than local markets about 0.90-1.20 baht/kg depending on the central market prices and the local market prices. And so, the auction prices used to be referred to determine market pricing at the local market that caused to increase market price at the local markets. In 1997, the central market began to trade RSS, using the same regulations of USS. It was found that the trade volume increasingly entered the central market due to higher value and higher prices than USS.

Table 5-32 shows that trade volume rapidly increased and price was higher than local market, when the service areas were served to intensive rubber areas in Surat Thani, Nakhon Si Thammarat, and the neighboring provinces. However, the rubber prices in Surat Thani central market was lower than the prices of the Hat Yai central market by 0.42 and 0.27 baht/kg respectively, in the years 1999 and 2000. In the average the rubber prices in the central market were higher than the local market prices of 4.91 to 6.55 percent (RRIT, 2005). Furthermore, supporting system was also developed to support a complete uniformity and stability to the rubber market such important as building warehouse, market information center and customer information services. Warehouses were to support the measures in supporting exports and price stabilization. Table 5-33 shows main warehouses and storage capacity.

Table 5-33 Rubber warehouse and targets of quantity

Warehouse	Quantity (ton)
HatYai central rubber market	17,200
Rubber experiment station: Kun Tale	16,000
Rubber experiment station: Krabi	16,000
Rubber research center: Cha cheong trao	16,000
Total	65,200

Source: RRIT, 2010

Another important function was served market information, prices and marketing situation for the farms, buyer, seller and publics. The central rubber markets would informed official prices, using F.O.B price, RSS, STR, Latex, and Cup-lump that were being sold by using auction. There was a important function in balance and complete information among marketing actors, the farms and publics.

Our respondent argued that RRIT was successful in building modern market and balancing market information thought promoting central rubber markets. Even though, rubber volumes entering these markets was only about 5.0 percent of total rubber in the service areas, the auction price was used the reference price for the farmers, merchants and exporters. Auction prices were officially recognized in Thailand as well as international markets. RRIT stated (2011) that in the next phase, the export supporting system and a rubber information center would develop for effectiveness of the central market and will promote a central market network up to 5 places; Rayong, Nong Khai, Nakhon Si Thammarat and Trang. The

central market will establish in new rubber areas at Nongkhai and Buriram province (RRIT, 2007).

5.2) Local auction market under ORRAF (ORRAF's market)

When the government launched price support in 1992, ORRAF has responsibility to establish and promote local auction market for primarily supporting price support and developing local rubber marketing systems. The main purposes were 1) to achieve selling and buying of USS directly between farmers and merchants, 2) to be reasonable in terms of fair price, quality and weight, 3) to develop the quality of rubber sheet production to the standard and 4) to achieve local auction market without any charge. To conduct these markets, ORRAF's staff has assisted to be function quality inspection, weighing, registering the sellers and inviting the farms to join local auction market (ORRAF, 2012).

Table 5-34 Annual budgets for rubber marketing development and price intervention

Unit= million baht

Projects /Budget	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Central rubber market	79.68	4.31	8.78	46.04	182.25	82.86	57.40	39.97	10.08	10.35
Local auction market	12.19	30.72	33.13	17.31	9.02	4.92	4.92	4.92	4.67	4.67
Rubber warehouse	-	-	-	37.50	58.24	-	-	-	-	-
Price support	1,243.4	1,243.4	1,243.4	4,775.0	4,123.0	5,276.49	3,792.8	4,093.36	4,093.36	-

Source: Bureau of the Budget, 1994-2003

During 1992 – 1999, the government forced ORRAF to accelerate development of local rubber market by establishing more than 290 of local auction markets under ORRAF. The local auction market bounded to price support programme. It meant that the local auction markets are established to support implementation of price support. Then when there was no price support programme, almost local auction market had ended their activities. Marketing functions were operated and promoted by ORRAF's staffs. Due to ORRAF's constraints in budgets and staffs working both the replanting and local auction markets, most local auction market can operate once a week which was not enough performed marketing activity. These markets have also competed with the local market. As a result, the local auction market did not achieve as expectation of the projects, except during price support programme.

Perhaps the less successful of local auction market well explained by a new function of ORRAF without familiar with the replanting, the rapid setting markets without complete information, and poor administration. However, local auction markets was made ORRAF's mission to integrate market development into ORRAF plan. Thereafter, ORRAF's staffs have learned to develop local auction market by pre-selling and pre-buying between merchants and cooperatives even it did not succeed due to the risks and price fluctuations (ORRAF, 2009; TDRI, 2001). Even though, the rubber auction market was continuingly ascertaining with

ongoing funding as Table 5-34 shows. In 2002, only 171 local auction markets still existed their market activities.

5.3) Market interventions and price support

During 1960-1981, the government had chosen taxation as policy to maintain stabilize price and never directly intervene market or uses price policy as discussion previous. The study found that the during the years 1990-2000, the government has increasingly emphasized how to develop rubber markets. Policy maker aspects causing price fluctuation, price declined and un-development of rubber market were assumed that market problems were caused by the imperfection of market information between the farmers and middlemen, low bargaining market power and multi-levels of merchants. Hence, market policies were considered to emphasize: mechanism to increase bargaining power for the farms, to increase marketing information and its balancing among the buyers and the sellers, to establish central market to govern the buying and selling between the farmers and the buyers, and to increase competition among marketing actors. Furthermore, the government has participated Associated of Natural Rubber Producing Countries (ANRPC) and International Natural Rubber Organization that would help to stabilize prices. In 1982, Thailand was a member of the International Natural Rubber Organization (INRO). INRO has played roles in price stabilization to conduct through the world market. Price stabilization would help to stabilize rubber prices and to reduce price fluctuation. However, the government has strongly complained inefficient measures and being dissatisfaction with INRO for withdrawn and then price support was launched as following details.

5.3.1) International Natural Rubber Organization (INRO)

The International Natural Rubber Organization (INRO) regarded the agreement of the international natural rubber (International Natural Rubber Agreement, INRA I) in 1980 consisted of 7 rubber producing countries accountable for more than 65 percent of total exports jointly and 23 consuming countries accounted for more than 65 percent of import jointly. Thailand joined INRO in 1982. The main purposes of INRO were (INRO, 2001);

1) To stabilize and to reduce rubber price without distorting the rubber market price in the long run
2) To create a balance between supply and demand of natural rubber and to guarantee the supply of natural rubber at a fair price
3) To cooperate in the research and development of natural rubber

Key features of the agreement were to create buffer stock. Market intervention derived by stabilized price and determination of low and high intervened price in which each level will have the lower trigger action price higher than the neutral stability of -15% and -20%, and the upper trigger action price lower than the neutral stability of +15% and +20%. As long as the rubber price moved in the range of + / -15% the stable price considered to be stable. When the rubber price moved into imbalance in consumption/production or vice versa, INRO might buy or sell to maintain balance by using collective fund of the member countries.

This fund has divided equally each side from the exporters and the importers, in contributing to the aid fund accordance to the council votes (UNTACD, 1997).

During 1981-1983, INRO stated that the purchased buffer stock during period of rubber decline in 1981 helped to increase rubber price but INRO did not purchase any rubber from Thailand despite rubber price dropped of 13 - 13.40 Baht/kg. During 1985 to 1986, rubber prices declined again, INRO had purchased the buying buffer stock more than 300,000 tons resulted in discontinuing of the price decline. However, the buffer stock began to release into the world markets in 1989 at the same time occurring the recession of global economy. Demand for rubber has dropped extremely causing rubber price to be lowered. Whereas the rubber price decline trends combined slow intervention of INRO causing adjusting level of price stability occurred twice times during 1991 - 1993, which then the stability of price occurred (UNTACD, 1997; RRIT, 2007).

RRIT (2007) stated that measurement to stabilize price and its action by INRO were efficient and a better solution to against price decline. In order to advantages of INRO, the local rubber price in Thailand should use to determine the stable price and the daily market conditions by INRO and should increase warehouse capacity to store more buffer stock in Thailand. INRO operations can be verified and transparent, it was necessary for Thailand to commit using INRO as international market to make buffer stock and funds to against rubber price decline. Furthermore, this report suggested that Thailand might maintain membership with the INRO. However, the governors argued that INRO did not buy buffer stock from Thailand as much as it should do as the major producer and did not keep buffer stock in Thailand. When the rubber price was falling, INRO did not immediately take measures by purchasing rubber in Thailand. This raises a question in reasonable benefits to participate with INRO. Eventually, Thailand announced the withdrawal from INRO in the year 1999.

5.3.2) Price support between 1992 and 2002

During 1960 – 1979, the government views regarded rubber price and its fluctuation depending on the world market, as free market. This was an external factor which free market could be solved itself. The government should not intervene directly in price and rubber market. Thus, the government would have to apply reduction of tax and temporarily suspend taxation as an immediate solution. In addition, the government allowed free trade without market intervention, in believing that the free trade market system will lead to a fair competition and the market mechanisms will manage all problems effectively. For such, the measurement to solve rubber falling price in October 1967 was the reduction of export duty from 40.6 satang per kg to 4 satang per kg and temporary cancellation of Cess.

Domestic rubber prices had shown a decline trend in the 1970s. The key factor was high competitiveness of synthetic rubber forcing the NR price declined following the trend of SR price. When oil crisis occurred in 1973, high SR price caused consumers then turned to consume NR again. In order to stabilize price and to security of supply as requirements of international organization, Thailand was a member of the International Natural Rubber Organization (INRO) in the 1982. INRO helped to stabilize the price decline during the early 1980s that well explained why government did not use any price policy in this period.

RRC (1971) argued that the rubber market in Thailand was characterized by oligopolistic market. The buyers were high market bargaining power forcing the low price at the local market to compare with Singapore market. Export tax, export duty, and Cess that were paid by exporters imposed on merchants. These merchants further have added these taxes onto production cost and pass down all of costs to the farmers. These doing caused underpriced selling when compared to the neighboring countries all along, especially Singapore. For such, price at local market was lower than Singapore market about 36.14 percent during 1969-1979 in the same quality, reflected inefficient of marketing system and lack of market development.

In the end 1990s, the price slump had heavily suffered the loss and vulnerable livelihood for farmers and adversely was a cause of the first protest of rubber farmers in Thailand in 1991. The protests have called for an urgent solution by the government. the government launched measurements for temporal solution to apply the reduction of income tax, rubber export tariff rate, and Cess. The original rubber export tax was 10 percent of the rubber price changed to 0.75 percent of the rubber price when in case the price had fallen to 18 baht per kilogram, but if the price is higher, than it can be collected and the original rate of 10 percent according to the former rate. Cess was to be reduced from 1.70 baht per kg to 0.60 baht per kg. In this period, International Natural Rubber Organization (INRO) was taken buffer stock by buying rubber in the world market amount of 34,459 tons, out of which brought 14,070 tons from Thailand generating some eased for the situations. However, the domestic rubber prices had still fallen in 1991 which the RSS#3 had dropped to 17.57 baht. The government urgently tried to solve this problem and requested assistant from INRO to buy rubber from Thailand once again. These and together with China and the Soviet Union came to buy rubber from Thailand resulting in an increase of domestic rubber price improvement again in 1992, with prices rising to 18.05 baht. These were alleviated some suffering for the rubber farmers.

Since 1992, the government had periodically implemented price support programme. The purpose was to have price at remunerative producers. Fund spent on this project came from the annual budget and loan from Krung Thai Bank. Throughout the six periods of price support since 1992-2002, Table 5-35 shows that the total budget used was 18,626.00 million baht. Stock at the end 1999 was 325,343 tons. Total of deficit and interest was approximately 8,128.0 million baht (TDRI, 2005).

In the early first phase in 1992, RES undertaken price support has constrained about staff and budget, and poor administration. So, the government authorized ORRAF to be cooperated administration and the responsibility for price support together that could potential benefit an increasing marketing place and services. By a result of the first phase, the project was totally administrated by RES in term of loans, purchasing rubber, processing rubber, stock and trade. Total rubber was 264,399 tons, equivalent to 3.0 percent of total rubber during 1992-1996.

At the end of 1996, the rubber price rapidly dropped. Then again, the price support was implemented in 1997 which were administrated by ORRAF and RES. Total rubber entering the price support was 169,085 tons or about 8.3 percent of total rubber in 1997. ORRAF was a major role of administration regarding ORRAFs' accessibility to scatter

rubber areas across the country. Local auction markets are rapidly established by ORRAF, allowing farmers to access price support and its expansion places. Local leader, farm leader, leader of educational institution, and representative from the local central market were invited to appoint a local committee of price support. They have been responsible to be administrative the rubber buying and selling activities. However, at the end of the project in 1997, the projects have been several problems in corruptions and self-interest in return buying and selling rubber.

Table 5-35 Budgets, rubber stock, average price and performance of price support during 1992-2002

Periods	Budgets (million baht)	Rubber (tons)	The average price (baht)	Total expense (million baht)	Deficit (million baht)
Phase1-2: 8 Jan. 1992-1996	3,126	264,399	23.64	6,252	2,377.8
Phase3: Feb. – Dec. 1997	5,700	169,085	28.22	4,771	3,100
Phase4: 21 Jan. – Dec. 1998	2,000	n.a		n.a	1,600
Phase5: 11 Jan. – Jun. 1999	4,000	81,899	21.33	1,747	475
Phase6: 16 Jun.1999- Dec. 2002	4,000	110,000	20.53	2,253	575
Total	18,826 (25,394)	682,933 (1.351 million tons)	23.94		8,128

Source: TDRI, 2001; Zuzuki, 2009

In the fourth phase, the government assigned ORRAF to be a major administrator in price support that helped to solve poor administration, in which from the past only those farms who were registered to be farmers have been the rights to sell rubber to the project. ORRAF has created method solving of reselling rubber through registration system and marking number of seller's registration onto rubber sheet to prevent subrogation and reselling. 171 of local auction markets were used to be place to serve price support. RRIT was jointed responsible to manage rubber stock together while RES contributed to support a loan and account auditing. Approximately 7.5 percent of total rubber in 1998 passed through price support program.

In the fifth phase, ORRAF and cooperative have been responsibility and administration in price support programme. These cooperative were jointly established by ORRAF and the department of cooperatives promotion of which have been to support building primary factory to produce rubber smoked sheet (RSS). These products were sold through price support to earn approximately 1.50-2.00 baht/kg. In this phrase, department of agricultural extension was undertaken responsibility for the farm registration eligible for selling rubber to the project. Department of cooperative promotion was responsible for auditing and monitoring the project and RES contributed to audit a detailed account of the project. The buying rubber was done by ORRAF at official levels of provincial and district, office of agriculture, office of provincial cooperative, and cooperatives. RRIT was managed rubber stock, warehousing, and introspection of rubber quality to be kept in the warehouse.

Approximately 81,899 tons with the average price of 20.53 baht/kg was entered in this programme in this period.

In the sixth phase, the project was cooperated by ORRAF, Department of agricultural extension, Department of agriculture, and the farmer's institutes. The project was announced administration and responsibility belonged to each government organization the same as the fifth phase. RES was responsible to support a loan. ORRAF remained to be key important roles in administrative project. The project sites were 241 locations in 171 districts, out of which consisted of 165 of cooperatives and 76 of farmers' groups. These farmers' institutes were only responsible for purchasing rubber by price support and delivered to the smoked rubber factory or contracting companies that contracted out to keep rubber stock for the government. The government was paid 1.0 percent of total purchasing amount for an administrative cost. In this phrase, the programme divided into four phrases as Table 5-36 (TDRI, 2001).

Table 5-36 Price support, local marketing price, total rubber in project and budgets in price intervention phase 6

	Price support (baht/kg)	Price at local marketing (baht/kg)	Total rubber of programme (tons)	Budgets (million baht)
Sub-phase 1: 16 Jun-15 Aug. 1999	20.50	16.30	100,147	2,064.7
Sub-phase 2: 15 Aug-10 Oct.1999	20.0	17.97	68,129	1,376.89
Sub-phase 3: 11 Oct. 1999-6 Feb. 2000	21.0	19.75	6,969	130.44
Sub-phase 4: Feb.2001-Dec. 2002	-	-	506,799	11,938.96

Source: RRIT, 2001, 2005; Zuzuki, 2009

Table 5-37 Price support and the average price at local market

Periods	Price support (baht/kg)	Average price at local market (baht/kg)
3 Feb - 20 Feb 1997	25	24.5
4 Mar - 12 May 1997	27.5	24.45
13 May - 31 Jul 1997	29	22.59
1 Aug - 19 Sep 1997	27.5	20.88
15 Oct - 31 Oct 1997	27.5	25.88
2 Dec - 31 Dec 1997	25	20.25
1 Jan - 27 Nov 1998	24	23.73
30 Nov - 31 Dec 1998	23	18.11
1 Jan 31 Mar 1999	21	17.9
16 Jun - 15 Aug 1999	20.5	15.75
16 Aug - 10 Oct 1999	20	17.14
11 Oct - 6 Feb 2000	21	20.36
7 Feb - 14 Aug 2000	21.5	20.79
15 Aug - 17 Sept 2000	22	21.7
18 Sept - 7 Nov 2000	22.5	22.05
8 Nov - Aug 2001	24	21.58

Source: RRIT, 2000; TDRI, 2001; Zuzuki, 2009

TDRI (2001) also stated that prices in the projects of RSS#3 were higher than the average prices of RSS#3 which were the average prices of three markets: the central rubber

market at Hatyai, Tokyo, and Singapore. It seems that the prices might derive from the average prices of RSS#3 from these three markets plus with additional prices. The prices are determined by a committee composed of; minister for transport, deputy minister of finance, deputy minister of agriculture, and the secretary of agriculture as Table 5-37.

Support prices in the early year were likely to increase. In February 1997 the price support was 25.00 baht while the average local price was 24.36 baht. Support prices were only slightly higher than the local price. Due to the falling price, support price also fell consecutively. Since 2000, there was no rubber entered into the programme, due to the local price was higher than support price. As a result, the farms rarely sold rubbers to the intervention program due to regulatory difficulties compared to the local market even when the support price was higher than the local prices. During 1997 – 2000, support price caused to increase prices at the local market in a short span and then market price was still lower that that of support price. It seems that programme's committee wants to set price to be higher than the market price and the international markets. Due to limited amount of budget, proportion of rubber passed through the programme depended on budgets which were about 10 percent of total rubber in the country. Support price was only affected in psychological effect. If the support price was high, the merchants halted on buying rubber in the local market that had affected on lower actual overall demand.

In the end of this period, there was a support price setting to be the same level as of the market price. Pricing seemed to be the result of intentional price setting for the support price and the market price to be on the adjacent level. Therefore, the support price was unable to raise the market price at the farm gate to a higher level and closer to the support price. Rubber farmers who have benefits from the support price programme were approximately 5 percent of total farms. Throughout the periods of project, there were registered farmers of 55,637 individuals during 1999-2001, representing rubber areas of 1,611,201.08 rais. Number of rubber organizations was 52 cooperative/farmer groups, representing 2,336 of farmers and covering rubber areas of 125,129.75 rais. Most rubber farms still sold their rubbers in the market price, with the amount of rubber entering intervention project of about 9.1% of the total rubber as table 38 (TDRI, 2001).

Table 5-38 Total rubber under price support programme and total rubber production

Year	Total rubber under price support (ton)	Total rubber production (ton)	Percentage (%)
Before 1997	262,376.6	1,503,941	17.1
1997	168,606.5	2,032,714	8.3
1998	159,696.0	2,075,950	7.6
1999	276,724.6	2,154,560	12.8
2000	69,278.6	2,490,107	2.8
Total	933,682.3	10,284,272	9.1

Source: TDRI, 2001; Zuzuki, 2009

TDRI (2001) stated that the impact of price support was affected on retard to improving productivity, not aiming at improving productivity and reducing production costs. This intervention had deteriorated on competitiveness and structure of rubber market. Market intervention caused the loss of social welfare and the government must reclaim losses to RES.

The impact on exporters is that exporters have to compete with the government in buying the rubber at a higher price than the market price and the international market which will affect on export contracts and trading in the futures market. Some exporters have suffered with heavy losses leading the market structure to form oligopolistic market. Market concentration increases by a few important exporters to take a large market share and more bargaining power in the market.

5.4) Promotion of farmers' institutes

In 1992, the committee of rubber policy board has announced a policy of price support and also emphasized policy to encourage rubber farmers to establish cooperative and farmers' groups to be function production, trade and markets. The government has supported the grants to build the smoked rubber factory with a capacity 2 .0 tons per day. The project was totally 1,500 factories. There were an increasing value add and the marketing bargaining power through cooperative and farmers' groups. The initial plan comprised of three years, 1994 building 300 plants, in 1995 building 400 plants, and last year building 800 plants. This plan had pushed a pressure to ORRAF to accelerate the establishment of farmers' institutes. There has origin of ORRAF cooperative and 675 of factory of smoked rubber sheet as Table 5-39. Consequently, the building smoked rubber factories cannot meet the target because it was unable to find location to build factory and farmer's group to operate factory. Therefore, the project was suspended in 1996. Factory building and budget presented as Table 5-39 (ORRAF, 2001).

Table 5-39 Smoked sheet factory and budgets

Year	Targets (unit)	Budgets (million baht)	Building Factory
1993	10	-	-
1994	300	1,013.25	-
1995	365	1,489.00	145
1996	-	-	165
1997	-	-	166
1998	-	-	163
1999	-	-	33
2000	-	-	3
Total	675		675

Source: ORRAF, 2001; TDRI, 2001

In the ORRAF plan 1997-2001, ORRAF have strongly commitment for development of farmers' institutes in term of number and strengthening their production and marketing functions. The targets of the farmers' groups were 405 groups for 1997, 360 groups for 1998, and 326 for 1999 –2000, respectively. All group types were to support by ORRAF totally 4,000 target groups. As a result, in 2000, 3,415 groups consisted of "*groups for development of the replanting planters*" and "*ORRAF cooperative*" have been to support by ORRAF.

Groups for development of the replanting planters were 2,718 groups. The objectives were 1) to support working tasks of ORRAF at the farm level in term of control and inspection of technological use, farm maintenances, and farm practices, 2) to promote

additional occupation during the period of immature trees, and 3) to provide knowledge and training in the time being, whereas most of the localities were in the south.

ORRAF cooperatives were 697 of cooperatives, consisting of 634 cooperatives with factory of rubber smoked sheet and another 63 cooperatives without factory, some of which were overlapping with group for development of the replanting planters. The cooperative focused on production, collecting, and selling which relied on philosophy of cooperative. In fact, a number of ORRAF cooperative was increasing according to government policy. By which, most of the cooperative began to operation in 1996.

Table 5-40 Total cooperative under ORRAF and active cooperative during 1994-1999

	1994	1995	1996	1997	1998	1999
Total cooperative (unit)	297	349	622	692	705	722
Active cooperative (unit)	30	51	437	461	504	451
Total members (person)	5,905	17,450	28,319	33,676	37,477	42,434

Source: ORRAF, 2001; TDRI, 2001

A registering and active cooperative is presented in Table 5-40 (ORRAF, 2001). However, some of these cooperatives ceased operation increasingly. These were due to the difficult to have a large enough shares of capital, and terminate by cancellation of the factory. By the end of 2000, there were only 684 registered cooperatives, and 555 cooperatives undergoing business, and 129 cooperatives have not started operating. This was the result of rushing cooperative to operate as fast as. Due to the rapid promotion in establishing a factory of rubber smoked sheet and cooperatives in a short period of time, and rushing cooperative to operate as fast as, it was a cause the lack of readiness and preparation time, such as providing workers, locations, and it did not derive from the need of the rubber farmers.

Furthermore, operating cooperative had faced serious conditions when members did not understand concept of cooperative due to the rapid establishment and the lack of knowledge, causing the lack of cooperation in operating cooperative system, including the lack of business skill and experience in business administration. The cooperatives also has a problem with the building of factory which grants by government, which is not up to standard and delayed to the designated time, low production capacity causing high production costs, labor shortage, lack of production expertise and management problems. These caused to terminate more than 314 plants.

Because of implementation of price support needed to have some supporting system, many cooperatives had rushed to establish and operate. It therefore also had impacted on a better performance of cooperative when RSS price set upon price support programme was higher than marketing price leading to a continuing profit. It is likely that during this period, the success of cooperatives can be explained by price support and it existed supply chains in the government intervention. The government also was supported the funding and low-interest loans for the building of primary factory and setup of cooperative, including technical assistance and knowledge by the authorities and government agencies.

It is likely that these policies derived based on the views that the farms have been lack of marketing bargaining power, imperfect of information and lack of rubber marketing development, leading consideration to emphasis policy for modern market and the restructure

of marketing system. Such policy was guided by government, which forced the project to the farm level urgency. These policies did not regard the need and capability of the farmers, although some farmers in some areas may be a progressive farmer. They were persuaded to have financial benefits and the building from the government projects.

In contrast, the forming of farmers' groups or cooperatives was driven by the need and their owned experiences to deal with inefficient rubber markets and imperfect of market information so that they found the means to deal with these serious situations by cooperative and farm's groups such as in Ban Phru Songkhla, Tamot Phatthalung, Mai Raing Nakhon Si Thammarat. They produced quality products, a large volume, seeking appropriate market channel, faire price and to collect all produce to be sold. They searched market channels from the local market to exporters directly. The government measures were further supported to enhance cooperative, to reduce the production costs, and to increase efficiency. The farmers have feeling in ownership solving problems and have a consistent approach between the farmers and the government, leading to the formation of farmer's groups or cooperatives corresponded to rules and social needs. These resulted in successful of cooperative's performances and sustainable cooperative's functions.

In facts, DAE began to promote farmer's institutes in the form of farm's group before ORRAF. Since Department of agriculture extension (DAE) established in 1967, the DAE began to promote farmer's institutes to expand new planting and also supported farmers to develop production, markets, processing and quality. The first rubber group was established in 1975, which called "*group of improving quality of rubber sheet*". The propose was to organize farm groups for improving production and rubber quality according to RRIT recommendations that would able to sale at a higher price. It was also reduced pricing bargaining power by merchants. DAE has supported technologies, materials and training to the group as a whole. Later in 1991, DAE proposed a plan to develop raw rubber production by establishing "*rubber sheet quality group*" by 605 groups per year and "*center for collecting rubber*" by 110 centers per year during 1992 – 1996. These groups have been producing USS, latex and collecting their owned products to be sold in the local market or central rubber market. DAE have supervised accounting and solving problems. In 2000, the rubber sheet quality group established up to 2,826 groups, of both registration and non-registration. The groups included 35 farmer's groups of rubber smoked sheet factory out of which only 20 of farmer's groups were still operating business activities. The rubber sheet quality group was renamed to "*The Rubber Quality Group*", out of which 50 percent were still operating and of 20 percent were effective of performance meeting the criteria of DAE. The establishment of "*center for collecting rubber*" in the community was 537 centers but it was found that the activity of gathering rubber were very little (ORRAF, 2001, TDRI, 2001).

Furthermore, DAE has obliged to promote farmer's institutes forming federation of cooperative at the provincial level, regional level and national level. Where the member of these institutes came from farmer's groups and cooperative at district level and sub-district level, the important farmer's institutes were "The Provincial Rubber Farmers Association" and "The Association and the Federation of Rubber Farmer of Thailand". There has been function as the organization of farmers to demand and to push appropriate policy and to cooperated with government. As of each year, DAE will give support budget to these organizations to conduct an association committee meeting for solutions and to provide

appropriate instructions or measurement for other committees at the national level (TDRI, 2001).

5.5) Development of rubber manufacturing and rubber industrial products

Before 1991, the government has less realized policy for promoting rubber industrial products and rubber manufacturing; i.e. it does not have any framework in developing and promoting the rubber product industries. It appeared that the policy concerned only the growth of raw rubber industry and primary processing industry. As soon the government realized that rubber product industries were necessary to add value of rubber products, to increase value-added exports and to reduce export of raw rubber. The Board of Investment (BOI) was established which the main propose was to grant special rights for the foreign investor. Industrial investors related rubber could specially support by BOI: 1) 50% import tax exemption for import and trade tax of machinery, 2) tax exemption up to 90% for trade tax of raw materials and components, 3) tax reduction or an exemption from corporate income tax from 3 to 8 years and can deduct losses from income tax for the cost of the goodwill, copyright and other rights for 5 years after receiving of promotion. There was strong incentive program for foreign investments and new joint venture (RRIT, 1995).

Furthermore, the Customs department, ministry of finance also provided exemption of import duties and tax returns from exports, especially on machines, materials and factors of production that is used only for exported products. Thus, the industrial policy emphasized to support exporters and manufacturers by reducing production costs in comparable to compete with others in the world market. The important promoting programs were: 1) tax exemption and return of the tax for the imported raw materials from abroad (Refund of tax and duty) to produce goods for export, especially under Section 19 2) compensation taxes and duties for domestic goods for export 3) tax exemption and import duty on domestic raw materials for export by storing at bonded warehouse (Bonded warehouse) 4) exempting tax and fees imposed on the import of machinery and devices in establishing industrial factory in a tax-free industrial zone for export (Export Processing Zone-EPZ). This exemption covered imports raw material for exports in duty free zone. There were two reasons for tax redemption: 1) tax redemption, taxation from the customs department was not for the exporters who especially produced for export, 2) tax redemption, in redeeming tax, the customs department imposed on raw materials imported from abroad, not locally manufactured raw materials that can be used to produce industrial goods for export to international market.

In addition to this, the government created idea to setup "*Research and Development of Rubber Industries Center*" that would have to promote rubber industrial in couple with the existing industrial development policies. The government had been promoting investments of a large company by creating special program using tax measures: 1) tax exemption on import raw materials, manufacturing machinery and equipment, and income tax for a period of 5-8 years, 2) to reduce import duties on raw materials, manufacturing machinery and science related equipment had dropped drastically of 5 percent for rubber chemical, 10 percent for synthetic rubber products that cannot produce domestically, 20 percent for synthetic rubber products that can be produced domestically, and 3) 5 percent tax decrease for production

machinery and testing equipment as well. Consequently, during the late 1990s to 2000s, tire industry grew substantially, correspondence to policy promoting automobile industry that aimed to promote Thailand to be the center of automobile industries in the Southeast Asia. These were stipulated the growth of related industries and tire industries.

During 1987-1993, gloves and condoms industries grew gradually. 89 companies were promoted by BIO that have been the initiating investment of 2,716 million baht and employed 17,177 of workers, where mostly located in the southern region. This growth corresponded to the demand for medical gloves in the world market. Thailand has advantage of being the source for raw material (latex) and cheap labor. At the same time, the AIDS epidemic increased that led to shift demand for the use of condom and medical glove, affecting the high growth of condom industry. In this period, the new condom investors to require BIO program were 11 companies with investment of more than 1,573.2 million baht and would increase the employment of 2,506 jobs (RRIT, 2001; BOI, 2012). Therefore, the policy till now was to promote the growth of rubber industries emphasizing rubber manufacture and related industries that have been a competitive advantage for exports such as vehicle tire, gloves, condoms and industrial parts. New foreign investments would have to take advantages in BOI program and national competitive advantages in term of supply of raw material, cheap labor, and a better infrastructure.

In 1998, government had shown the attention to implement "*The Master Plan of Rubber Industry*" due to the delays in the development of rubber industries and lack of nation policy for development of industrial rubber products, and lack of a master plan to develop the industry. Ministry of industry had created "The Master Plan of Rubber Industry" to be guided an appropriated policy and master plan for the rubber products industries. By this master plan, the rubber product industries can be classified into four sectors: 1) vehicle tire industry, 2) engineering rubber and rubber industrial parts, 3) latex industrial and related latex, and 4) general rubber goods. In 1998, the data shows that vehicle tire industry was dominated in consumption of rubber and accounted the highest value of export. This industry consumed dry rubber about 120,000 tons which export estimated about 15,000 million baht (32 percent of total rubber exports). For latex industry, it consumed rubber of approximately 63,000 tons, but the highest export value estimated 21,600 million baht (44.5 percent of the total export value). Other rubber products could have revenues from exports of about 100.0 billion baht which has less impact on the country's revenue, it might be because of all other countries were manufacturing their own products. Therefore, high potential rubber industries in term of rubber consumption and exported value were vehicle tire industry and latex industry. The purposes of this plan were to promote industrial rubber products as a major industry for the country, increase domestic consumption at an average of 10 percent per year, increase exports of rubber products at average 10 percent per year, increase the competitiveness for small and medium entrepreneurs, and increase the number of rubber factories through the existed promoting programs (OIE, 2002).

This master plan was consistent with the development plan of rubber product industries in 1999 that targeted to increase domestic consumption by about 20.0 percent of total rubber or 400,000 tons per year. This could be promoted through the existed BIO program and special promotion of rubber industry that have been implemented. In addition, RRIT would emphasize to accelerate research and development attempting to increase

proportion of natural rubber in rubber products, improve quality or rubber products and determine national standard of rubber product to be an international standard that would influence to induce the growth of investment of the rubber industry.

In 2002-2006, the government has promoted "*Chalung Rubber Industrial Estate*" in Songkhla, which would have to be the center of rubber industries according to the master plan of rubber industry even this was not a success till to now, because it was not truly implemented (RRIT, 2006, 2008).

5.6) Farmers response to the replanting scheme

After the Korean War, rubber in Thai people has been changed from sources of additional cash income generation to be main occupation. The farmers paid more attention to plantation and to motivate expansion of new plantings (Stifel, 1973). Meanwhile, the government has foreseen rubber as economic crops to generate government revenue and foreign income in the future. Price boom in 1950/1951 remained influences the continuing expansion of new plantings during the 1960s to 1970s. Population density increased from 2 million in 1960s to 3 million in 1970s, reflected rising population pressure. Indeed, in the paddy field areas, rice tended to have insufficient income and low profit due to many family member, high cost of living and education tuition for their children (Taanthai, 2002). Minimum of living has raised serious pressure to move into new settlement. They began to occupy new land for new plantings. Anyway, they had moved for free unoccupied land in the deforest zone and uphill areas in the central line of region.

Consequently, rubber areas grew rapidly across southern region. Rubber areas increased from 0.49 million ha in 1961 to 1.27 million ha in 1970 with the rate expansion of rubber areas at the annual average 16.0 percent. With regarding policy for promoting extensive production together with the replanting scheme, rubber land continued to increase from 1.38 million ha in 1971 to 1.5 million ha in 1980 with the growth rate of 2.0 per year. And then was slowdown trend in the 1990s in responded to falling price trends. An increase in new plantings was converted of the existed agricultural land, such as rice, fruit and empty land. The conversion of these lands into rubber was high after the 1990s. It also included the beginning new plantings in the northeast during 1991-1997. As a result, the growth rate of rubber area was about 1.4 per year during 1981-1999 which totaled rubber areas of 1.98 million ha in 1999 (RRIT, 2002).

Before the 1980s, the farms, especially Thai people, have preferred to plant a particular rubber plot that would have source of income generation to expense daily household expenditures and tuition fees for children. Meanwhile, money accumulation was starting, some farms who owned a large size was able to re-invest for improving productivity and expansion. This pattern was observed by medium and large farm, which called "Toa-Kea Suan Yang". Most medium and large farms historically was the first movers to participate with the replanting scheme and used of new technology. These resulted in increased economic opportunities for capital accumulation and grown in farm structure when land price remained cheap. A large size associated high yield could be earned high income that can be well explained a capacity to expand farm structure continuously during 1960 - 1980, while

small farms still accustomed to traditional ways of farm life that have gave an importance to rice farming or fruit tree for home consumption (Taanthai, 2002).

As state by Taanthai (2002) and Songmaung (2002), the primary pattern of production in South was to produce rice for home consumption and sale its the surplus. There was the traditional economic activity when market economy began to develop in the village at least before World War II. Horticultural activity was made to achieve adequate food consumption or to grow only popular fruits to be consumed in home and exchange within community. Then, most of small farms would not only plant rubber but also plant several fruit trees in the same plot, which we called "*Paa-Yang (Jungle rubber)*". The important reason for growing rubber was earned more cash income and can bring in daily income for daily expenses. Rubber tree also was easily planted intercrop with fruit trees. As well, the cultivating calendar for growing rice, fruit and rubber were coexisted perfectly in seasonal, land use, farming system, and working time , that have been the optimal utilization of land and labor, and mutual benefits both food and cash income. When the fruit is sold, it could be earned much money for saving, they also have generated daily income from rubber production and cultivated paddy field for family consumption. There were integrated farm systems and the use of their resources to satisfy traditional agrarian life. This pattern was dominated the traditional farms across region before the farm transformation began to develop into rubber based economy.

The analyses found that the three important reasons can be explained the farm transformation to be dependent rubber production were: the first reason corresponded to rubber prices and profitable combined market economy forcing farm transformation due to profitability, low risks comparing with other ones, its security, the growth of market economy. Second, specialization and its effects involving production, resources, technology, and market were increasing, resulting shift of productivity and farm expertise falling mono-specific rubber. Lastly, farms faced decline of agriculture due to low labor availability, high production cost, and the falling earn. These reasons caused them to leave old paddy field areas out and inability maintaining the orchard plantation of which these areas were therefore encroached into new plantings. This mechanism was actively developed across region and accelerated momentum of transformation when the non-farm sector substantially grew after the early 2000s.

5.7) Impacts of the replanting scheme and technical changes

Our respondent indicated that after 1967, ORRAF began to promote the replanting, new technologies and the grants in the village. Regarding high yield and the regulation of the scheme, land must be completely cleared and planted rubber alone as mono-specific plantation. The scheme has supported planting materials (new clone), capital, and knowledge on growing modern plantation.

The first re-planters were to dominate by a large farms regarded to large size, capital, and confidence to new technologies in which some of them have learned modern plantation in Malaysia and then they have prompted to participate with the replanting scheme. Most small farms has been delay in the replanting because they were worried and less trusted the scheme authority's advices on how to grow rubber, maintain rubber plantation and follow the

regulations of the scheme from cleared land, land preparation, planting, weeding, application of chemical fertilizers, herbicides, and discontinuation of using manure.

Due to small size, small farmers commonly concerned the loss of income during five-year of immature period and then the year of replanting would expand as long as, eventually off-farm activities with share-tapping adopted widely. This plantation called "*Saung Yang-Song Khroa*". Upon the sixth year, the tapping can be done with the yield shift about 5 times. This plantation cannot be tapped every day, unlike the Jungle rubber whereas. Most of farms have been some understand that tapping system can only be done half spiral which was appropriated with tapping day and pause other day. Third spiral can be tapped every three days and pause other day. In this period, un-smoked sheet rubber (USS) was mainly produced to be sold to merchants in the village except large farms will bring their output to sell in district or province because it could get a better price. Our respondent stated that profitable and productivity were encouraged them to convert all holding into modern plantation, especially the replanting by large farms was higher. In other hand, small farm would wait and delay till to ensure successful of the replanting by observed large farms, and thus the replanting was adopted later.

In this period, the government emphasized two policies for the expansion of new planting and the replanting scheme. Such policies belonged to the recommendation and advisory by the World Bank. It is likely that the government would have to govern all stages of the productions from the selection of high yield, planting, farm maintenance, tapping and processing, obtaining shift of productivity by replanting of high yield instead. The old seedling variety has been low yielding at average yield about 375 kilograms per ha while the high yields were higher, especially RRIM 600 yielded an average of about 1,250 to 1,875 kg per ha (RRIT, 2001). The replanting scheme realized farm structure and the economic conditions of the rubber farms which were characterized by small size, scare capital and simple technology. The scheme considered to support the grants and control technological use as a key role of the replanting. The Rubber Replanting Aid Fund was established to be conducted ensuring efficiency and flexibility in administration and responsibility of the scheme. "Rubber Replanting Aid Fund (Cess)" was an export duty to be charged from the exporter for ORRAF funding for the scheme. There was advance funding system paid by the farms and returned in form of the grants when the replanting occurred. Initially, the *Cess* was allocated into 3 parts: 90 percent of the Cess would be used to support the grants according to the rubber replanting scheme, another 5 percent for operations of ORRAF, and the last 5 percent was for rubber research and development by RRIT. This proportion could be considered by the committee of the Office of Replanting Aid Fund. According to "Rubber Replanting Aid Fund Act 1987, the proportion of ORRAF increased to 10 percent and reduced the proportion of the replanting scheme to 85.0 percent and 5 percent was paid for research and development by RRIT accordingly (ORRAF, 2003).

In 1961, the grants was 1,500 baht per rai, then this amount will grow continuingly according to the Committee of ORRAF may deem appropriate. Whereby, the amount of fund could have supported from other sources such as loans, government budgets, and grants from abroad. By the regulation of the scheme in the early stages, the requirements of Article 8(3) according to the Rubber Replanting Fund Act 1960 enacted that farmer shall own land not

less than 2.0 rais each farm and rubber trees old aged 25 years or above or high exploitation or damaged of at least 10 trees, and on average of standing tree 25 trees per rai.

This grants was divided into two types; 1) materials and planting items such as planting materials, fertilizer, herbicide, and weed, and 2) cash costs which were costs for labor, cleared land, and land preparation. The grants will be pay periodically into different types of amount in five and a half years and that will end the grants. Thereafter, the rubber farm must take care of their owned plantations.

Table 5-41 Landholdings of the re-planters, the distribution of landholding and number of farms according to the re-planting during 1961-1970

Province	Landholding (%)								Total land (rai)	Number of farmers
	1-20	21-40	41-60	61-80	81-100	101-120	121-140	> 140		
Chumphorn	8.77							91.23	368.21	2
Surattani	5.14	26.1	29.32	14.74	11.73	3.77	2.9	6.03	17,462.00	404
Nakorn si thamarat	14.74	35.97	17.67	8.89	4.79	1.29	3.07	13.58	33,019.00	979
Pattalung	12.98	28.07	21.76	22.12	6.21	3.72	5.14	-	2,732.12	77
Songkhla	6.24	9.71	6.78	8.78	5.22	3.87	4.26	55.14	27,880.38	420
Trang	6.78	14.98	11.08	6.43	6.31	6.25	3.62	44.55	14,172.23	233
Satoon	27.81	25.32	5.92	11.55	5.18		6.49	17.73	1,938.58	77
Phuket	1.74	3.7	2.01	5.37	5.19	0.65	2.51	78.83	16,507.99	102
Ranong								235.94	235.94	1
Phang-nga	7.19	10.06	10.52	12.97	8.22	2.6	5.31	43.13	12,542.50	206
Krabi	0.78	7.37	15.76	9.37	6.26	8.73	6.71	45.02	9,994.21	110
Yala	6.78	7.44	6.97	8.36	5.69	1.25	5.31	58.2	9,621.00	133
Pattani	8.16	4.62	11.78	5.26	7.09	6.9	1.99	54.2	6,446.06	96
Naratiwat	19.92	17.58	9.42	6.5	6.68	2.71	6.2	30.99	16,939.57	526
Chantaburi	4.89	6.88	3.84	6.81	6.29	4.94	5.58	60.77	6,980.33	68
Rayong	9.6	32.08	10.38	14.16	5.36	9.32		19.1	4,794.86	119
Trad	5.46	19.03	12.57	14.66	4.79	5.81	6.8	30.88	1,862.56	35
Total	8.81	17.16	12.19	9.17	6.37	3.48	4.06	38.76	183,497.54	3,588

Source: Jiranakorn & Tipyakul, 1974

Since the introduction of rubber in the village, the rubber farms have been imitating technology and practice in productions from the Chinese plantation. Those of technology was adapted into simple technology to meet their capital and traditional cultivation in fruit orchard as a result of the growing rubber intercrop or mixed with orchard or native tree. Rubber tree therefore planted spread throughout the area by old seedling that could collect from Chinese plantation. Without specific technique, rubber has planted everywhere there was an empty space and will stand. This could be imaged as Jungle rubber. This was contrast to new technology and highlighted the difficulty to promote the replanting scheme in the first period. During the first promotion period, our respondents stated that the farms have been quite worry to commitment of the scheme. Because the farms held only temporary document of the land right (S.K 1), they do not have title deed of land right. If they jointed to the scheme, the government will seize their property later. Most of the farm does not believe that the government will provide free support and do not believe that the new rubber will give high yield. This evident was highlighted lack of confidences and untruth between the farms and the government (Songmaung, 2002).

For small farms, the replanting also affected on the loss of rubber income during immature period. When they required the replanting, the famers must clear-out their land or to separate size down into small plot that could remain some income by old trees. However, income was still not enough, and then they must be adopted off-farm with share-tapping for sufficient household income. In contrast, large farms could be take advantage from the replanting. They can separate land into different plots for the replanting that did not affect revenue during the immature period. It seems that ORRAF already perceived these constraints and farm conditions. Thus, ORRAF began to promote the scheme with large farms who are head of villager, Chinese, and Sino-Thai which mostly owned large land holding and were characterized family farm enterprise. Most of the first re-planters in the villages were Chinese and Sino-Thai. Perhaps, Thai people would wait for the results of the first re-planting that could be ensure to the scheme. Even they have participated with the scheme, some farms did not believe in the recommendations of ORRAF's staffs because they believed in the old techniques (Taanthai, 2002). These reasons together with the limited budget and insufficient number of officers caused a slow rate of the replanting during 1961-1972, which was amount 96,000 ha.

Accordingly, the survey of the re-planters across region between 1962 and 1972 founded that the sample of survey was 3,588 farms. Total of land holdings was 183,490 rais with the average holding of 51.1 rai per household, consisting of 41.0 rais of rubber areas and 5.0 rais of rice areas and the rest being fruit orchard. Out of rubber areas consisted of 26.5 rai of old trees and 24.5 of immature trees. These included new plant in deforest areas and the re-planting areas. Out of 3,562 households consisted of 2,311 new planting and 1,858 replanting. Table 5-41 shows landholding size in each province. 46.3 percent of total re-planters owned landholding more than 100 rais and only 8.81 percent holding less than 20.0 rais. Therefore, large farms would be the first group to participate with the scheme prior to those of smallholding. This survey also indicated the use of new rubber variety that more than 60.0 percent of farms are planted by Tjir1 and the rest is planted by RRIM623, 605 and 600 with 7.74%, 7.56% and 4.15% respectively (Jiranakorn & Tipyakul, 1974).

In the first decade of 1970s, the replanting expanded very little, which was not proportional to the exits of old rubber areas which tended to expand rapidly during the years 1957-1977. The first year of replanting in 1962 was 24,436 rais and later rose at an annual average of 45,000 rais during 1963-1972. This rate provided a serious constraint to NESD that need to increase the level of replanting to compensate with the expansion of old trees and new planting with old seedling. As results, the government have supported budget for increasing level of the replanting since 1972. The rate of replanting increased to an average of 137,000 rais during 1972 to 1977 as a double size to compare with the past. During this period, ORRAF began to set ORRAF office at the main province and district across region. The replanting activities have expanded into the main district and the remote area. One of the important reasons affecting the high growth rate of replanting after 1972 was the achievement of the first replanting. The first lot of replanting during the 1961-1962 had tapped with high yield and increase of income. There was demonstration plot helped to present the successful of new technology and the scheme. This had impacted on the rapid expansion of the replanting and the growth of new plant with new technology. ORRAF also succeeded to

encourage the farms to replanting because of presenting many samples of the high-yielding plantations (ORRAF, 2009).

During 1977 – 1990, the rapid replanting projects were performed to pursue to rapid expansion of the replanting. There was an expansion of ORRAF offices, an increase of official and ORRAF staffs, and full function of the replanting. The average rate of replanting area was about 266,000 rais per year along with the oncoming of the third stage of rapid replanting project. In the end 1990, the accumulated replanting totaled 4.82 million rais, or about 40 percent of total rubber areas. And thereafter, the rate of the replanting remained high level of 230,000 rai per year. NSO survey (1998) showed that the old seedling areas were only 198,032 rais of rubber or 1.90 percent of the total area. Out of all high yield areas, 44.9 percent was under the provision of the scheme, and 53.2 percent as self-investment (NSO, 1998) as Table 5-42.

Table 5-42 The estimated rubber areas by immature areas, mature and senile in 1998

	Immature	Mature	Senile	Total
High yield clone	2,421,717	7,661,861	123,266	10,206,844
- Owned	1,319,145	4,164,643	47,187	5,530,975
- Granted	1,102,572	3,497,218	76,079	4,675,869
Low yield clone	48,105	125,868	24,059	198,032
Total	2,469,822	7,787,729	147,325	10,404,876

Source: NSO, 1998

Along with this process of the rapid replanting, the study found that the establishment of Rubber Research Center (RRC) in 1965 and several The Rubber Experiment Station and Rubber Nursery Plot were more effective measures to support achievements of the replanting scheme. These organizations were sources of knowledge, trial plots to train how to manage modern plantation and increasing accessibility to new technology with low cost. There were process of learning and increasing new knowledge. When the public have raised more knowledge and confidences, it was induced them to new behavior and changed by the scheme that began to develop new production technique seriously.

Since 1961, the study has observed that the government intervened every process of rubber production by the replanting scheme and a given institutional arrangement whereas the farmers are guided and closely regulated technological use in every aspects of production. In facts, these technologies were developed or modified in specific condition of Thailand by RRC in Kho Hong, Hatyai Songkhla. For such, high yield varieties were classified into three levels. First level of variety was strongly recommended by RRC which was properly planted due to high yield, resistance to disease, and better growing with condition in Thailand. What kinds of variety to be use depended upon the decision of farmers but most of the time it also depends on the recommendation of the ORRAF and their nursery provision. The popular rubber varieties were RRIM 600, PB5/51 and GT1. RRIM 600 was widely used because by perspective of the farms, it provide a consistent latex, rarely fallen over when blown by strong windy, and resist to disease. ORRAF also regulated planting practices and steps of farm maintenance (RRIT, 1980). For such, they must be cultivated with specific row avenue planting pattern and planting density per rai including types and frequency of farm maintenances by using different kinds of chemical fertilizers and herbicide for weeding

control in each class of growing tree, starting from first planting until rubber tapping. The use of chemical weeding, cover crops, and intercrops to raise more income during period of immature trees must meet the requirements of ORRAF in order to provide high yield and modern plantation belong to RRIT recommendation. ORRA staffs will closely advise, inspection, and pay costs of labor and other materials in each period within 5.5 years.
At the end of year fifth, the farmers will have to take care of their own rubber. The study found that the farmer will start to tap after the age of 7 years to ensure the complete growing tress. In order to increase yield and long productive period, ORRAF will advise not to tap rubber every day which common tapping system is half spiral (S/2) and third spiral (S/3) with three day tap stop day (3d/4) or one day tap stop day (d/2).For small holing, three day tap stop day (3d/4) was mostly applied. This essentially depends on the economic status, size of tapping areas and available labor in each family. Therefore, the replanting scheme was characterized by government intervention in order to increase rubber output and improvement of productivity. The replanting scheme strongly embedded both economic behavior and driving rubber institutionalization.

Since the announcing of the Rubber Replanting Fund Act of 1960 until the late 1980s, the study found that the replanting area was low in term of planting areas and also has been slow feedback by the farms. This phenomenon appeared because the farmers did not trust in commitment of government. This is because the people never did receive the government's support before. In the past, the government generally would come to collect taxes and solve specific problems that emerged on occasional situation. Therefore the farmers were suspicious of government and the government officials. The farmers also feared that the scheme would have a hidden agenda. Some farmers thought that if the farms received the supported grants, ORRAF would confiscate their replanting rubber and their rubber plantation. These were characterized to un-trust in power and irregular roles of government in the past which never played appropriate roles by the views of local people.

When the replanting scheme had introduced in the village, the replanting scheme provided regulations and related measurements affecting the farmers' life and traditional economic behaviors tremendously. The stud found that these changes can be classified into two parts: 1) behaviors in economic activities and social life and 2) farming system and resources allocations. The study found that the farmers who wish to receive the grants must completely abolish all existence rubber trees and fruit trees as well, and if there any part of the land with fruit trees, the rubber replanting aid fund will cancel that part. Due to scatter fruit trees all over the plantation, they mush abolish both old rubber trees and fruit trees. It means that farming system change from traditional cultivation into modern plantation based on RRIT technology. These also resulted in the loss of a revenue and food that produced enough for home consumption. This is due to traditional farming system emphasize farming diversifications. Farmers would plant fruit trees mixed rubber, fruit trees such as; Stink bean, Djenkol bean fruit, and Durian, etc. There were food and additional income in a long year. When rubber do not tap, they were not much troublesome, because they would have fruits in the orchard that they can survive with. Therefore, to cut down all trees and fruit trees would discontinue farming diversifications which farm would have revenue during waiting for tapping season. Even though, they could plant intercrops during three year of immature

period after that other tree does not produce as expected due to growing constraints with rubber trees.

In facts, ORRAF realized the difficulty of losing income, food and farming diversification which led to an improvement for the conditions for demolishing rubber trees to do replanting. It was to allow farmers to keep their fruits orchard.

After 1990, with regarding to price decline, farming diversification and intercrop were promoted by ORRAF in order to increase additional income, food security and farm diversifications. Diversified farming system allowed them to produce more income and food for the household. Then, monoculture in expecting of high yield regardless of traditional of farm life that had existed for a long time affected farm life rather high and to loss of income and food security from demolishing their orchard.

The study also revealed that the replanting scheme played a major part to accelerate farms falling market economy of which growing rubber was for trade only. The farms faced with price fluctuation, high bargaining power of merchants, and imperfect of marketing system out of which had impacted both losses and profits for rubber farms. Rubber was mainly household income generation then amount of income depended on size of landholding. Especially, rubber price which rise and fall according to the demand of the world market. If the rubber prices fall drastically, the remunerative production did not occur and income will not be enough for household expenditure. When this happened too often it will reduce savings of households and lead to increase debt. There was rising socio-economic pressure leading to worth on technological use, improving productivity, mobility of labor into non-farm and vulnerable livelihoods.

Mechanization was increased after 1960. In Songkhla, tractors began to use for cleared land and land preparation in 1957, by the first used in large farms, and then spread to medium farms and small farms. For large farms, they may have their own tractor to be used in rubber planting. As for the medium size rubber plantation usually having 50 rais and more, they would hire tractor. Wage rates do not appear clearly, but cost was per rai. After the end 1967, tractor cost had increased to 450 baht per rai for cleared land and 30 baht per rai for land preparation (plowing). In 1987, cost of tractor was changed by hour wages and it was that way ever. For small farms, they may not have enough money to hire a tractor. Family labors were employed to do every task because the grants were not enough to hire a tractor for clearing and plowing land, which had taken time in each task. Cleared land is a hard work especially demolishing down trees using simple tools of axes. It takes a lot time to tear down trees in each rai. In some case, farms may have both exchange-labor and hire labor. Some case with enough money would hire workers to help, etc (Taanthai, 2002).

By some small farms, the use of tractors helped to accelerate their rubber planting because the grant was paid by installment plan of task. Each installment will be paid on the activities scheduled and completed such as; demolish old rubber trees, cleared land and land preparation to pay the first payment, etc. When selling of rubber wood fully expanded in the late 1990s, the use of tractors began widespread area. The buyer of rubber wood would proceed with machineries in wood thrusting, plowing, cutting trees and stem trimming. Rubber wood price was about 10,000 - 15,000 Baht per rai. The farmers had to do only preparation land for planting. Moreover, the replanting scheme began to introduce paid labor

into the farms. Especially, because of new technique of budded stumps or application of green budding in plant, paid labor who are expertise in technique still required to employ except the farm could be handled. This raises new type of labor use widespread in the village.

5.8) Development of rubber markets

After WW II, rubber market system was oligopolistic market to dominate by Chinese capitalist to achieve to build international trade and their network across Southeast Asia. Chinese capital investment was successful to build raw rubber processing factory in the Southern region by constructing monopoly network during 1947-1953. Indeed, the Chinese capitalist from Singapore under the Ton Kaki Co., Ltd. established many companies to invest rubber factory and estate across southern regions. They would collect all kinds of raw rubber with mixed grade and low quality. This is because some countries required only a certain level of quality rubber such as Japan and China, and also was easy pricing with low price. However, if the customers in the world market want quality rubber they can buy it from Malaysia (Songprasert, 1993). Therefore, marketing channel consisted of peddler merchants, merchants at the village, sub-districts, district, province and exporters where most processed rubber plant and exported rubber to overseas countries (RRIT, 2012). There were multistage of marketing channels. These merchants were included in network of a few big companies.

Chinese merchants' network was fully functioning because of the difficulty to access into market and rubber areas. There were many peddlers and merchants in the village which have the different marketing techniques to be effective. For such, the peddler merchants were accessible remote areas by bicycle and lever scales "Beam scale" suitable for buying and selling in the remote area. After the early 1980s, accessibility in rubber market has increased. The change from bicycles to motorcycles and from lever scale to weighting scale "Sitting scale" that has convenience in bringing to far places allowed peddlers to buy more rubber and further distances in remote areas. Peddler merchants remained to use only cash and therefore closely linked to the merchants in the village in term of credit and merchant networks. Peddlers and the merchants at the village or district included merchant networks into exporters or merchants at province. Then, marketing bargaining power was high by the merchants. Therefore around the early 1967 rubber farmers groups and cooperative are promoted that would able to increase bargaining power to the rubber farmers and to improve product quality. The rubber farmers received better price from sales, therefore, the farmers came together even more, in which affect the buying and selling of the merchant peddlers directly. The role of the merchant peddlers became less and less, and they had to go further to buy rubbers (RRIT, 2012).

Furthermore, the transportation became even better than before which gave more choice of market for the rubber farmers. There were some rubber farmers refused to sell their product to the merchant peddler and willing to use the local transportation in bringing their rubber to be sold at the city market. This routine became more and more, where the merchant peddlers had less and less role, making them insignificant, and in some area had to discontinue their operation around the early 1977, such as Ban Phru in Songkhla and Tamot in Pattalung. For the merchants in the village, they were affected by the organizing of the

rubber farmers groups after 1977. The role of the merchants in the village began to decrease, because the rubber farmers began to have interest in organizing groups for sheet rubber quality improvement. During this period, the merchant in the village can only buy rubber from farmers who were not member of the farmers groups, causing buying volume began to decrease steadily.

Some merchants has changed their role from buying of rubber sheet to buying latex instead and continued operation until now. For merchants in the city or province, they were still playing an important role in rubber trade. These merchants have stores for buying and selling rubber in the city or around the province. They will only trade rubber and will buy several kinds of raw rubber from farmers, merchant peddlers, merchant in the village, and sell it to exporters or factory.

In order to understand network of merchants and its impact, RRIT (2012) argued that the merchants in the city or provinces will buy rubber from merchant in the village, which would pay partly of total payment. They will bring the rubber to trade with factory/exporters and then they will pay the rest when return to the village. The process took not more than one week. Generally, the buying and selling of merchants would do their business with the familiar factory that led to create a good relationship between the merchants and factory/exporters. They have a loan with free interest rate from factory/exporters without any collateral. When the merchant brought rubber for sale, the return will be deducted from the advanced payment. Some merchant were very familiar and good relationship and they were highly credited as high as for the buying rubber. They will get special allowance of price but there must be at least 10,000 kilogram of raw rubber to be sold per day. Therefore, the merchants in city or province were an important middleman in pricing that determined price at the farm gate in daily. By the pricing, the merchants would use RSS# 3 price criteria that were being sold at the gate of factory/exporters and then deducted by marketing cost, their profit and the moisture percentage and impurities within the raw rubber by visual valuation. There was determination of price for un-smoked sheet rubber. If level of merchants increased, marketing cost and profits also increased accordingly. It means that price getting by the farmer was low. Purchasing price also depended on the competition among merchants and rubber quality. By the competition among merchants, there was not much or less competition as discussion above. There were high merchant network and relationship enabling integrates from merchants at the village to the exporters. This was characterized by oligopolistic market and then the buyers can set pricing with less competition.

For the quality of rubber being trade in this period, rubber mostly produced to be low quality. Merchants also preferred to buy mixed quality which was mostly classified into USS#3 or USS#4 according to the general quality of the rubber by eye tracking quality. The profits will increase after grade and smoked rubber. As a result, the farmers had lack incentives to improve the quality of their rubber, because no matter how much they try to improve the quality, it will eventually be graded as USS#3. In the mid-1990s, the rubber farmers began to change their product forms form the selling of un-smoked sheet rubber to selling latex instead. Merchant would have to encourage the farm selling latex by pricing a bit higher than rubber sheet that help to increase supply of latex into concentrated latex factory. However, the farmer still quite worry about the method to measure level of dry rubber

(%DRC) in latex and then calculate using percentage to evaluate dry rubber for pricing. This method caused fear of being cheated to the rubber farmer.

In the early 2010s, the measurement of %DRC verified and understanding how to buy and sell latex increased. There were a wide spread of buying and selling rubber latex. Farmers had more available time or reduction of working time about 2.0 hr per day, low fatigue in sheeting rubber, do not having building for rubber sheet or worry being its stolen. They were able to earn money from selling rubber latex as daily and do not have to wait for gathering rubber sheet as much as possible before selling which sometime takes as long as half a month. The selling rubber latex increased eventually it replaced selling of rubber sheet. Now, 90 percent of the rubber farmers in Songkhla was selling latex for local merchants, farmer groups, and ORRAF cooperatives (Somboonsuke et al., 2008).

The study found that the development of infrastructure to facilitate better transportation and communication including price announcement on radio help to improve marketing information and to increase more choices to access a particular marketing channel. After the mid-2000s, the government emphasized to increase more marketing actors and to develop marketing system but did not achieve as much as in this period due to the fact that the traditional marketing structure had network and highly monopolized.

5.9) Rubber production and export

During 1960-1980, 95 percent of total production was exported and about 5 percent was domestic consumption. The domestic consumption increased to 8.0 percent per year after 1990 and rose more than 10.0 percent after 2000. It is due to the growth of rubber product industry according to industrialization and motorization in the country (RRIT, 2012).

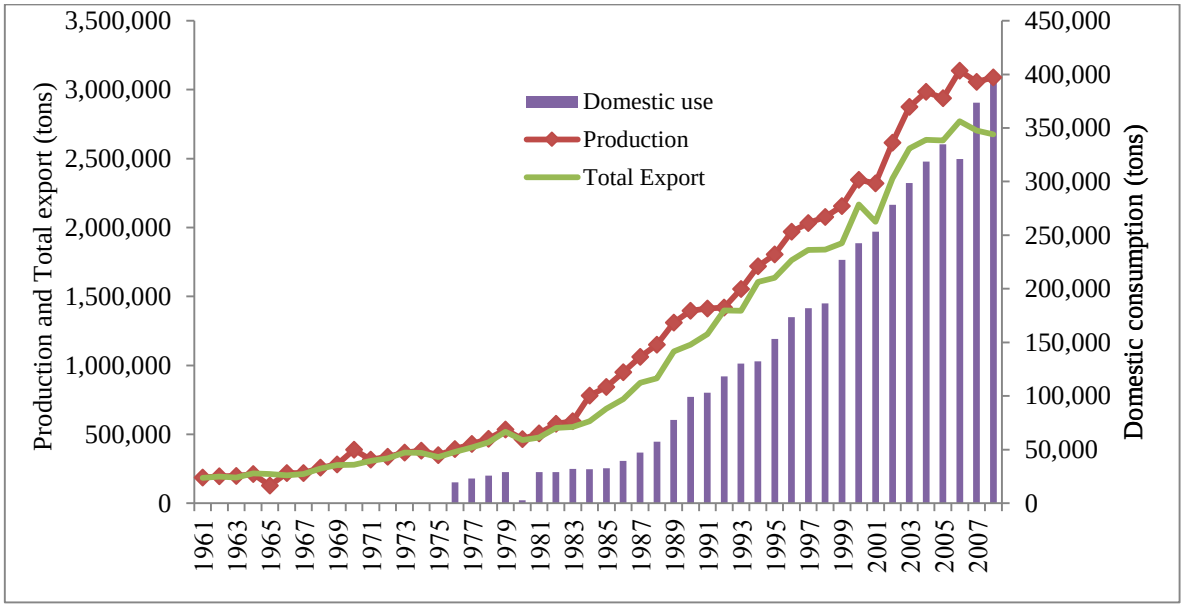

Figure 5-5 Total production, total export and domestic consumption during 1961-2011
Source: RRIT, 2013

As Figure 5-5, before 1980, total rubber productions were exported. The growth rate of export was 7.38 percent per year. This growth continued rapid increasing growth rate even

though the rubber price has declined in the late 1980s. The growth rate of export still grew continuously at annual average of 18 percent and slowdown during Thai economy crisis in 1997. This growth contrasted with the declining price in the country, reflected the full capacity of production and impact of productivity improvement. The growth rate of domestic consumption increased from 5.0 percent before 1980 to 8.0 percent in 1990, which was consistent with the economic growth and industrialization in the country. However, it seemed that rubber export policy was supported by the government continuingly along, after the economic crisis emerged, the export was stagnated in a short term. But the devalue of baht had benefit the growth of export at average 3.80 per year, which the export was peak to 2.60 million tons in 2001. However, the export structure was changed in terms of product structure and trading partners as Table 5-43.

Before1970, Thailand mainly exported smoked rubber sheet (RSS) and other products in a form of rubber crepe. In early 1970, the factory of a block rubber began to produce where technology was imported from Malaysia and it was the first year to export block rubber. In the mid-1990s, factory of concentrated latex started to produce in the south region that caused to latex export. The change in kinds of rubber products had been accordance with the world market demand and the progressive technology in the rubber manufacture. As result, the exported proportion of the smoked sheet rubber (RSS) has decreased from 82.26 percent in 1970, remained stable during the end-1990s and fell sharply in the early 2000s to 29.77 percent in 2008 (RRIT, 2010). In other hand, the exported proportion block rubber and con-latex have increased. The export of rubber block rapidly increased from 19.72 percent in 1980 to 37.32 in the year 2000, and continuously to increase to 42.32 percent in 2008. As well as, the exports of con-latex increased from 4.0 percent in 1990, to 13.14 percent in 2000 and rose to 19.04 percent in 2008. These proportions reflected the change in structure of rubber consumption in the world rubber market that further caused structural change of rubber production in the country.

Table 5-43 Proportion of exported rubber according to types of products during 1970-2008

Year	RSS (%)	TSR (%)	Con-Latex (%)	Other (%)
1970	82.26	0.11		17.63
1975	79.00	9.71		11.29
1980	75.22	19.72		5.06
1985	81.04	13.65	0.07	5.24
1990	81.51	11.86	4.01	2.62
1995	66.45	19.33	10.34	3.88
2000	46.45	37.32	13.14	3.09
2005	34.99	42.14	18.56	4.31
2008	29.77	42.32	19.04	8.87

Source; RRIT, 1970-2008

As well, structural change in export destinations (importers) was observed. Before the 1970s, Thailand export destination depended on the USA and Europe. Japan became the largest consumers of rubber from Thailand since the early 1970s and became the most important rubber consumer country for Thailand. During the middle of 1970s - 1980s, Japan imported 50.0 percent of all exported rubber from Thailand, in consistent with the rapid

growth of Japan economy and motorization. In 1975, Thailand started to trade with China which trade continuously increased from 5.7 percent of total export in 1975 to 14.4 percent in 1990 and 22.5 percent in 1995 respectively. Since 1995, China was the important consumers when proportion of export was above 20.0 percent of total rubber exports, which resulted in a less significant for the Japanese market as well as American and European markets.

In addition to this, the loss of market share in the U.S. and Europe was due to the growth of synthetic rubber to replace demand for natural rubber. After the World War II, the synthetic rubber industries especially by supporting the United Governments was able to lower production cost and to achieve economic of scale. As result, SR price was lower than NR price that was enabled to substitute a large share of natural rubber market even more. USA, Britain and France were likely to decrease NR consumption since 1960 – 1970, and it was one of the reasons for a severe decline of rubber prices in 1967 because the consumers turned to the use of synthetic rubber even more. In 1973, there was an oil crisis that oil price was increased up to 4 times as much as higher than normal which was the result from the Middle East wars. This had impacted on high production cost and increase of SR price, in turn the consumers turned to natural rubber once again (RRIT, 1987, 1990, 1994).

5.10) Primary processing rubber industries and exporters

The exporters and factory were companies that processed and exported rubber into the world market. Rubber generally is purchased from a large farm and merchants. Raw rubber is processed into RSS, STR, Crepe or concentrated latex according to the market need and specific quality by the users. There was a primary rubber processing industry. In the pricing, RSS#3 is used to be basis rubber for the pricing. Most of which were based on market prices in Japan, Singapore, and Malaysia deducting export expenses, export tax, and *Cess*, plus marketing cost, processing cost, and profit and then could determine the buying price for RSS#3. They also consider the future contracts and the expectation of market situations. In trading day or before, the merchants will check the price at the factories and the central rubber market. When a particular factory is selected, the rubber will bring to be sold. After weighing, factory's staff will estimate moisture content visually by using experience to deduct the weight moisture. Staff also randomly checked rubber quality that is graded by the merchants. In the case of RSS#3, factory's staff will check the quality of RSS by sampling. When determining of quality according to the merchants proclaimed then the price is determined on the delivering date. Importantly, the export tax and Cess that government charged from the exporter. These charges included to the deducting price tremendously and will transfer to the farmers. Then there was a price at delivery date by factory or exporter. The return will pay to the merchants on that day.

With regarding to oligopolistic market, three capitalist Singapore companies consisted of Tai Tong Co., Ltd., Siam Pak Tai Co., Ltd., and Thai Pak Tai Co., Ltd. and later these companies incorporated into Teck Bee Harng Co., Ltd. There was mono-rubber trade at least before 2002. After 1960, there was an increase of exporting companies according to the growth of export market. But market share is still concentrating relatively high within a few large exporting companies. In 1983, the registration of exported companies was 51 companies but only 5 large companies accounted share of 61.8 percent; Yang Thai Pak Tai

Co., Ltd. (formerly known as Teck Bee Harng Co., Ltd.) with the highest market share of 32 percent, and four lower range companies were namely Huainan Chuan Co., Ltd., Yang Para Teck Soon Co., Ltd., Thai Sub Rubber Export Co., Ltd., and Rubber Had Yai Co., Ltd., holding market share of 10.50, 7.85, 7.15 and 4.30 percent, respectively (RRC, 1970; Songprasert, 1993, 2005). This type of market share concentration of large companies still exists today. Our respondents stated that this market share was substantially changed after 2002 because Tech Bee Hang has suffered a drastic loss in 2000 due to failure in business management and price speculation.

Regarding policy for development of rubber market after 1992, rubber market has developed substantially through various measures such as modernizing marketing channel, establishment and strengthen of cooperative, increasing and balancing market information, and to cooperate with an international rubber market. Consequently, these policies led to restructuring market system by setting modernizing market channel, increased number of marketing actors, being more competition, and increasing accessibility to information. It is obviously that the government has increased to monitor and interventions in market closely. There were public investment to serve and facilitate the market, information enrichment, lower marketing cost for marketing actors, and creating market power for the farmers.

6. Self-reinforcement and Price boom between 2001 and 2012

Rubber policy appeared to be specific framework for rubber development since the establishment of "*Rubber Policy Committee*" in the 2nd of February 1993. The committee created "*the strategic rubber development plan for 1999 to 2003*" as a framework of policy and guide for rubber development. After finished this plan, Ministry of agriculture and cooperative has developed "*Plans for adjusting rubber structure and manufacture for 2006 to 2008*" but this plans couldn't be completed for political reasons. In 2009, Ministry of agriculture and cooperative has been presented "*Comprehensive rubber development strategy for2009 to 2013*" to Rubber Policy Committee. It was used as a framework for development of rubber industry. However, the government agencies have adapted several operations and objectives which had led to some conflict among them. The study found that national rubber plan hasn't been utilized much by the government since 1999. There were also many problems involved policy implications and cooperation such important as: there was lack of coherent among government agency, lack of cooperation, inflexible of implement, working based on Bureau structure and command, the lack of co-mission and no budgets, reflecting less committed by the government. Then the government agencies will be function in prevalence of scopes in responsibility and authority. These reasons had caused the policy to be unsuccessful. This implies that there was the lowest commitment and cooperation among many government agencies. Rubber Research Institute of Thailand, Office of Rubber Re-planting Aid Fund, Department of Agriculture Extension, Department of Agriculture, and Rubber Estate Organization were un-integrated in term of mission, cooperation, budgets and implementation that constrained to path of rubber development (RRIT, 2010).

Comprehensive rubber development strategy, 2009-2013

This plan was developed by the cooperation between several government agencies, private organizations, and several stakeholders in rubber economy. There were eight strategies as following:

1) to increase quality and productivity of rubber: this strategy aims to increase yield , improve quality and the use of appropriate technology at the farm level.

2) to develop rubber market at domestic and international market: this strategy emphasize to the faire price, stability of price, accessible new international market and to maintain competitiveness at the world supply chain and to increase proportion of the export of rubber goods.

3) to develop the rubber processing industry, manufacture and wood industry: this strategy aims to increase competitive of rubber industry, promoting manufactures, to increase domestic consumption, to promote high value add and to reduce the import of rubber goods.

4) to improve public administration and re-organization involving rubber under new structure of "Rubber of Thailand Act" and to enhance these administrative and management.

5) to emphasize international cooperation in Asian countries under AEC (Asian Economic Custom), which would enhance cooperation and policy of production, marketing and research and development among producing countries.

6) to support research and development by enhancing rubber research in specific conditions and situation of production, market and the different stakeholders in rubber industry and to integrate research of all the organizations.

7) to increase additional income and improving standard of living of rubber farms, emphasizing to create welfare systems for owners and laborers, and strengthen cooperative and farm's group.

8) to develop human resources in rubber industry by emphasizing farmers, tappers, researchers and technical staff in rubber industries.

The main objectives were:

1) to increase yield; rubber output will increase about 10 percent or the average yield will increase from 278 kg/rai/year in the year 2008 to 306 kg/rai/year in the year 2013.

2) to increase domestic consumption about 46 percent; the domestic use will increase from 397,495 tons per year in 2008to 580,000 tons per year in 2013.

3) to increase competitiveness of rubber industry of Thailand in international market and to increase values of export rubber products and woods from 178,935 million baht per year 2008 to 230,000 million baht per year 2013.

4) to increase farm household increase in the level of 15,000 baht/rai/year and will establish the carbon credit market enable to be additional income in the farms.

5) to establishment social welfare for rubber owners and tappers.

Annual plan of ORRAF and RRIT are derived by national plan which has integrated in term of implementation and budgets rather than in the past. However, the study found that several projects did not include in national strategic plan but it was emphasized by ORRAF and RRIT such as the extension of new plant in new areas, while some projects did not

implement or lack of implementation. It was reflected the gaps between national strategic plan and the real policy implementation. The study would therefore review a priority with the real policy implementations. The analysis found that which emphasized. During 2000 to 2013, the analysis found that the government has been a priority on increase of output, improvement of productivity, market development and promotion of rubber industrial products and manufacturing.

Main policies were implemented;

1) the policy for promote/support expansion of new plantings in the new rubber areas and the old areas
2) the policy for promoting the replanting scheme
3) the policy for market development and price support
4) the policy for promotion of the rubber industrial products and manufacturing

6.1) Policy for promoting expansion of new planting

6.1.1) The project of promoting new planting for new planters

In the late 2000s, rubber prices were stable due to the growth of the world demand and the economic recovery in global economy. Devaluation of baht probably helped to increase proportion of exportation steadily. By the strategic rubber plan in 1999-2006, because of a trend slow down in the price and price support less affected in the market price, the government proposes to maintain rubber land at the level of 12.0 million rai in 1999 to 2006 and the growth of total output in Thailand less than 4 percent per year. The policies would reduce the expansion of rubber in unsuitable area about 300,000 rai each year in which should promote to replant with oil palm about 60,000 rai per year. The replanting areas with high yield would increase from 150,000 rai to 300,000 rai per year. They propose reduce rubber output from 2.52 million ton to 2.46 million ton. This was able to increase yield from 255 kg per rai to 265 kg per ria. The project was proved by the Cabinet in 2000, but it was cancelled in 2003 when they agreed to launch project for the expansion of new planting again.

In 2003, the government established policy for promoting expansion of new plants in Northeast and North. The objectives are to increase income for the poor family, to create occupations, to increase farm employment and to bring back a better environment. This project was divided into two stages: the first stage was about 408,120 rai and continued to expand 200,000 rai, totally about 608,120 rai. The evaluation of project found that about 444,712 rai was planted by this project which was about 74 percent of the target. It was below the target in the beginning due to the fact that the farms had a lot of debts and hence terminated by the screen of Bank of Agriculture and Agricultural Cooperative. It was also due to the lack of knowledge in the farms which had led to be very insecure about the outcome by the farmers. Most of new plant in Northeast area before 2001 was part of this project.

In the second stage during 2007-2009, the target of new plant in Northeast was about 160,000 rai and 40,000 rai in the old areas. By the implementation of project, there were about 169,561.45 rai which was about 84.78 percent of the project, out of which comprise of 5.18%, 4.79% and 74.81% for south, east, and northeast region. The result of the promotion

had given the opportunity for a continuous expansion of rubber land indeed it was made encouragement to a large expansion by private investment.

6.1.2) The project of rubber for increasing income and farm sustainable in the new rubber areas

Regarding to the growth of the world economy presenting a potential shortage of rubber supply in 2009, Cabinet cancelled the strategic rubber development plan of 1999 to 2006. The government proposes to maintain competitive in rubber supply chain by expansion of rubber land and increasing rubber output. Underpin reasons was political reason to new attractive project. In the 26th of February in 2003, the Cabinet had authorized the policy for expansion of rubber in all the areas in Thailand and also agreed to launce "The project of rubber for increasing income and farm sustainable in the new rubber areas" by Ministry of agriculture and cooperative. The objectives are to increase farm income and farm sustainable in the new rubber areas (Northeast and North region). In the first stage between 2004 and 2006, the budget was 1,440 million baht to financial by the mutual fund of farmers. This budget used for material planting about 90 million trees (Table 5-44). The projects also will refund by *Cess* from the replanting scheme after the rubber plantation began to make a profit about 10 years. Cabinet agreed to authorize Bank of agriculture and cooperative to provide special fund about 5,360 million baht at a low interest rate for the farms to maintain their plantations. The project's targets area were 700,000 rai in 19 provinces in Northeast region and 300,000 rai in 12 provinces in North region (ORRAF, 2010).

Table 5-44 Targets of new plantings in Northeast and North according the projects

Region	2004	2005	2006	Total
Northeast (rai)	140,000	210,000	350,000	700,000
North (rai)	60,000	90,000	150,000	300,000

Source: ORRAF, 2011

Many government agencies were operated together. The key agencies was ORRAF had responsible to certify planting area, to handle planting materials, to follow-up the operations and to advice the farms. At the end of this project, there were 923,544 rai of rubber plantation which were amount to about 126,043 plots as Table 5-45 shows (RRIT,2009).

Table 5-45 New plant and number of farmers according to the project

	North-Eats		North		Total Area	
	Area (rai)	Number	Area (rai)	Number	Area (rai)	Number
2004	99,502	12,941	49,687	5,857	149,189	18,798
2005	286,568	41,361	48,659	5,696	335,227	47,057
2006	225,780	31,375	87,933	10,255	313,713	41,630
2007	96,740	14,376	27,278	3,947	124,018	18,323
2008	1,397	166	0	0	1,397	166
Total	709,987	100,219	213,557	25,755	923,544	125,974

Source: ORRAF, 2011

This project had the great expansion of new plantings in new areas by about 0.92 million rai combined with private investment. The project further had increased the substantially accelerated expansion of new planting after 2008. This project continued to promote new planting by cabinet authorization during 2011-2013. The objective was to promote rubber occupation and income of household income for new planters. This project was further expanded to all regions from 2011 to 2013. The target of new rubber area were 800,000 rai where should promote in suitable area with high yield. These areas were divided as the following: 150,000 rai in the North, 500,000 rai in the Northeast and 150,000 rai in the Central, Southern and Eastern regions. The budget was 569.1780 million baht in 2011 and increased to 1,053.8440 million baht in 2013. There were 25,933 farmers who had joined the project with an area of 565,000 rai of land in 2011. Due to budget constraints and rising questions on technological use at the farm including politic reason, the project has been retarded in 2013.

Price boom was important factors determining a rapid expansion of new planting. The price had been stable after 1995 at the average annual 27.73 baht per kg and steadily increased after 2000. Price rose 77.0 baht per kg in 2008 and fell in that year. It increased again in 2011 at the rate of 129 baht/kg before it decreased again in 2012 and 2013 at the rate of 80 to 90 baht/kg (RRIT, 2012). This indicated that price has gradually developed in a trend of price boom in 10 years. The result was that expansion of rubber areas had been operated continuously. The promotions of government project combined with high level of price were affected on a large expansion of rubber areas continuously. It was associated with the former planters to achieve in the level of income and a satisfying level of yield which had made to accelerate private investment.

Table 5-46 The new planting and the growth rate during 1991/1999 and 2000/2011

	1991-1999			
	Southern	East	North East	North
Total new planting 1991/1999	4,001,782	612,740	310,716	3,272
Annual average of new planting (rai)	500,222.8	30,107.4	39,185.0	467.4
Percentage of expansion (%)	6.9	13.3	70.0	242.3
	2000-2011			
Total new planting 2000/2010	1,804,621	1,064,847	3,079,512	861,518
Annual average of new planting (rai)	159,668.8	92,211.9	259,739.2	71,989.3
Percentage of expansion (%)	1.28	7.34	57.54	996.23

Source: RRIT, 2013

During 1991-2000, the growth rate of new plantings was about 7.8 percent/year. New planting in East region was at 13.3 percent /year and 6.9 percent in Southern region. In 1991, the Northeast region began to extent new plant that had rapidly expanded from 49,717 rai to 397,791 rai in year 2000. New plantings totaled 310,716 rai during 1991/99 which mostly belonged to the government projects. Expansion of new plantings in the north was very slow that increased from 258 rai in 1992 and ended with 5,884 rai in the year 2000 (RRIT, 2012). During 2000-2011, the growth of new planting in the north and northeast regions grew continuously. New planting was about 3.07 million rai in Northeast and 0.861 million rai in North. The old areas were diminished expansion of new plant at 1.80 million rai in South and

1.06 million rai in East as Table 5-46. The growth of new planting in the south region had a slowdown trend to compare with new areas as Figure 5-6 shows. Figure 5-6 also presents the evolution of rubber land in each of regions and Thailand during 1991-2012.

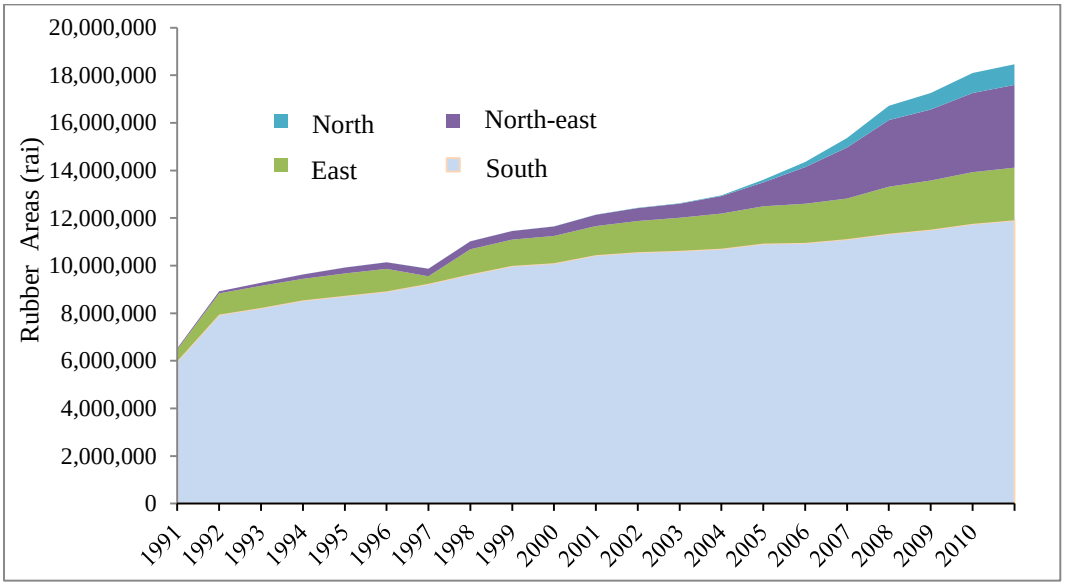

Figure 5-6 The evolution of rubber areas in Thailand and each region during 1991-2012
Source: RRIT, 2013

6.2) The replanting scheme

In turn to this period, the replanting scheme was performed based on "*The strategic rubber development plan of 1999 to 2006*" and *"Comprehensive rubber development strategy of 2009 to 2013"* that should consider an importance to replant with new high yield and the use of appropriate technology. By "*the strategic rubber development plan of 1999 to 2006"*, the annual rate of replanting was about 300,000 rai per year that would reduce the rubber land with diminished yield and high exploitations (ORRAF, 2011). However, high levels of price cause to retard the replanting time that led to reduction of the rate of replanting areas as Figure 5-7.

Figure 5-7 shows that the rapid replanting project during 1978-1989 has shifted the arte of replanting areas from below 150,000 rai per year in 1972/77 into above 272,000 rai per year during 1978/89 and thereafter fell to the annual average of 230,000 rai in 1990-2002. In 2003-2005, the replanting areas have increased to the annual average of 367,000 rai. This is the result of the conversion project. This project had the purpose to promote the replanting rubber where rubber planted in the reserved area or illegal areas. This project was made by the political reason in short run and raised the conflicts among government agencies. After 2006-2011, the annual average of the replanting areas had decreased to 236,000 rai/ year. By ORRAF plan in 2011, ORRAF have strong committed to increase productivity by enhancing the replanting with high yield and to promote the appropriate technology in the farms. ORRAF also concentrated on the promotion and support farms for reduction of production cost, increasing efficient of farm maintenances, quality of product, increasing additional

income, enhancing marketing function of cooperative and farm's groups, and environment in plantation. There were the main objectives of ORRAF by scope of the replanting scheme.

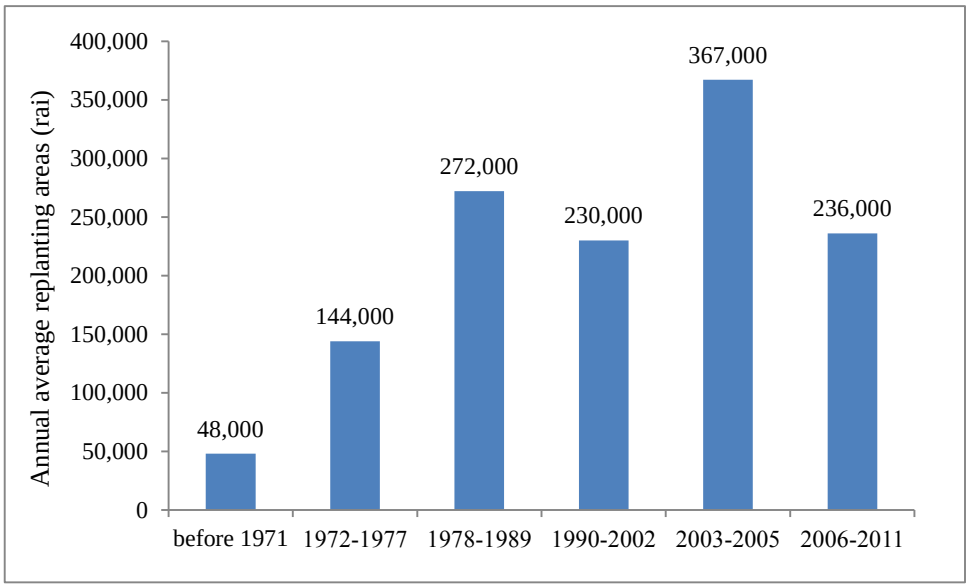

Figure 5-7 The rate of replanting areas according to the main periods of change
Source: ORRAF, 2013

In the master plan of ORRAF during 2012-2016, the main objectives were;

1) to replant rubber with high yield or cash crops at level of 255,000 rai per year
2) to promote expansion of rubber according the ORRAF Act (sub-Article 21) in the new areas about 600,000 rai.
3) to promote the use of new clone at least 50 percent of the total replanting areas in each year.
4) to promote the use of appropriate technology more than 80 percent of the total replanting area which could reduce the immature year to 6.0 year for the first tapping year.
5) to improve the replanting system by emphasis of ecological and environment in plantation and farm life through promoting intercrops, reduction of pesticide, the use of mix fertilizers (chemical and organic fertilizers) in every the replanting areas.

Importantly, the policy was made up of an important policy which emphasized to promote new clone based on RRIT's recommendations. It seems that a favorable clone of PRIM 600 would replace by RRIT251. Yield of RRIM 600 was the annual average of 297 kg/rai with the maximum rate of 349 kg/rai. RRIT recommended that the utilization of RRIT series, for such, RRIT 251 and RRIT 408 should increase to replace RRIM600. Yield of RRIT 251 was the annual average rate of 462 kg/rai with the maximum rate of 662 kg/rai. RRIT 251 appropriately planted in the old areas. RRIT 408 was promoted in the new area which yield was about 352 kg/rai with the maximum rate of 422 kg/rai. The promotion of RRIT series of clones would have to increase output by 10 percent without having to expand the rubber area. The study argued that the promotion of new clones was slowly due to the rubber owners believed that RRIM 600 was more suitable in conditions of the old areas and

resisted the local disease. RRIT also paid attention on control of clone quality and to promote the use of new clone (RRIT, 2009).

Table 5-47 Clone capacity in each of regions according to main types of clone in 2012

Unit: tree

Regions	RRIM600	RRIT251	PB235	BPM24	RRIT408	Total
South	12,361,070	2,572,613	200,410	103,000	311,900	15,548,993
Central	1,836,900	362,100	176			2,199,176
North	3,616,200	568,980				4,185,180
Northeast	11,113,662	1,844,206	2,190		140,000	13,100,058
East	10,524,500	5,064,500	956,000	191,000	43,000	16,779,000
Total	39,452,332	10,412,399	1,158,776	294,000	494,900	51,812,407

Source: RRIT, 2012

Table 5-47 can be interpreted that there was 76 percent of RRIM 600 and only 20 percent of RRIT 251 in 2012, reflected the popularity of RRIM 600 and accessibility of new clone. Therefore, the promotion of RRIT 251 was an important policy for improving productivity. The last survey in 2008 indicates that about 96.26 percent was planted by high yield. Low yield was about 508,470 rai of rubber areas which was about 3.74 percent of the total rubber area. These comprise of 350,305 rai of young rubber trees, 153,927 rai of mature rubber tree and 4,238 rai of old rubber trees as Table 5-48 (RRIT, 2012).

Table 5-48 High yield and low yield areas in 2008 by the survey of RRIT

	Immature (rai)	Mature (rai)	Senile(rai)	Total(rai)
High yield clone	6,459,181	6,572,788	51,911	13,083,880
Low yield clone	350,305	153,927	4,238	508,470
Total	6,809,486	6,726,715	56,149	13,592,350

Source: RRIT, 2012

Furthermore, the cooperation between RRIT and ORRAF strongly committed to promote the use of appropriate technologies as identified by "Comprehensive rubber development strategy of 2009-2013". They had set more practices at the farm to regulate technological use and farm maintenances as following (RRIT, 2010):

1) to support low cost of production: clone, fertilizers, chemicals and equipment tools for the farms and to control them as RRIT's quality or recommendation, and to promote the use of RRIT series in specific conditions of areas

2) to promote the use of appropriate technology at the farm level emphasizing tapping system, girt of tapping, application of fertilizers based on soil fertility and reinforcing fertility of soil by alternative methods

3) to enhance knowledge and training regarded to tapping skill by the target of 15,000 man per year

In facts, yield has substantially improved from the annual average of 169 kg per ria in 1991 to 291 kg per rai in 2004 and thereafter fell continuously to below 260 kg per rai in 2010 as figure 5-8. The southern region had the highest rate of yield, follow by the eastern region, northern and the last region was the northeastern region which was the lowest yield.

Diminished yield was observed in all regions that cause to promote the selection of new clone and technological use in the farm.

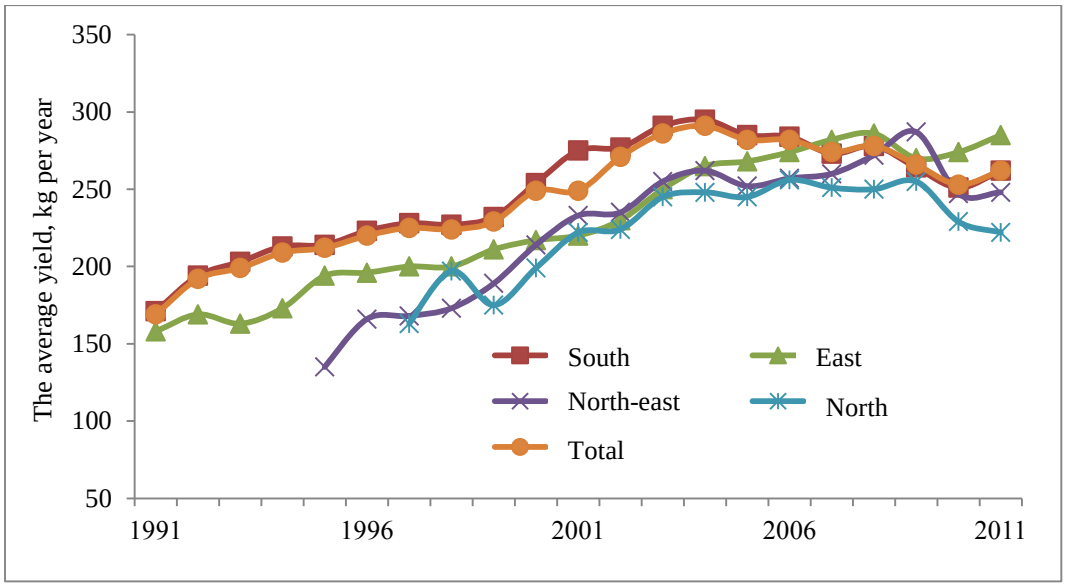

Figure 5-8 Yield and improvement of yield according to regions during 1991-2011
Source: OAE, 2013

6.3) Market development and price support

Price support had ended in 2002 due to the increasing price and continued a trend upward. Rubber market development remained an important policy, emphasizing the development of marketing system, modernizing marketing channel and strengthening market function in cooperative and farm's grou South ng price support during 2012-2013. The important developments of market were as following:

6.3.1) Development of central rubber markets

The impressive marketing policy in the last period was the establishment of Hatyai central market. The central market provided a significant change in modernizing marketing channel and auction price to reference local market and national market. Central rubber market also played important roles for balancing market information, setting new marketing channel, and to be tools for market intervention. Competition in market and the fair price increased considerably. The most of significant impact was the auction price by the central rubber market used the referencing price for the local market.

Furthermore, RRIT (2010) stated that the central market had profound effect on the farms and rubber production in term of quality and marketing channel. This was due to the fact that the farms had selected rubber quality to trade at the central market and also low grade to trade with the merchants in the local market as well. The farms tended to bargain both for the price and the quality by claiming the price of the central market. This had created the need for the merchants to adjust their prices based on quality of rubber. RRIT stated that it had caused the profit of traders to decrease up to 50 percent. The price of the USS and the

RSS#3 by the central market are standard price to be pricing at the local market and at the factories. Local merchants become the seller in the central market. They have been more available options of marketing channel rather than the regular channel of factories and the exporters. In this period, cooperative and farm's group was increasing marketing functions to compete with the local merchants. Marketing information also increased by the central market. Then, the fairness of price and trade of rubber increased accordingly. As the successful of Haadyai central market, the government continued to establish the central market in Suratthani and Nakhonsithamarat in the early 2000s. Also in 2009, the central market in Nongkhai and Buriram are set to have central market in the new rubber areas.

After 2002, the central market was modernized marketing channel with auction price which were made to change in structure of rubber market. There was trade and the exchange of products as real local market which was controlled and regulated by the law in acceptance by the buyer and the seller. The role of the central market had grown more important as time passed. This important was observed through the volume of trade in three central markets which had shown that the numbers of marketing actors and volume of rubber had been increasing every year. About 0.5 – 1.0 baht per kg of price which was higher than market price was attracted the sellers of the farms, traders, and cooperative (RRIT, 2009). Most of the buyers are factories, exporter and the large merchants in the provinces which mostly have auctioned a large volume in certain of rubber quality. In 2011, network of central market and electronic auction were developed that would have to link three central markets and local auction market together and could be to increase volume of rubber and number of marketing actors. There was a development in the trade of rubber for these three locations which were connected through an electronic system. This had given an opportunity for the marketing actors in the three locations to bid at the same time.

In order to enhance the roles of central market, the central market was developed supporting system and warehouse to store the rubber and also to create an information service system regarding the rubber market and price at nation and international level. For the development of warehouse, it is necessary to have a large capacity of warehouse based on international standard and other facilities that would able to benefit when price support applied. There was a project to promote the exportation by establishment of warehouse in four locations. Four warehouses were Hatyai central market at the amount of 17,2000 tons, the center of research and academy of crops and factors of production at Suratthani and Krabi, including Rubber Research Center in Chacheungsao at the amount of 16,000 tons for each center; which summed up to a total of 65,000 tons (RRIT, 2010). RRIT (2010) also emphasized on accessibility and update information into the public in order to increasing market information among the farms and marketing actor and their balances. The central market was center of market information by providing research, analysis, update information, and forecast in market situations and price. Addition to this, center of rubber information was established by RRIT in 2001.The objective was to provide information of production, rubber industries, market, and price. Technology of information system was set to facilitate their function by systems of "*Voice mail Exchange*", "*Electronic Mail System*" and Website of *www.rubberthai.com* that would able to increase accessibility and choices in information service and update.

In 2006, the network of central rubber market established in each or province whereas did not have central market, which was totaled 14 of market. These market played roles as local auction market using regulation of central rubber market. The propose was to increase volume of rubber, accessibility of the farms, and enabling reduction of transportation cost to bring rubber into central market. Importantly, the price in local auction market was the same as central market. These networks apparently linked local auction market and strengthening cooperative (RRIT, 2009).

Moreover, the future agricultural market of Thailand established in 2004. The objectives were to have new marketing tools and facilities for the farms, industries, and traders. This market was characterized to understand or forecast a trend of price and market situations and further decreased risks in market and price fluctuations. The types of rubber were traded RSS#3, STR#20 and concentrated latex. Even this market has less achieved in bid activities and did not compass a trend of price but it will have the important roles to guide market situation and price in the future. This market had set the rules for biding in advance, but Thailand did not take part in the biding of the world market, even though Thailand was the main producer of rubber. It was believed that Thailand would have a role in the future rubber market. Therefore, the government remained to develop central market that led to structural change in marketing system when multistage of merchants is replaced by new modernizing marketing channel as well as marketing information gradually developed and balanced among marketing actors that can be explained the result of high competition and the faire price.

6.3.2) Development of local rubber market

After 1997, ORRAF had been more involved in the development of rubber market. Development of market and farmer's institutions is one of the ORRAF's missions since 1997. ORRAF's market continued to develop local auction market, which we called "*ORRAF's market*" and account for strengthening marketing functions of cooperative and framer's groups (ORRAF, 2011). These markets were operated by ORRAF's officials in the respective order of ORRAF's office. Supporting staffs also have supported in operation of marketing function and to manage account of budgets in each market. Head of operation division in each of ORRAF office contributed to play role as market managers and ORRAF's staff also worked together with staff of local market. There was under the supervision of head of ORRAF' officers in each location. This included representative member of cooperative to be form "*The Committee of Local Auction Market*". There were many types of rubber to trade according to locations and the needs of market. In the beginning, there were only local auction market and later these markets had been developed to coincide with the production and the market needs. Four types of ORRAF's markets are as following (ORRAF, 2012);

1) Local auction market: this was the original local auction market since 1992. This market mostly located in cooperative or farm's groups where were facilitated in place and administration that was made convenient in collection and storage of product and low transportation cost. Farms who are member of market or cooperative will bring USS and cup-lump rubber for grade and weight by market's staff. The buyers will have to check quality and auction of price. Perhaps the price would also have to set a minimum price to

commence the bidding by the buyer that could reduce or protect buyer's collusion. The market's staff would inform the bidders to check products and in the end start the biding.

2) Paper Rubber Market (PRM): this market was developed from the local auction market to be more modern and easily accessible market of both cooperative or farm's groups and the buyers. The products would be certified to a certain level of quality so that the buyers did not have to check quality before purchasing them. The buyers could bid by phone or fax. They could also connect the biding through the electronic systems into network marketing of PRM. This market generally located at ORRAF office in each districts and provinces.

3) Pricing contract markets: this market was appropriate for the trading of latex. The price should be bided and contracted at least one day before delivery of products. Market's staff must be able to negotiate the price, volume and to prepare the payment for the farmers before their collecting products. Latex is collected into the place of collection where mostly located cooperative or farm's groups. Total volume by each of collecting place will report to ORRAF office. After that, they would deliver the order to the buyer according to volume of orders by ORRAF market. This market mostly located in the areas which latex forms is popularly produced such as in Songkhla and Satoon. In Songkla province, this market was applied to RSS#3 where was well known in ORRAF Rattaphoom district. Some of the markets had developed from PRM market which they have trouble in grading quality and weight. Rubber is collected by the cooperative or farm's group into ORRAF office. These products will be grading and weight by responsible staff. Price of the central rubber market was used as standard price for negotiate and pricing between the buyers and the farms.

4) Contract market: this is new development of ORRAF market in the line with future trading and export market. Cooperative and farm's groups were able to produce RSS#3 and ADS (Air Dry Sheet Rubber) in a certain need of market. The products have been premium quality, suitable packages and ship with the containers. Pricing is contract and negotiate between the representative farmers and the buyers. The farmers could also offer prices to the market manager by themselves as well. The manager would then take the offer in consideration and later on choose price in suitable conditions of the market. Once the order was delivered to the buyers, the committee of market is responsible for transfer of payment and it was paid to the farm members. It appears that the farms sold their products to the buyer directly and at the same time they were taken marketing function themselves to meet the needs of market and developed their own learning in the market. Regarding ORRAF staffs, they had the main task to regulate market contracts in order to maintain market rules by the farms and the buyers to follow. They also have managed all the important stages of receiving orders, negotiation, administration in production, delivery, transfer of payment. Today, the well known of this market is ORRAF markets in Maung Nakron si tammarat and TaSaLa. These are only markets to function on contract market.

During 2007-2011, 89 of local markets were established by ORRAF and partly derived by the needs of farmers. Volume of trade was about 308,016.507 tons in 2011 which increase by about 56.85 percent from 2010. The value of product was about 43,610.093 million baht. The annual average of price in these markets was higher about 1.0-2.0 baht per kg than the local market price. Price gap has increased during the period of price boom. The important impact is that the quality improvement and expertise in marketing function gradually developed. Moreover, 202 farm's groups are promoted by ORRAF to collect their

own latex and trade with the concentrated latex factories directly. The price at farm gate increased about 1.0 – 2.0 baht per kg. 30 of farm's group had set in 2010 as a total of 332 groups. Volume of trade was 26,422.313 tons with a value of 3,385.468 million baht in 2011. Then, the development of markets can be remarked by ORRAF market and a great expertise of marketing function in the farms. In 2011, volume of trade in these markets has increase from from 55,589 tons/year in 2004 to 117,976 tons/year in 2006 and rose to peak of 368,016.507 tons in 2011. It was 10 percent of national rubber production. It was presented the successful of ORRAF market and structural change of market at the farm level (ORRAF, 2012).

It is likely that ORRAF markets have been appropriate market channels in specific conditions and characteristics of the farms. It also enabled increasing marketing information and building confidence in the deals between producers and the buyers. The important success of this market is that price was higher than local market and raised the fairness of price. To compare with the price of the central market which was the reference of price in the market, especially in dealing with smoked rubber, the farms could have to get high price and low transportation cost. This is because the product is delivered order at the location of market or maybe it would deliver to the buyers with additional cost of transportation depended on kinds of products and types of orders dealing with them. In facts, the price of the central market of Hatyai is used as standard price for status quo pricing in ORRAF market. Generally, in case of USS (Un-smoked sheet rubber), the farms produced USS and sold their owned product for merchants in the local market.

In order to establish ORRAF market in such area, the farms are encouraged to establish farm's group or cooperative under ORRAF arrangement. They would have to produce a better quality of product and to collect a large volume of production. At the same time, ORRAF have supported training and knowledge in marketing function and how to deal with regulation of ORRAF market as well as to support facilitations such as machines and building, etc. There have been increase of value add and low marketing cost. Because of a large volume and quality of product, many buyers who are merchants, factories and exporters have preferred to auction in this market. Buyers would have low marketing cost for collecting a large volume of rubber and to reduce risk of price fluctuation. Another key success factor is the location of ORRAF market setting throughout intensive rubber areas where mostly located in Office of ORRAF at districts, provinces and operation unite including cooperative and farmer's groups. These market locations enabled to increase market accessibility, low marketing cost, and convenience to access services by farmers. With strong commitment to the buyers for quality and quality control, rubber is controlled in certain of quality and weight by the committee of market which composed of the farmers and ORRAF staff. The regulations of this market were agreed and made confident to the buyers. As well as, ORRAF staff also is key factor to raise market confidence or trust and was made to enhance marketing function. ORRAF office also helps to facilitate equipment such as the weighing machine, pallets, the forklifts and the warehouses which have been services to the farmers and the buyers, that might reduce marketing cost for them (ORRAF, 2009, 2011). As shown by Table 5-49, ORRAF continued to develop ORRAF market as ORRAF plan in 2012 – 2016. The main objectives were development of ORRAF market, increasing economic opportunities of market networks and information. This plan also emphasized on accessibility, balance and

update of marketing information that are useful for farm decisions in production and market to avoid and overcome the risks and uncertainty. In the current ORRAF plan, the existing ORRAF market remained to enhance marketing and production by ORRAF. ORRAF markets would enable to be formed market networks that could increase volume of trade and number of the marketing actors in each of market location. The further development was integrated these markets to be supply chain in rubber manufacturing and international market.

Table 5-49 Number of farm's group, ORRAF market, and targets of volume of trade according to ORRAF plan 2012-2016

	2012	2013	2014	2015	2016	Total
New farm's group (latex)	86	46	44	45	43	264
Total farm's group	232	318	364	408	453	453
ORRAF's market	108	108	108	108	108	108
Target volume of trade (kg)	340,000	357,000	374,900	393,700	413,400	1,879,000

Source: ORRAF, 2011

6.3.3) Price support under the project for the development of farmer institutes and stabilization of rubber price

As consequences in recession of the global economy, price boom had finished in the early 2011and started a trend of slowdown after the end 2011. It was associated with rising pressure by farmer interest to the government. "*The Committee of Rubber Policy*" agreed to policy for reducing rubber supply into market that would able to stabilize price at remunerative level. A council of "*International Triparties Rubber Council*" also agreed that each rubber producing countries should cooperate to reduce supply of rubber through pause of tapping, increasing replanting areas, retard of trade, and increasing stock into government stock that could stimulate to increase the price and to reduce speculation in the rubber market. Thus, the government implemented policy for price support, which called *"project for the development of farmer institutes and stabilization of rubber price"*. The objectives were to stabilize rubber price by reduction of supply into government stock and to support loan for cooperative to purchase rubber from their members and then sold its to RES with price support. A government would support special loan to cooperative and farmer's group to purchase the rubber from their members. Then cooperative will process into USS#3 or RSS#3s and sell those of rubbers to RES (ORRAF, 2013).

Due to about 800 of farm institutes setting in various forms of cooperative, farm's group and community enterprise, there were familiar with marketing intervention and to dominate marketing function at the farm level. The government would implement price support and stock through farmers' institutes which can stock up to 100,000 tons. Farmer's institutes will buy rubber from their members at the price support of about 100.0 baht per kg and keep in the stock of them, RES and enterprise warehouses. This project would have to increase marketing price to expectation of 120 baht per kg. The operation began from January 2012 to March 2013. The total amount of budget was about 15,000 million baht, which divide by 5,000 million baht for farmer's institutes and 10,000 million for RES. The loan was guaranteed by using value of rubber stock at about 80-100 percent of the price range 120-96 baht per kg. This loan was securitized by Bank of Agriculture and Cooperative.

The main government agencies cooperated to administrate this project were ORRAF, RRIT, Department of Agriculture Extension, Department of Cooperative Promote, Bank of agriculture and cooperative, and Farmer's institutes, etc.

Price support was derived by the price of central market plus with additional price. This meant that price in the project was higher than marketing price that would stimulate a leading price in the market. This support price is used to purchase rubber in every province since the 18th of July 2012 onward as shown on Table 5-50. In the first stage, the loan paid for purchasing rubber with 15,000 million baht, which would able to reduce supply of rubber as much as possible. The study found the support price was higher than the average price at local market in Songkhla by about 10 to 15 baht during 2012. The support price was maintained even price in local market fallen steadily. The gap between the support price and market price was still ranged about 10 to 20 baht / kg in 2013 that adversely created serious problems in quality control, purchasing, stock and properties of the farmers which had not met the requirement. This is due to the difficulty of administration and lack of statistics in production capacity and their members in each rubber institutes that had serious complain by the farmers and that of corruption.

From Jun. 2012- Jan. 2013, the project has been purchased rubber into stock about 196,728,441 tons from 862 farmer's institutes. Some witness stated that only 30 percent of stock has purchased from farmer's institutes and the rest relied on suspecting corruption or from local market. This price support helped to increase farm income for about 300,000 farmers from total about 1.0 million farmers. The government claimed that this project helped to increase farm income about 3,900 million baht and also tried to resolve the problem on subrogation and insufficient warehouses (RRIT, 2013). Furthermore, three major producing countries i.e. Thailand, Malaysia and Indonesia, agreed that each country should give attention for increasing domestic stock and reduction of export into the world market. This had affected on the FOB price to maintain at 85 to 100 baht/kg.

Table 5-50 Price supports and the average price at local market during 2012-2013

Price	Price support (baht/kg)	Price at local market Jun-Dec 2012 (baht/kg)	Price at local market Jan 2013 (baht/kg)
USS#3	100	91.11	85.45
RSS#3	104	96.97	89.76
RSS#3 block	106	-	-
Cup Lump 100%	92	86.43	81.25
Crepe 100%	92	-	-
Latex	-	89.76	81.73

Source: ORRAF, 2013

In the 28th of August 2012, "*The Committee of Rubber Policy*" had requested 15,000 million baht for continuing this project. Cabinets had ordered to revise their request again. After the revision, the request was handed in again on the 18th of September 2012. Cabinets had authorized 30,000 million baht to purchase rubber about 300,000 tons. The amount of budget given to the commission in the first six months was 5,000 million baht, staring the 1st of October 2012 to 31st of March 2013. The commission could withdraw only 5,000 million baht each time to purchase about 50,000 tons at 100baht/kg of USS#3 and at 104 baht/kg of

RSS#3. The second sum was another 5,000 million baht. Government ordered that the provincial governors might supervise every stage carefully. They had to acknowledge the farmers that there were no fees to be paid in this project. This was to avoid corruption of the officers and to manage the project a certain standard. There were some adjustments and additions of the procedures applying for efficiency in project administrative. Indeed, the government has required the registration of volume and number of farms in each of farmer's institutes. The farmers must registry to sell their products in limit of total rubber land less than 25 rai per farms, total product less than of 2.0 kg per day and tapping day of 17 day per month. In order to measure budgets and to strictly supervise administration, farmer's institutes should present list of farmers, farm details, and a detail account with administrations of institutes such important as the list of production, payment, new farms, expansion of production, and purchasing list. These reports should present in every time of deal with RES. This report must be handed in every 15 days to the provincial offices and on the 1st of each month, these reports must be sent to the ministry. If some farmer's institutes did not comply with the rules, they would be excluded from the project (ORRAF, 2013).

In the early 2013, this project has burden to manage government's warehouse that led to find addition from enterprise warehouse. There were private companies that have serviced warehouses for the storage of the rubber. The project presented that about 170,000 tons was kept by enterprise warehouse since January 2013 to the 31st of March 2013. For example, one of the companies was Siam Commercial Seaportin, Tambon Aoudom, Siracha, Chonburi province. The area of the warehouse was 6,600 meter square and the rent was at 120 baht / meter square. The second company was KK Kasedphan Limited in Amphur Banmoor, Saraburi Province. The area of the warehouse was 15,000 meter square at 120 baht/meter square. The third company was SCC Wire & Cable. The area of the warehouse was 6,000 meter square at 120 baht/meter square. It seems that the need of warehouse was increasing to cover a large volume of rubber which was increasing. This raised another serious constraint in stock management and administration burden (RRIT, 2013).

Moreover, this project stated that the only 11.0 million rai has been registration under ORRAF, where rubber area was totally 18.0 million ria, reflected many rubber owner to plant without registration. So the government then ordered all of rubber farms to registry belong to Rubber Control Act. This project has been reluctant in massive implication and has raised constraints and difficulty to manage project such as the over stock, lack of warehouses, limit cash flow of cooperative and too much debt to payback the farms. The latest problem was about the loan of 15,000 million baht already spent on purchasing the rubber products. The factories and the cooperative have temporally stopped to purchase rubber into stock of project. Then, it appears that this project causes to market panic and not working as function of market. The market price was lower than price support of the project by about 10-20 baht per kg. The gap of price strongly encouraged the farm to participate this project and sold their product to farmer's institutes. Due to limit of loan and poor administration, many farmers' institutes did not completely receive the payment that caused an immense problem about cash flow. Price in this project did not enable to increase market price. Market price steadily declined to below 90.0 baht per kg in same a trend declining price in the world market.

It confirmed that this project was stabilized farm income in short run and did not affect on market price. Only about 10 percent of total rubber was purchased with price

support. As well as, the reduction of export about 10.0 percent of total export remained to pressure exporters and tended to deteriorate local market and price. This project ended on the 31st of March and the government will not continue this project any further. The government would use other measures to deal with declining price and its fluctuation.

6.3.4) International Rubber Consortium Limited

Since 1992, the major rubber producers began to have idea establishment of cooperation among the major rubber producing countries. The major producing countries (Thailand, Malaysia and Indonesia) that produce and export about 70 percent of the world market agreed on creating a new rubber company between Thai, Malaysian and Indonesian governments. This company was call, *"International Rubber Consortium Limited (IRCo)"*. This company was international cooperation on the form of consortium that would have to administrative and to cooperate in price and rubber market among major procurers. The main purposes are to stabilize rubber price in at the fair price and remunerative producers and also focus on to analysis price and market situation in nation and international market. If price has declined, the IRCo would intervene instantly to solve that of crisis. All three countries were shareholder of this company since the 28th of April 2004 with a register fee of 12 million US dollars. These shares comprise of 5.33 million dollars of Thailand, 4.00 million dollars of Indonesia and 2.67 million dollars of Malaysia (RRIT, 2009). The IRCo have procedures to deal with price and market situation as following:

1) Supply Management Scheme (SMS): this is a long-term measure. This scheme concerns on promoting and supporting extension of rubber in each of country in order to comply with the demand of the world market.

2) Agreed Export tonnage Scheme (AETS): this is a short-term measure within a year. There is control of export based on exportable percent in each of three countries. Government should control level of export by quota of exportation and domestic stock including it should have appropriate regulation, law or measurement accordingly.

3) Strategic Market Operations (SMO): this operation involves intervention of market by IRCo stock in order to stabilize price and reduction of supply in the market. This was able to resolve crisis of the rubber price but this operation did not apply after 2004

The important operation under IRCo is that plan of expansions of rubber plan in 2020 was introduced and recommended to three producers plantation. They also evaluated and forecasted expansion of rubber, production, and consumption to compare with their supply management scheme. IRCO and ITRC agreed to apply the scheme of AETS in 2011. The propose was to reduce exportation of all three countries by 700,000 tons. Furthermore, they had agreed to fix FOB price above 1.35 dollars/kg even through any measure never apply. In the latest meeting, they were also planning to set up "rubber price stabilization funds" that will apply to perform the scheme of AETS and SMS and to invite Vietnam (4th producer of rubber products) (RRIT, 2013). However, the study found that the achievement of IRCo was not so clear and had a little effect on the rubber market even the last cooperation did not follow by three members.

Accordingly, in the 29th of August 2012, the three major producers (Thailand, Malaysia and Indonesia) agreed to limit volume of export and reduction of supply belongs to

the rules of AETS under agreement of "International Rubber Consortium Limited". They agree to reduce export about 300,000 tons and replanting rate of 100,000 hectors, which would decrease the production further at 150,000 tons. All together of reduction supply was totally 450,000 tons in each of country. However, due to less commitment and reluctant to implement among these countries, these agreements did not effect on the price. It seems that the International Rubber Consortium Limited did not function in a position of its agreement.

6.3.5) Development and promotion of farmers' institutes

This is one of the main policies that governments continued to support implementation and strongly committed by ORRAF and DAE. The purpose was to promote and to support farmers' institutes in various forms such as cooperative, community enterprise, farm's groups, social ware of tapper and owners, and farmer association, etc (ORRAF, 2011). After 1988, the development of farmers' institutes was one of the main objectives by ORRAF plan. ORRAF plan emphasizes to support the establishment of farmer institutes, to develop their functions in production and market, and links them into networks of farmers' institutes. These would have to increase business performance and management in production, processing and market including increase of bargaining power. It also promoted young labor becoming to be farmers. By plan of ORRAF, firstly, ORRAF remained to promote to increase number of farmers' institutions in various forms such important as cooperatives, farmers' groups, Federal of rubber farms, and Federal of cooperatives and other community enterprise. The second stage emphasized to enhance and strengthen their business, administrative and management on production, processing, and market. These farmers' institutes were required training and knowledge by ORRAF or DEA. It is obviously that ORRAF have been successful for promoting the establishment of farmer institutes in various forms and also to strengthen their performances which resulted of the improvement of productivity and quality of product and increased bargaining power in market (ORRAF, 2011).

Table 5-51 Number of farmers' institutes during 1992-2011

	Farm's trainee	Cooperatives	Farmer groups
Before 1992	100,854	-	-
1992-1996	110,194	-	-
1997-2001	110,566	950	
2002-2006	126,740	997	
2007-2011	150,243	815	1,787

Source: ORRAF, 2012

In Table 5-51, ORRAF had encouraged farmers under the replanting scheme to establish farmer institutes since 1997 and continued to increase in term of number of famer s' institutes in 2006. But some of them had ended which depend on constraints, farm conditions and their learning themselves. Some new ones were formed and some had disappeared. Until 2011, only 481 of cooperatives and 1,529 of farm's groups left as a total of 2,010 groups that remained active their functions. In ORRAF plan, there were plans to set up more number of farms' group which will target at 2,000 groups per year. These groups could register as a

cooperative or farm's groups by about 10 groups per year. In 2011, the result of ORRAF plan shows that about 150,243 of the farmers are trained by ORRAF which would have to increase new knowledge and technology including rising tapping skill and standard practices in quality production. More than 815 of cooperatives and 1,787 of farm's groups are established and developed continuously by ORRAF (ORRAF, 2012).

Furthermore, ORRAF still implemented programs to improve the knowledge and training tapping skills such as the project to enrich rubber plantation and training of tapping skill, Rubber teachers, Center of rubber learning community and pilot rubber factory (ORRAF, 2012). These projects needed to create stability and security in rubber production and livelihoods and further to develop cooperatives in consistent with the different farm conditions and diversifications to unite rubber farmers as well.

6.4 Promotion of rubber manufacturing and rubber industries

Rubber development industry policy was apparently cleared since 1993. The government realized the important of value added rubber, rubber manufacturing, exported rubber goods with high value add and increasing domestic consumption but this policy has been reluctant in massive implementation until the last plan of 2009-2013. The main idea to create this policy is that the development of rubber industry provides a mean to increase value add of rubber for export, to reduce supply of raw rubber in the world market and to increase domestic consumption. This leads to increase competitiveness of Thailand in rubber industry rather than only raw rubber producers in the world supply chain. There were the promotion of rubber manufacture and export of rubber goods.

In 2001, the government had clear ideas to develop rubber industry by utilizing a plan called *"Master plan of rubber industry development 2002 to 2006"*. There was no such plan in the past and then Office of industry has established this plan for promoting rubber industry and used as master plan for development of rubber industry. Once again, this plan did not implement due to no budget and lack of coherent among government agencies. In facts, rubber industry has expanded continuously in consistent with the growth of overall industry and motorization in the country. This growth was mainly driven by foreign direct investment and tax policy. There were 524 factories out of which 90 percent were medium and small companies. Rubber industry could be divided into four groups: vehicle tire, rubber industrial parts (car parts and engineer part), latex goods (gloves and condom), and other products (shoe sole, rubber band, and tubes etc). In 2001, vehicle tire had utilized about 120,000 ton of raw rubber that had exported value of 15,000 million baht or 32.0 percent of total export of rubber industry. Latex industry had consumed about 63,000 tons of raw rubber but it had a higher exportation value which was 21,600 million baht or 44.5 percent of total export of rubber industry. Other products had exported value of 100 to 1,000 million baht only (RRIT, 2006).

The study found that manufacture and export company have dominated by foreign companies which were direct investment or joint-venture in Thailand. In tire industry, about 71.0 percent of export was accounted to multinational big three companies: Bridgestone, Michelin and Goodyear. These companies also were main supplier of tire for automotive industry. Another company which was owned by Thai and medium size of factory constituted only 15 percent of exported value (RRIT, 2012).

Tire industry depended on automotive industry, which the demand for new car stipulated to demand for tire and rubber parts. Due to motorization in the country, these industries grew gradually in the last period and already linked to automotive industry. There were high competitive industry with regarding to multinational companies and their owned high technology and capital. Then, policy was emphasized to strengthen tire industries and to promote new direct investment by multinational companies according to the growth of automotive industry. Thai companies which still constrained progressive technology and capital were needed to support research and development, capital investment, and to open export market in specific markets. Generally, Thailand still had to develop on its technology and staffs' ability. There was still a problem on lack of investment by the small and medium size companies. The data roughly indicated that rubber industry in Thailand depended on foreign investment that strongly drive by automotive industry and the world supply chain.

Due to the fact that Thailand was the largest producing latex rubber once comparing with other countries, the policy gave more importance to the latex industry. Latex industry was still growing such as gloves, condom, and elastic bands. Regarding glove industries, about 50-60 percent of the exported value accounted by foreign investment or multinational companies and the joint venture companies by about 30-40 percent of the exported value. There was only 5 percent of exported value from the Thai companies. The growth of gloves industry was about 10-20 percent per year. In condom industries, foreign companies have dominated at 88 percent and another 22 percent from the joint venture companies. Elastic band industry grew about 8.0 percent per year.

Due to lack of development in the past, this sector faced with many constraints and restrictions such important as lack of investment, low progress of technology, shortage of quality employee and lack of research and development. These situations are recognized for rapid development by policy and special program in order to be able competition in international market. There was a new path of rubber development and high potential income generation by exported value. Other problems were needed to resolve immediately that industrial standard for the products, management, safety and environment should identify and verify accordingly by authority of government agency. There was only RRIT which have widely authority from the farms to rubber manufacture. RRIT also have limited number of researchers and budgets; therefore there should be to establish a responsible department for the development of rubber industry. This department will support research and development and promote rubber industry to pursue efficiency and competitive of rubber industry in global market (RRIT, 1999; OIE, 2002).

Therefore, master plan of rubber industry development 2002 to 2006 pursued to establish an organization to be responsible for the development of rubber industry, to promote small and medium enterprise, and to develop latex industry to become the main rubber industry of Thailand. This also would increase domestic consumption by 10 percent per year and increase the exported value of 10 percent per year as well. However, the evaluation of this plan found that the plan did not implement due to the lack of funds from the government, lack of coherent among government agencies and a lack of communication in promoting this plan (OIE, 2002).

In order to rapidly increase competitiveness and growth of rubber industry, the government emphasized policy for promoting foreign investment and joint venture,

especially direct foreign investment of multinational companies. There were expansions of rubber manufactures and their investments which could have more benefits from supply of rubber, linkage to other industries, and program of promoting investments offering by government. It is also seen that multinational companies with high technology would have to transfer technology in the country so that small and medium companies could learn new technology and to accelerate rubber development as well (RRIT, 2010).

By the "Comprehensive rubber development strategy of 2009-2013", the government has promoted the growth of rubber industry through tax policy and investment promotion program. There were the promotion of foreign investment and the development of Thai enterprise. The main objectives were to increase domestic consumption about 17.0 percent, to increase competitive enterprise and to expand the exported value about 30.0 percent on the basis of 2008. Moreover, this plan aims to promote research and development, to set rubber standard of Thailand, and to develop efficient of rubber manufactures including to reduce the import of rubber products. With regarding to growth of rubber wood industry in the last period, this plan also began to promote rubber wood industry in consistent with to raising supply of rubber woods, exported value and the growth of demand for rubber woods.

In 2011, office of industrial economics and the relevant departments were made *"Master plan for development of rubber industry and rubber woods"*. The purpose was to promote foreign direct investment in industrial rubber and rubber woods, to strengthen Thai enterprise, and to develop research and development for setting Thailand rubber industrial standard. This plan would rise the important of industrial rubber and rubber woods and enable to enhance competitiveness of rubber industry in international market. On the 1st of March 2011, Cabinet agreed to establish *"Industrial rubber and rubber woods development institute"*. This institute was authorized by master plan for development of rubber industry and rubber woods. This institute have play role to develop research and development, to transfer technology and innovation into enterprise, and to support creative value add in rubber and rubber woods. This was impressive development to set authority organization that would achieve to rapid growth of industrial rubber and their high competitiveness (OIE, 2011).

By the strategic rubber development plan 2009-2013, RRIT still organized and implemented "*Plan of industrial rubber and rubber woods development*". There were research and development relying on new technology, human resource development, capacity and efficient of laboratory and improving database. This plan have amount of budgets 405 million baht within 5 year. There was a concrete implementation driven the development of rubber industry and seem to have strong commitment by the government.

The analysis reveals that the foreign direction investment was a key policy for rubber industrial development, which was strong incentive of investment by tax policy and promoting investment program of BOI (The Board of Investment of Thailand). This policy has less concerned to develop small and medium Thai enterprise regarded to lack of technology and small capital. The policy had given more importance to the foreign companies more than supporting the Thai enterprise. After 2005, the projects that declare to invest in rubber manufacture has rapidly increased in terms of number of project, capital of investment and employment as Table 5-52 (BOI, 2012).

Table 5-52 New foreign investments of rubber industrial products belong to BOI programme during 2007-2011

Year	Project	Investments (million baht)	Employment (people)
2007	6	1,288.70	503
2008	15	2,584.90	1,112
2009	18	3,027.40	1,503
2010	21	7,725.30	3,004
2011	21	6,834.40	3,188

Source: BOI, 2012

Consequently, Thailand has been successful to promote the growth of domestic consumption in this period regarding to policy for promoting rubber manufacturing, industrialization and motorization. The study found that the domestic consumption has substantially increased from 18,202 tons which was 8.95 percent of total rubber in 1997 to 468,745 tons which was 13.64 percent of total rubber in 2011. The annual average of domestic consumption was about 11.12 percent per year but it was still lower than the set target which was 20 percent as Table 5-53. However, this consumption has doubled in 2000/2010 and was comparable level of domestic consumption by Malaysia and Indonesia (RRIT, 2012).

Table 5-53 Domestic consumption according to types of rubber products during 1999-2011

Unit: tons

Year	RSS	STR	Con-Latex	ADS rubber	Crepe	Blended Rubber	Others	Total
1999	60,960	77,699	71,454	11,021	2,245	-	3,538	226,917
2000	55,041	88,223	81,183	6,707	1,316	-	10,079	242,549
2001	61,083	96,309	75,047	10,720	3,190	-	6,756	253,105
2002	68,828	107,024	77,888	11,363	3,381	-	9,871	278,355
2003	73,573	115,352	82,742	12,270	3,578	-	11,184	298,699
2004	78,500	123,067	88,263	13,029	3,157	-	12,633	318,649
2005	82,425	129,224	92,676	13,681	3,383	-	13,260	334,649
2006	70,276	104,168	131,974	7,840	1,258	-	5,369	320,885
2007	96,308	116,292	149,659	3,372	1,012	-	7,016	373,659
2008	162,225	135,029	81,788	1,660	5,978	1,454	9,461	397,595
2009	119,450	107,315	100,262	4,998	1,290	62,455	3,645	399,415
2010	119,693	140,759	115,205	4,142	372	74,708	3,758	458,637
2011	109,337	147,683	159,958	532	1,453	63,092	4,690	486,745

Source: RRIT, 2013

Table 5-53 shows that STR was main rubber used by domestic consumption. Share of STR was about 35 percent, following by con-latex and RSS. After 2006, the usage of STR had decreased and then it increased again in 2011. At the same time, share of RSS decreased to replace by share of STR. Share of con-latex decreased from 31.49 percent in 1999 to 27.69 percent in 2005 and thereafter tended to increase proportion with unstable rate which was about 32.86 percent of total domestic use in 2011. It seemed that the pattern of domestic consumption coincided with the world market and the structure of primary rubber industry. In 2011, the study found that share of rubber was characterized by the growth of rubber manufacturing leading by tire industry. Tire industry was the largest consumers which was

about 60.2 percent of total domestic consumption. The growth of tire industry was at average of 10.1 percent per year. This industry mainly used STR and RSS#3. Glove industry consumed 13.8 percent in consistent with the growth rate of 7.1 percent per year. There was a rapid growth in the condom industry as well, which only consumption of condom industry has increased from 281 tons in 2008 to 9,353 tons in 2011. It was increased about eight times of the original amount. Rubber band industry also consumed 13.6 percent of total consumption with the growth rate of 5.5 percent per year. Other rubber products were at 12.4 percent (Table 5-53).

Table 5-54 Domestic consumption of rubber according to main industrial rubber products during 2005-2011 Unit: tons

Year	Tires	Gloves	Rubber stick	Motor tires	Rubber band	Others	Total
2005	139,790	57,658	43,752	24,526	25,412	43,511	334,649
2006	137,153	52,312	68,179	21,577	16,382	25,282	320,885
2007	170,893	54,808	72,193	29,589	17,232	28,944	373,659
2008	208,886	52,436	54,108	29,614	21,657	30,894	397,595
2009	233,257	42,635	50,107	22,787	23,806	26,823	399,415
2010	290,982	49,663	46,064	24,262	13,101	34,565	458,637
2011	292,963	67,413	66,054	20,858	10,954	28,503	486,745

Source: RRIT, 2013

Table 5-54 shows that tire industry has been a large share in domestic consumption which has doubled from 139,790 ton in 2005 to 292,963 tons in 2011. The share of tire in domestic consumption has increased from 41.8 percent in 2005 to 60.2 percent in 2011. Glove was the second share in domestic consumption which steadily grew from 57, 658 tons in 2008 to 67,413 tons in 2011 with the annual average of growth 13.0 percent (RRIT, 2013).

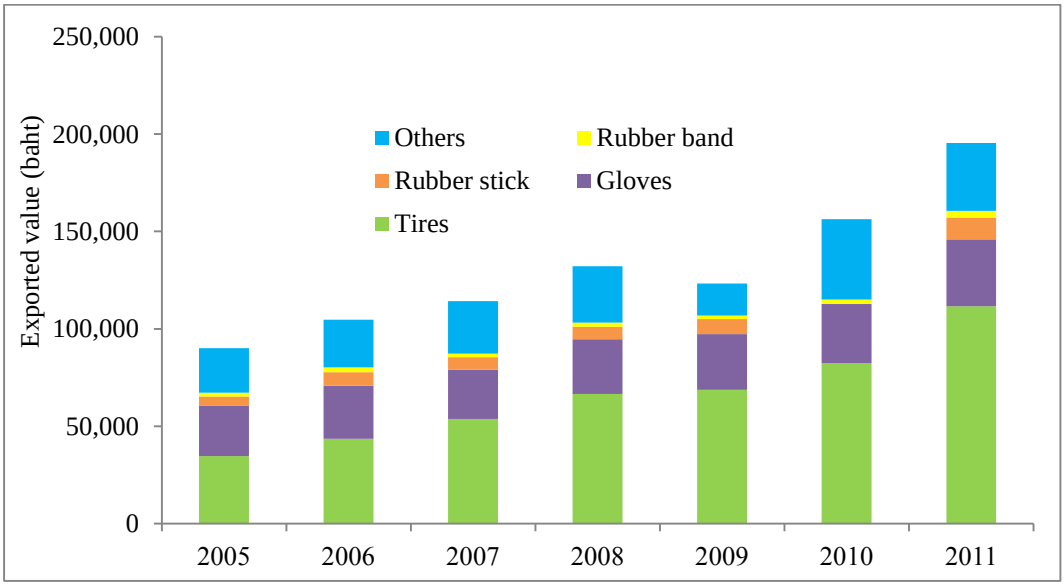

Figure 5-9 The exported value according to industrial rubber products
Source: RRIT, 2013

Glove industry was shrinking during 2009/11 due to high latex price. The growth of rubber stick industry was consumed rubber the same pattern as glove industry. While bicycle tire and rubber band tended to shrink, the consumption of rubber has declined continuously as Table 54. Figure 5-9 shows that the exported value has substantially increased from 90,126.0 million baht in 2005 to 195,431.0 million baht in 2011 with the annual average of growth 16.7 percent. Tire was the largest share of the exported value which was increased from 38.4 percent in 2008 to 57.1 percent in 2011. Glove has slow growth about 1.7 percent per year. Home rubber goods also had declined in the exported value (RRIT, 2013). Thus, policy to promote industrial rubber products has achieved in term of growth rate and the exported value. It is likely that these policy was followed the model of Malaysia.

6.5 Expansion of rubber areas

The data reveal that rubber areas continued to grow as results of government project and private investment. The government project had a large expansion of new plants in new areas while new planting in old areas was encroachment of other cash crops into rubber. Figure 5-10 shows that areas of tree crops in Southern region were increasing while annual crops declined accordingly.

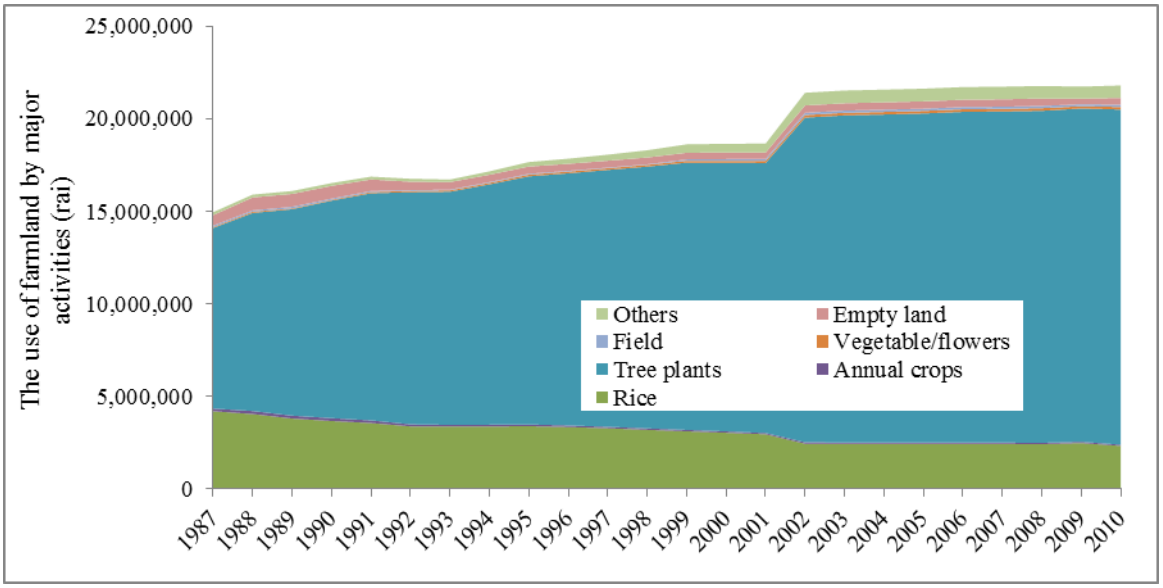

Figure 5-10 Land use according to main types of land use in southern region during 1987-2010

Source: OAE, 2012

As shown by Table 5-46, the growth rate of new plant has declined from 6.9 percent in 1991-2000 to 1.28 percent in 2001-2010, indicating that low available land for new planting was observed in southern region. It can be interpreted that after 2001 new planting was converted from empty land and other cash crops. Figure 5-10 shows that in 2010, 44.19 million rai of southern area composed of 22.39 million rai of farmland (50.68 percent), 11.68 million rai of forestry land (26.44percent) and 11.11 million rai of non-farm sector (22.88 percent).

Farmland was increasing continuously from 15.355 million rai in 1989 to 22.399 million rai in 2010 with annual average of 1.91 percent, out of which has dominated by tree crops. Tree crops increased from 9.76 million rai in 1987 to 18.112 million rai in 2010 with the annual average of 3.56 percent. Rice areas decreased gradually from 4.19 million rai in 1987 to 2.32 million rai in 2010 with the annual average of 4.19 percent. Other crop lands also were the same pattern of rice (OAE, 2012). Then, expansion of new planting was characterized by encroachment of rice area, annual crops areas, green field, and others to convert into rubber land.

Table 5-55 Land use and land-use change in Songkhla during 1980-1999

	1980	1999	The change	Converted to tree crops
Paddy field	775,735	567,835	-216,340	188,488
Forest	536,399	417,673	-118,726	116,943
Tree crops	2,419,883	2,623,313	+203,430	-
Total areas	4,621,181			

Source: Wongkham, 2001

Wongkham (2001) stated that about 300,000 rai of rice areas and deforest had converted into rubber in Songkhla during 1980-1999. There were a large reduction of rice areas and forest areas. Table 5-55 shows that 216,430 rai of rice areas had converted into rubber 188,488 rai or 24.30 percent of total rice areas. Rate of convert was about 3.9 percent per year as Table 5-55. In the same period, forest area decreased about 118,726 rai, out of which 116,943 rai were planted. There was illegal plantation in conservation areas due to the unclear borderline and weakness of protection.

Table 5-56 Land use and land-use change in Pattalung during 1992-2004

	1992	2004	Land changes	Percentage
Rubber area	68,886.419	112,280.610	43,394.191	13.94
Rice area	149,722.436	103,884.040	-45,838.396	-14.72
Other crops	2,633.907	3,913.383	1,279.476	0.41
Wet land	69,882.928	69,174.416	-708.512	-0.23
Water area	17,089.083	17,533.389	444.306	0.14
Mountain area	2,243.482	2,149.010	-94.472	-0.03
Non-farm sector	869.920	2,393.327	1,523.407	0.49
Total areas	311,328.175	311,328.175	-	-

Source: Pongsapan, 2007

This pattern also was observed in Kaun Kanoon district, Pattalung province. Pongsapan (2007) showed that expansion of rubber areas substantially increased during 1992 – 2004 as Table 5-56 shows. Rubber areas increased from 68,886.419 rai in 1992 to 112,280.610 rai in 2004. Rice areas decreased from 149,722.436 rai to 103,884.040 rai in the same period. Other land use has been a little change. The survey at the plot indicated that rice areas were mostly converted into new plant. This pattern could explain expansion of new plantings across region after 2001.

6.6 Development and structural changes in primary processing rubber industry

In the early 2000s, Thailand was the leading country in producing rubber products. The production had increased continuously from 2.3 million tons in 2000 to 3.0 million tons in 2006 and rose to 3.5 million tons in 2010. These raw rubbers can be classified into three main products: Block rubber (STR), Rubber smoked sheet (RSS) and Concentrated latex (Con-latex). The study found that rubber smoked sheet (RSS) had decreased from 53 percent in 1999 to 25.0 percent in 2010. In opposite, STR increased from 29 percent to 40.77 percent. Con-latex had increased from 13.95 percent to 20 percent at the same time. It was reflected structural change in primary rubber industry in respect to the need of the world market and technological progress. STR became the main product to replace RSS in favorable with technique, processing, transportation and production cost in rubber manufacturing. High share of Con-latex regarded to the growth of latex industry in this period that further stipulated the change of production form at the farm level. RSS still used in specific requirement and niche market, especially demand from China and Japan. Importantly, mixed rubber, which RSS mixed with chemical to be masticated rubber, gradually developed in term of demand and proportion in this period. There was the need to reduce cost of production and in favorable manufacturing technique in China (RRIT, 2012). As result, mixed rubber increased 12.0 percent in 2010 as shown in Table 5-57.

Table 5-57 Percentages of raw rubber products during 1999-2011

Year	RSS (%)	STR (%)	Con-Latex (%)	Blended rubber (%)	Others (%)
1999	53.00	29.00	13.95	0.38	3.67
2000	45.00	37.00	14.96	0.41	2.63
2001	41.00	37.50	19.00	0.25	2.25
2002	42.50	35.96	18.00	0.27	3.27
2003	42.60	35.80	17.20	1.29	3.11
2004	37.00	38.00	19.80	2.90	2.30
2005	34.24	42.23	19.93	1.25	2.36
2006	32.80	38.00	22.25	4.40	2.55
2007	31.33	39.87	21.73	4.96	2.13
2008	31.50	41.49	19.00	5.00	3.01
2009	26.46	33.46	22.24	15.40	2.44
2010	25.00	38.00	17.00	16.00	4.00
2011	25.00	40.77	20.00	12.00	2.23

Source: RRIT, 2013

Table 5-58 shows number of primary processing factory and capacity during 1994-2006. The number of RSS factory had decreased from 123 factories to 73 factories in 2006. Capacity of RSS was used about 1.30 million ton by full capacity of 1.72 million tons in 1994. Surplus of RSS capacity therefore was observed due to the rapid change of product forms from RSS to STR. Number of STR factory also substantially increased by the investment of RSS enterprises. There were expansions of RSS enterprises which could be taken advantage from vertical integration when these processing were complementary in term of raw materials and processing techniques. Number of STR factories had doubled up and capacity of production rose to 1.414 million tons per year during 1994-2006.

Generally, standard grade of STR compose of 35 percent of low grade of USS which was scraped from RSS#3 and 65 percent of cup-lump and scarp rubber. This meant that the low grade of USS which was scraped by RSS#3 was used to value add in STR production. Table 5-58 shows that STR capacity has increased from 0.41 million ton in 1994 to 1.414 million ton in 2004 reflected the change in demand for kinds of rubber in the world market (RRIT, 2012). STR production was only used 75 percent of full capacity in 1997 and then use of capacity rapidly increased according to growth of STR market.

Table 5-58 Number of factory and producing capacity according to main types of rubber products during 1994-2006

Year	RSS		Block rubber		Con-latex		ADS rubber		Crepe	
	Nb.	Capacity (ton/yr)	Nb.	Capacity (ton/yr)	Nb.	Capacity (ton/yr)	Nb.	Capacity (ton/yr)	Nb.	Capacity (ton/yr)
1994	123	1.72	32	0.410	66	0.521	10	0.022	61	0.077
1998	99	1.72	45	0.846	59	0.717	-	-	-	-
2006	73	1.482	59	1.414	91	1.984	9	0.016	24	0.048

Source: RRIT, 2000, 2008, 2012

Accordingly, number of con-latex factory was about 66 factories with production capacity of 0.521 million ton in 1994, and thereafter production capacity has substantially increased to 1.984 million ton in 2006. That of capacity was expanded in respect to the growth of con-latex industry. Most of them were located in the southern such as in Songkhla, Trang, Suratthani and Yala. Most of enterprises were the same companies to own factory of RSS and STR. For crepe rubber and air dry sheet, capacity of production tended to decrease in response to slowdown of demand for these products. Crepe factories were additional business of RSS enterprise and located in the same areas. Air dry sheet (ADS) mostly carried out by cooperative in south region.

Table 5-58 shows that the primary processing factories were 308 factories and total production of all these factories could amount to 4.275 million tons in 2006 but the real production rate was at 3 million tons or 70 percent of the production capacity. In 2007, the exporters and trade companies were 158 companies: 9 big companies exported more than 50,000 tons, 39 medium companies exported between 10,000 and 50,000 tons and 110 small companies exported less than 10,000 tons. Exportation of nine companies was about 1,559,331 tons accounting 59 percent of total exported rubber. 39 medium sizes of companies were exported about 817,590 tons, constituted 31 percent of total exported rubber. Small companies were exported only 26,175 tons or 10 percent of total exported rubber.

6.7 Export and structural changes in rubber export market

Thailand was the largest rubber exporters since 1991. The growth rate of rubber export was at annual average of 3.2 percent since 1993. This was share of 36.4 percent in the world rubber export. The main market was China, Malaysia, Japan, U.S.A and South Korea (RRIT, 2013). As shown by Table 5-59, value of rubber export increased gradually in the last decade. In the year 2000, the value of rubber export was at 53,204.97 million baht, out of which composed of 47.23 percent of RSS, 39.25 percent of STR, 13.28 percent of con-latex

and 0.23 percent of mixed rubber. In 2011, the rubber export was about 383,318.60 million baht with the growth of 51.7 percent and surpassed the exported value of rice, accounting by 44.81 percent of STR, 30.11 percent of RSS, 19.9 percent of con-latex 5.09 percent of other products. This implies that there was the change in structure of rubber export driven by the world market demand as Table 5-60 (RRIT, 2012).

Table 5-59 Rubber export value according to main types of rubber during 1999-2011

Unit: million baht

Year	RSS	STR	Con-Latex	Other	Total
1999	24,760.35	12,507.01	6,298.80	525.45	44,091.61
2000	25,129.90	20,885.44	7,066.60	123.03	53,204.97
2001	23,584.56	22,275.94	12,657.63	182.23	58,700.36
2002	29,817.96	26,824.13	17,433.18	530.91	74,606.18
2003	43,264.76	45,264.10	26,856.99	440.91	115,826.76
2004	49,050.13	53,402.85	34,651.72	499.51	137,604.21
2005	47,902.01	63,936.58	36,535.74	494.12	148,868.45
2006	68,620.34	83,869.85	52,357.83	513.43	205,361.45
2007	64,022.10	73,061.49	49,717.63	7,555.16	194,356.38
2008	69,173.38	87,500.02	46,110.52	20,844.33	223,628.25
2009	42,995.55	50,146.11	40,638.64	12,483.30	146,263.60
2010	67,700.47	97,737.08	35,143.69	48,681.26	249,262.50
2011	115,400.12	171,762.30	76,632.76	19,523.42	383,318.60

Source: RRIT, 2013

Figure 5-11 presents share of rubber export by in Thailand. Share of RSS has decreased from 59.6 percent in 1996 to 25.3 percent in 2011. At the same time, STR has increased from was at 18.4 percent to 44.1 percent. Con-latex also increased from 11.5 percent to 17.6 percent. These results corresponded to the change of structure in market, production, and export.

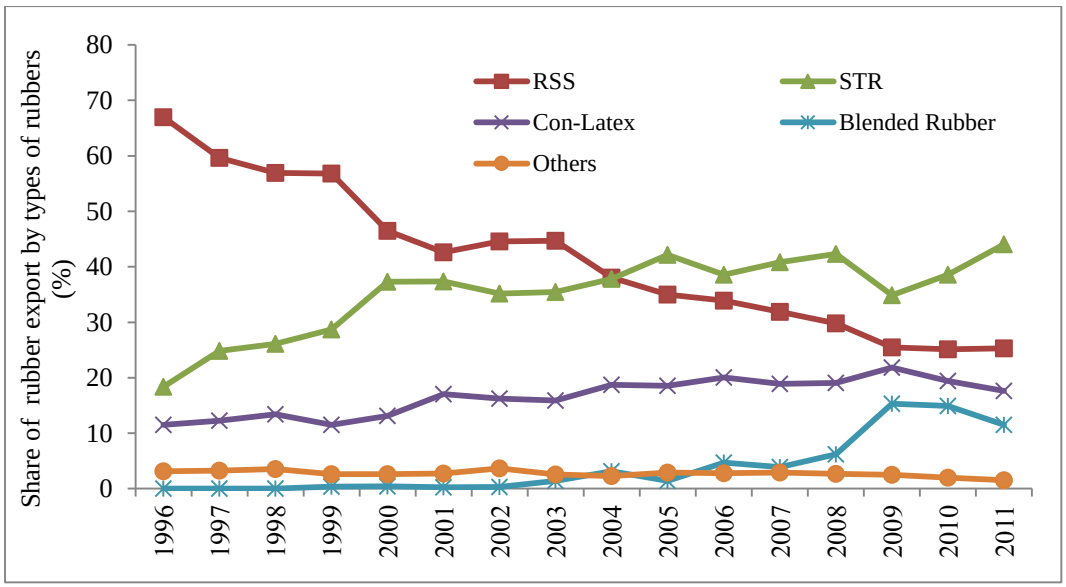

Figure 5-11 Percent of rubber export by the major rubber products

Source: RRIT, 2013

In 2000, Japan was the import rubber importer with share of 23.3 percent. Other importers came from China, U.S.A, Malaysia and Korea. However, share of export to Japan and U.S.A decreased continuously. So China became the major market for rubber export from Thailand since 2006. Export to China increased continuously from 417,638 tons in 2000 to 1,274,188 tons in 2011. Thailand has shared more than 43 percent of total China consumption. Malaysia also became the importers for con-latex from Thailand which was about 11.0 percent of total export. Other important imputers were the USA and Europe which was stable in consumptions as Table 5-60 shows.

Table 5-60 Rubber export of Thailand by major importing counties during 1993-2011

Unit: tons

Year	Japan	China	USA	Malaysia	Korea	Europe	Others	Total
1993	477,010	240,691	183,653	63,008	78,329	152,037	202,055	1,396,783
1994	521,741	235,801	214,760	104,993	100,278	198,846	228,548	1,604,964
1995	561,766	150,317	231,859	108,404	95,758	214,849	272,580	1,635,533
1996	529,992	382,580	174,352	110,981	101,681	212,257	251,147	1,762,990
1997	563,195	299,924	239,595	131,737	122,395	209,804	270,498	1,837,148
1998	499,629	237,642	280,355	179,316	122,580	225,788	294,086	1,839,396
1999	509,701	243,318	236,382	154,913	157,215	240,700	344,110	1,886,339
2000	505,233	417,638	329,504	243,708	136,387	231,178	302,505	2,166,153
2001	435,453	368,114	302,174	296,989	139,295	233,390	266,664	2,042,079
2002	498,854	436,637	382,317	363,651	138,756	266,392	321,809	2,354,416
2003	542,837	650,898	278,693	365,486	165,832	294,239	275,465	2,573,450
2004	525,654	619,800	249,196	383,695	171,668	291,670	395,413	2,637,096
2005	540,485	573,385	237,858	403,506	185,308	281,090	410,766	2,632,398
2006	492,740	747,168	210,784	442,664	173,477	261,882	442,958	2,771,673
2007	405,599	827,369	213,080	413,049	151,824	262,182	430,659	2,703,762
2008	394,742	824,833	219,986	398,043	154,340	249,509	433,830	2,675,283
2009	256,984	1,160,339	156,069	480,313	133,079	245,589	293,820	2,726,193
2010	346,302	1,128,553	177,859	443,000	171,530	268,693	330,510	2,866,447
2011	333,669	1,274,188	205,410	344,589	186,634	223,938	383,953	2,952,381

Source: RRIT, 2013

In this period, the growth of China economy was a key factor to drive the growth of the world rubber consumption. Since China opened to global market in the early 2010s, the rapid growth of China economy driven by industrialization and motorization needed to consume a large import of rubber. Thailand was able to take advantage from this miracle economy by high marketing share above 40 percent. Consequently, China was the major rubber importers from Thailand to account about near half of total export in 2011 as figure 5-12. This was also made government policy enhanced more on the Chinese market.

Since 1960, the major rubber importers of Thailand were USA and Europe which were major industrialized countries and dominated the world rubber consumptions. The decline of natural rubber consumption in industrial countries regarded to the loss of share of natural rubber to synthetic rubber. Japan had a major rubber importer during 1980-1990 as the results of industrialization and the growth of new economy in Japan. Thailand could open of rubber market in China since 1975. When China opened to global market since 2000s, the rapid growth of China economy was shaped to the world rubber consumption.

Many car makers and tire companies have invested new factories or moved manufacturing plant in response to high expansion of China consumption. Some of them moved their factories in order to benefit of cheaper labor and low production cost. There has been structural change in the new geo-economy affecting the world rubber market which corresponded to the change of world economy. Liberal trade after the 2000s also had impacted on the growth of the world consumption.

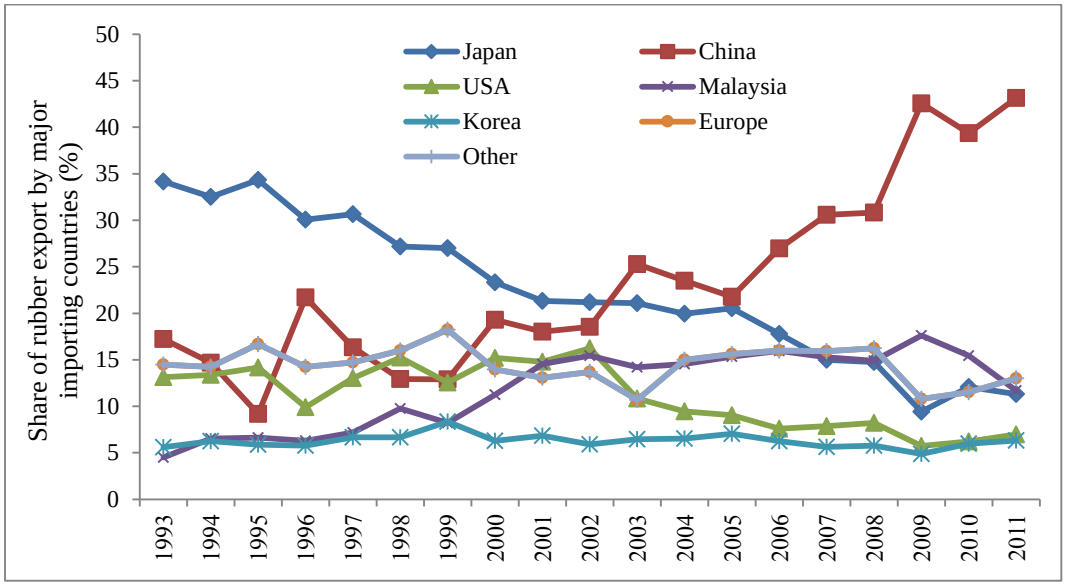

Figure5-12 Percent of rubber exporter of Thailand to the major importing countries
Source: RRIT, 2013

6.8 Dynamic of rubber price in the period of price boom

In the 2000s, the world price tended to decline and fluctuated around a trend of decline. The price started to decrease in 1991 and hit the lowest point in 1993. It began to increase again from 1994 – 1995 and then has declined during 1996-1997. Thereafter, price was set on a trend upward since the end of 2000s. The growth of demand was due to the miracle China economy and the growth of global economy. A trend of short supply of rubber was observed when the world consumption increased at the average of 4.1 percent and rubber supply increased about 2.3 percent per year. This was made the world price of rubber increased after 2002. During this period, the references of price were the real consumer market and the future market price of TOCOM, SICOM and CHINGHAI in consistent with the consumers' demands.

Table 5-61 shows that the average price of RSS#3 in TOCOM, SICOM and Chinghai market increased in the same direction as the price in FOB. The average growth of price was about 38.03 percent per year from 2000 – 2011. FOB price was increasing into the period of price boom since 2002. FOB price increased from 32.70 baht/kg in 2002 to peak of 87 baht/kg in 2008 and rapidly drooped at an average of 66.29 baht/kg in 2009. Price rapidly increased to 115.37 baht per kg in 2010 and rose to peak of 148.4 baht per kg in 2011 (RRIT, 2013). Period of price boom had ended in the mid. 2012 when price rapidly declined with a trend slowdown. The recession of global economies leading by the crisis of the USA

economy in 2008 and followed by debt crisis in Europe in 2011 has pressured to the decline of rubber market after 2012. The USS price at the local market in Songkhla also has been changed in the same pattern of price at TOCOM, SICOM and CHINGHAI as Table 5-61.

Table 5-61 Price of RSS#3 at TOCOM, SICOM (advance 1 month) and FOB price of Bangkok

Unit: baht/kg

Year	TOCOM	SICOM	Thai (FOB)	Price of USS#3 at Local market, Songkhla
1997	29.80	30.04	30.18	23.60
1998	29.32	29.03	29.35	23.35
1999	24.16	23.22	23.50	19.77
2000	27.95	26.48	26.67	23.29
2001	24.40	25.34	25.34	22.53
2002	34.16	32.57	32.70	29.15
2003	46.17	44.34	44.45	40.17
2004	52.31	51.54	51.72	46.66
2005	60.44	59.81	60.17	55.19
2006	79.77	78.97	79.77	72.12
2007	78.09	78.23	78.54	72.15
2008	85.65	85.87	87.00	79.95
2009	65.49	65.67	66.29	59.46
2010	116.99	115.37	115.34	106.07
2011	145.06	146.67	148.40	131.69

Source: RRIT, 2013, calculated at annual average market exchange rate of BOT (Bank of Thailand)

The price increased about 300 percent during 2002-2011 which called “price boom”. Price boom not only drives by the growth of rubber consumption but also it has impacted by peak of oil price and commodity booms. Oil price has adversely affected on production cost of synthetic rubber (SR), which consequently shifted to high level of SR price. High price of SR further caused to decline share of SR in the world consumption that shifted to replace by natural rubber. New demand for natural rubber was due to high SR price and decline of SR consumption. This gap shifted to replace by natural rubber. As below, the study will detail in price and it change. In the early 2000s, the price of rubber was stable. Demand of rubber from China and Japan steadily grew. By the overviews of the world rubber industry in the early 2000s, the world rubber production was higher than the consumption. With regarding liberal trade order, China agreed to participate with WTO that led to carry on by process of opened economy belong to liberal trade order. Indeed, rubber import began to reduce import duties in 2000, must be abolished rubber quota system in 2005 and cancellation of import tax in 2006. This change was affected on shift of rubber consumption in China economy. The government also started to promote Chinese market and to support rubber enterprise enable to get a large market share in this period.

In the mid-2000, China market grew about 50.0 percent. China imported more than 50 percent of rubber product from Thailand when compared to 1999. The United States market which Thailand shared about 20 percent grew about 39 percent. Japanese market seemed to decline to 0.76 percent. In 2001, the price has dropped due to the release of INRO stock and the stagflation of Japanese industries and recession of USA economy.

However, China consumption steadily increased that helped to maintain the growth of the world economy. Rubber export declined from 2.0 million tons in 2000 to 1.88 million tons in 2001 with diminishes of 5.8 percent. In 2002, rubber price rapidly increased from 20.14 baht per kg in the first quarter of 2002 to peak of 32.15 baht/kg in September and fell to 30.0 baht per kg in the fourth quarter. The annual average of price was about 27.69 baht per kg as a consequent of the growth of rubber consumption driving by China, Japan and U.S.A. even China consumption has decreased by about 4.0 percent. In 2003, China consumption has recovered from 0.956 million ton to 1.202 million at the average growth of 26.0 percent meanwhile Japan and the USA declined by about -9.2 percent. So rubber price gradually rose from 37.89 baht/kg in January to 52.76 baht/kg in November and decreased a little later on. The speculation in the future market was increasing which had caused the price of agricultural commodities to increase as well.

In 2004, rubber price was quite stable with the annual average at 51.72/kg. Rubber price increased from 48.79 baht/kg in January and it was highest in June at 55.92 baht/kg. The effects of being a member of WTO lead to accelerate growth of China economy. High growth of the automotive industry in China stimulated to have high consumption of natural rubber. The total rubber import rate was at 1.284 million tons which was increased about 6.7 percent from 2003. Because of the increasing price rally, the China asked for the price to be stable at 120 dollars/kg. Rubber import from Thailand has decreased about 9.0 percent to replace by share of Indonesia and Malaysia. In 2005, rubber price was still increasing at the annual average of 60.10 baht per kg in consistent with the growth of the Chinese market and expansion of the automotive industries in the country. About 1.406 million tons are exported to China which had increased 9.5 percent. The world rubber production expanded only 4 percent while the world consumption increased at 5 percent. These were associated with high SR price and the speculation in the future market. As results, rubber price continued to present upward trend. In 2006, the rubber price was fluctuated in response to uncertainty of the world economy even though China had imported 1.612 million tons with the growth rate of 14.5 percent. Rubber price has increased from 74.09 baht per kg in January to peak of 104.30 baht per kg and fallen to 62.80 baht per kg in December. The annual average of price was about 79.79 baht per kg.

In 2007, rubber price was stable with the annual average of 78.51 baht/kg. It was a little higher than the past year due to the continuous expansion of automotive industry and tire industry in China. By the China economy effects, China consumption would expand about 12 percent between 2006 and 2007 and 10 percent between 2009 and 2010. Automotive industry was remained key factor to drive the growth of Chinese market. At the end of 2007, the total importation of China was at 1.647 million tons which was increased by 22 percent, out of which more than 45.6 percent was imported from Thailand. In 2008, rubber price was increased from 87.17 baht per kg in Juanaury to peak of 107.75 baht per kg in July and fallen rapidly to 44.35 baht per kg in December, reflected high fluctuation and uncertainty in the world economy. The financial crisis in The USA and debt crisis in Europe pressured to foreseen the recession of global economy. It was associated with decrease of oil price, release volatility of speculation in the future market, and rapid reduction of new car sales in America, Europe and Japan. There were complexity factors to force decrease of price. Price has drastically decreased in the end 2008.

In 2009, rubber price was improved quickly. It increased about 20.11 percent in January in response to fiscal policy in the United States and Europe that needed to increase purchasing power and home consumption through on. The speculation in Japanese market had also caused the rubber price to be unstable between 2008 and 2009 which at the time the world economy was unstable as well. This had stopped the productions of many factories. Meanwhile, the automotive industry in The USA required loan and special program from the U.S. government to avoid bankruptcies which cause to reduce rubber consumption at -5.0 percent. This presented slowdown of global economy continued to 2009. However, China economy remained to drive the growth of the world rubber consumption. Rubber import was about 1.628 million tons which was increased by about 2.07 percent. Thailand was shared of 49.7 percent of total China consumption. In the early 2009, rubber price increased from 53.27 baht/kg in January to 93.75 baht per kg in December with the annual average of 66.27 baht per kg. China imported a total of 1.710 million tons with a trend slow down at 1.74 percent. Thailand has shared over 51.0 percent in China market. This was due to the expansion of automotive industry and tire industry which have been a large support and stimulate by government policy. This fact was the exact contrary to the fiscal crisis in the United States. In 2010, the price began to increase again rapidly at 100 baht/kg and rose to the highest point in December at 142.5 baht/kg. The annual average of price was 115.54 baht per kg. The price increased through the whole year of 2010. This high price is drive by the expansion of the Chinese market, the recovery of the economy of United States and the increasing oil price. Meanwhile, the supply of rubber has decreased due to facing with variation of weather and high rain in main producers.

In 2011, the rubber price was still increasing. Price was increased from 168.66 baht per kg to peak of 190.31 baht per kg in February and then fallen after March. The annual average of price was about 148.0 baht per kg. Price showed a trend upward in the first quarter in response to the recovery of the USA economy, release pressure of debt in Europe and the continued growth of China economy. In March, rubber price rapidly fallen to 167.67 baht per kg. It was response to concern about Japan economy which had severely impacted by the earthquake on March 11 2011. Many car factories had ceased production that adversely declined in rubber consumption. The recession of global economies appeared to increase when fiscal crisis and debt problems quite solutions in short run. While Thailand faced with the flooding in central region where located of automotive industry to be stop production (RRIT, 2002-2013). With uncertainty conditions and recession of global economy, only China has increased the rubber consumption and help to absorb the world rubber supply. Movement of rubber price will fluctuate in response to unprecedented increase in the world economy, weather and external shock (RRIT, 2013).

6.9 Futures rubber market

Since the 2010s, it seems that the government has achieved to develop rubber market and setting modernizing marketing channels that created marketing power to the farms, increasing competitions, fare of price and efficiency of market but the price in Thailand still has less influenced on the world market. Marketing decision and pricing in Thailand depended on movement of price in TOCOM, SICOM and SHFE future market because these

markets could be reflected market situations, a negative trigger and the demand for rubber in the real market. The government also perceived on the important of future markets that lead to establish **"**The Agricultural Futures Exchange of Thailand (AFET)" in 1999. Rubber market can broadly be classified into two markets as following: the international market and domestic market. International market was a market for consumers which grouped into two different sectors:

1. Direct Trade: this type of market dealt strictly between buyers and sellers. The prices derived from different local markets and the rubber market. The selling agreement was done case by case between the sellers and the buyers and at least 80 percent of the rubber trade was done through direct sells.
2. The future market: this market was composed of TOCOM, SICOM, SHFE, New York and London. The important market were TOCOM, SICOM where have been active market and play role to guide the world price. TOCOM served to trade only RSS#3. SICOM has traded RSS#1, RSS#3 and TSR#20. Price in these markets was recognized by pricing of direct trade and is used for referencing price in international market. Today, the future market was set up to trade agricultural commodities in Thailand, China, Japan, Singapore and India. Indeed, Tokyo Commodity Exchange (TOCOM) played important role to guide pricing in Thailand regarded to a major rubber consumer of Japan. This market could be characterized by the market of consumer that was made distinct between TOCOM and SICOM. The Chinese market "Shanghai Future Exchange (SHFE)" is the future market as well. This is the largest trading market regarded to a great consumption of China. The level of trading was the highest in the world by the latest report of FIA Association in 2006. The Agricultural Futures Exchange of Thailand (AFET) was considered the youngest association but it became one of the main sources of pricing for the world rubber industry in a very short period of time. The rubber products that were traded international mostly derived from Thailand. These have given as advantage to the Thai investors on the information available. The prices of the future market were used both by the buyers and sellers and the rubber prices of TOCOM, SICOM and AFET were changed in the same pattern. The trade and speculation were working on day in consistent with the different time of opening trade between TOCOM, SICOM, SHFE and NEW YORK. There was characterized the relationship among the future markets. There has been high speculation in the period of price boom. The price of the future market could be useful to marketing actors in central market and local market when they could be able to update on the price and marketing situations (RRIT, 2012). However, AFET has a little affect the real market due to market of producers and less active of contracts and investors.

6.10 Development of rubber market channel and the change in product forms

At the farm level, rubber forms can be mainly classified into: fresh latex, un-smoked sheet rubber, cup-lump and scrap rubber. Regarding to structural changes in rubber industries associated new demand for rubber, about 95 percent of farms had the change from un-smoked sheet to selling latex and the rest produced cup-lump (RRIT, 2011). In case of latex sales, the farms will sale their latex to cooperative, farm's group or merchants. This latex will transform into smoked sheet rubber (RSS) by Cooperative. It also was sold into con-latex factory, ORRAF market or central rubber market. Then, most of USS and RSS are produced

by cooperative or farm enterprise. It appears to have occurring the same pattern across region. It is obviously that the farms could be switch to produce any product forms but in facts it was difficult to switch backward when the choice is selected. Most of farms were changed by collective order in respect to the choice by cooperative, farm's groups and a given allowance to incentive by merchants. Several factors have influenced on the choice of product forms. By view of the farm decision, our respondents stated that the selection of product forms depended on price, working time, and income. Other important factors are farm structure, labor availability, local institutions, marketing system, farm objectives and characteristics of the farms. A particularly, the changed product forms were driven by the encouragement of marketing actors and collective order. The following was the different attributions of marketing channel by each type of products (RRIT, 2012):

1) Latex: this form was favorable to select with regarding to reduction of working time, low available of labor, and daily cash income. Selling fresh latex has highly responded to daily price, market variability, and price fluctuation that could affect on variability of income. The buyers are merchants, farm's group, cooperative, and representative point of factory. Two main marketing channel were; the first is marketing channel composes of the farmers, cooperative or farm's group and factory. Second, latex is traded passed through merchants at local market, merchants at second level, and factory, respectively. There was high competition among merchants in each area. Pricing at the farm gate derived by open price at factory deducted with compositions of marketing cost and profits at the different merchants.

2) Cup-lump: latex was coagulated in cup after tree is tapped to be form Cup-lump shape, that enable to collect at a few days later. Cup-lump could be kept for longer period before sold. The farms were selected to produce due to low available of labor, low yield and difficult to access local market. This form was difficult to widespread when selling cup-lump did not standardized in term of %DRC (percentage of dry rubber content) and pricing. Pricing and grade have less developed and unaccepted by the party. The main marketing channel composes of: the farms, merchants at local market, merchants at district or collectors and factory.

3) Un-smoked sheet rubber (USS): there was the traditional product form. USS would favor to produce due to certain of weight, pricing by grade, and high price to compare with others. USS could store for one week or one month before it has sold that could be speculated with price fluctuation and increased marketing power. The important marketing channel composed of: the farms, merchants at local market, merchant at big collectors and factory. There was channel of local market. Other channel was composed of: the farms, cooperative or farm's group and factory. Most of cooperative and farm's group have traded this product in the central rubber market or ORRAF market. If the farms were done by the large farms, USS was delivered to be processed into rubber smoked-sheet (RSS) which could be sold to the factories or the central market. RSS was a better price than the price of latex or cup-lump rubber.

4) Scrap rubber and by product of rubber: the farms could trade them at the local market. These products were important materials to produce STR#20. Pricing has less standardized by mixed grade even it seems to correlate with USS price.

During 2000 and 2010, there were two important reasons affecting the change of product forms. The first reason was the demand of latex from con-latex industry. Con-latex industry would increase supply of latex and paid strongly attention to promote the selling fresh latex. Factory began to promote advantage of latex form and build network of local merchant to encourage the farms into the selling latex. There has been successful to change products from USS to fresh latex. The second reason is cooperative and farmer's groups have been functions in the primary processing rubber and marketing. Fresh latex is sold to cooperative to produce USS or RSS which could be sold at a better price at central rubber market, ORRAF market or the factory. There were a process of increasing value add and increasing market bargaining power. There has high response by the farm when they could delegate value added task to cooperative. They also could reduce working time up to two hour per day, more leisure time, and increasing other jobs for hobby or additional income. These rubber forms passed through three types of rubber markets were:

1) Local markets: the local market located at the village, sub districts, districts or in the province. There was also much competition in the trading among merchants. The merchants would purchase all rubber forms and trade at once with the factories. Key marketing actors composed of the local merchants, district merchants, farmer's groups, cooperatives and preventative points of factories. Local merchants could trade rubber with upper level of merchants or the factory directly. It appeared that competition in purchasing the latex was high rather than USS and other products. Latex could be processed into USS or RSS by cooperative and some of local merchants that would able to gain more profit.

2) The central rubber market: rubber products in this market must meet the requirements of central market. The key sellers are local merchants, district merchants, large farms and cooperatives. The buyers are the factory and exporters in the service areas. The bidding would be organized in sessions. In these sessions, the rubber products were divided into lots. The highest bidder would obviously get the products. A better price, quantity and rubber quality are key factors to encourage marketing actors to trade in these markets.

3) ORRAF rubber market: ORRAF market was mostly setup in ORRAF's offices in every province. Cooperative and farmers' group could be traded with the buyers directly. The farmers had been more choices in where and to whom to trade their products with. The farmers who are member of cooperative or farmers' groups bring their products to the location for the bidding. The buyers are the factory and exporters in service areas. The bidding was regulated by regulations of ORRAF. The buyers must complete payment before receiving products. Specific quality, a large volume and low marketing cost are important factors to trade in ORRAF market while price was higher than the local market.

Annex B

Analysis of the world rubber economy: structure, price and market changes

In this section, the study aims to understand market forces and the change a long the development of rubber industry. The study began to identify the important change and major trend in the world rubber market in order to analyze market force and structural change. Five major periods of changes in the world rubber market were: 1) rubber market under territorial rubber producers, 1900-1933, 2) the international rubber regulation, 1934-1943, 3) trade barriers and rising substitute products, 1947-1960, 4) market uncertainty and high competition rubber markets, 1961-2000 and 5) liberal trade rubber market and price boom, 2001-2010. The last section is the analyses of structural transformation in the world rubber markets.

1. Rubber markets under territorial rubber producing countries, 1900 – 1933

1.1) The world consumption of natural rubber

Demand for natural rubber depended on economics of the developed countries and industrialization in the consuming countries. The rapid demand for cars and other vehicles consuming many tires and rubber goods to assemblies them led to increase demand for natural rubber. In America, the motor industry rapidly expanded production as showed in Figure 6-1 increasing demand for natural rubber. Demand for natural rubber depended on economics of the developed countries and industrialization in the consuming countries.

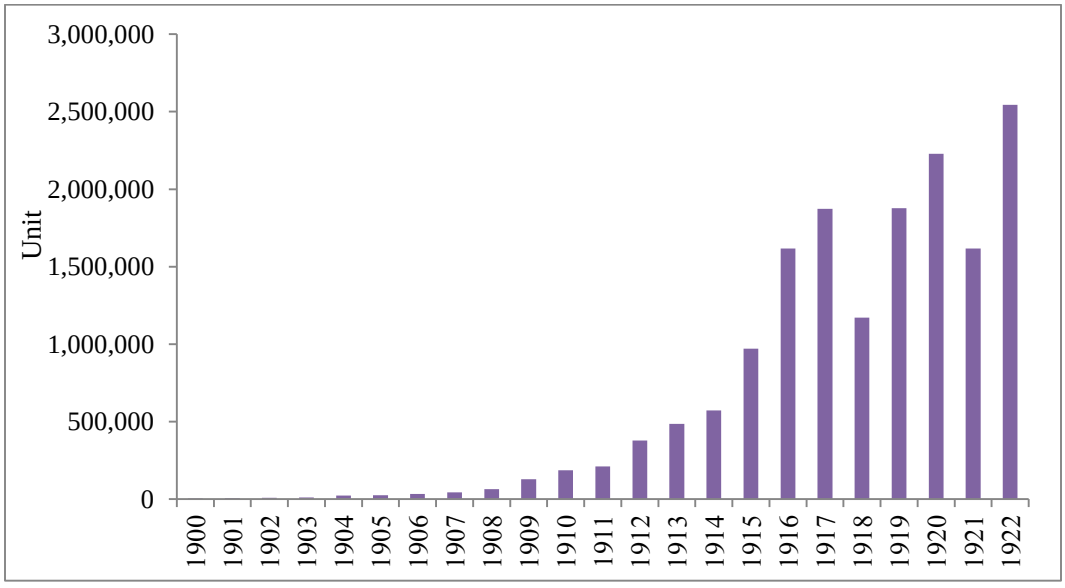

Figure 6-1 Motor vehicle factory sales in America during 1900-1922
Sources: Drabble, 1973

The rapid demand for car and other vehicles need to consume many tires and rubber goods to assemblies them that led to increase demand for natural rubber. Then, natural rubber is a derive demand determining the consumption by output of automotive industry. In America, the motor industry was rapidly expanded production as shown in Figure 6-1. Demand for vehicle is increasingly regarded reflects the growth of demand for natural rubber. Rubber world consumption has generally doubled in each decade during 1900-1933. The consumption rapidly increased from 53,000 ton in 1901 to 100,000 ton in 1910. The average growth of consumption was about 7.6% per year. The world consumption still rose to over 100,000 tons in 1910 and to peak of 137,000 tons in 1913 before falling in later year. The rubber consumption still rose to 301,000 tons from 1915-1920, doubled in 1927 and reached to 816,000 tons in 1929. The consumption declined after 1930 due to the recession economy in The USA.

During 1900-1913, the world consumption was higher than the supply of rubber consistent with the low availability supply of the wild rubber mainly from South America. It caused to price boom. Since the 1910s, rubber plantations (*Hevea Brasiliensis*) in South-east Asia became the important supply of rubber and have been sufficient for the consumption of the world rubber. Until the 1930s, natural rubber experienced no competition from substitutions and less competition from the wild rubber (Nehmer, 1959; Drabble, 1973).

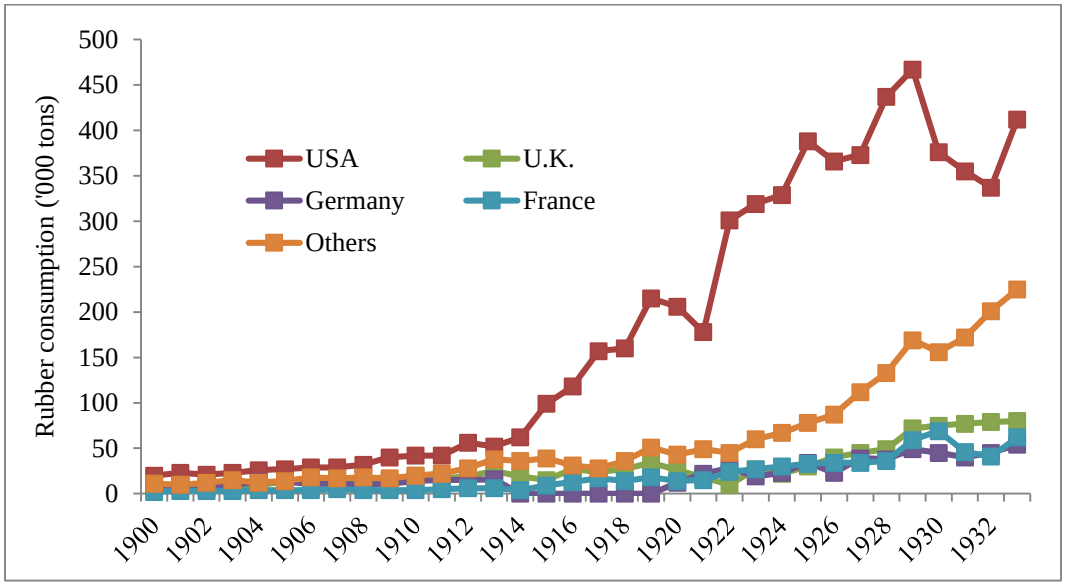

Figure 6-2 Consumption of natural rubber by the major consuming countries during 1900-1933
Source: Nehmer, 1959

Nehmer (1959) stated that there has been the significant relationship between the growth of rubber consumption and the growth of gross national production. Since advent of the vehicle industry, a country with high rate of the growth of industrial production has been a higher rate of the growth of rubber consumption. In case of the USA, the industrialization is key factor to determine the growth of rubber consumption as Figure 6-2. The USA has always been the largest rubber consumer accounting about 40.0 % of the world rubber consumption in 1900/05.

This share increased to approximately 70.0 % in 1921/25 and fell to 60.0 % in 1926/30. The consumption from The UK, Germany, and France together constituted about 39.0 % in 1900/05 and steadily declined to approximately 16.6 % in 1921/25 before recovered in share. These shares reflected the important of consumption from the developed counties and their industrializations.

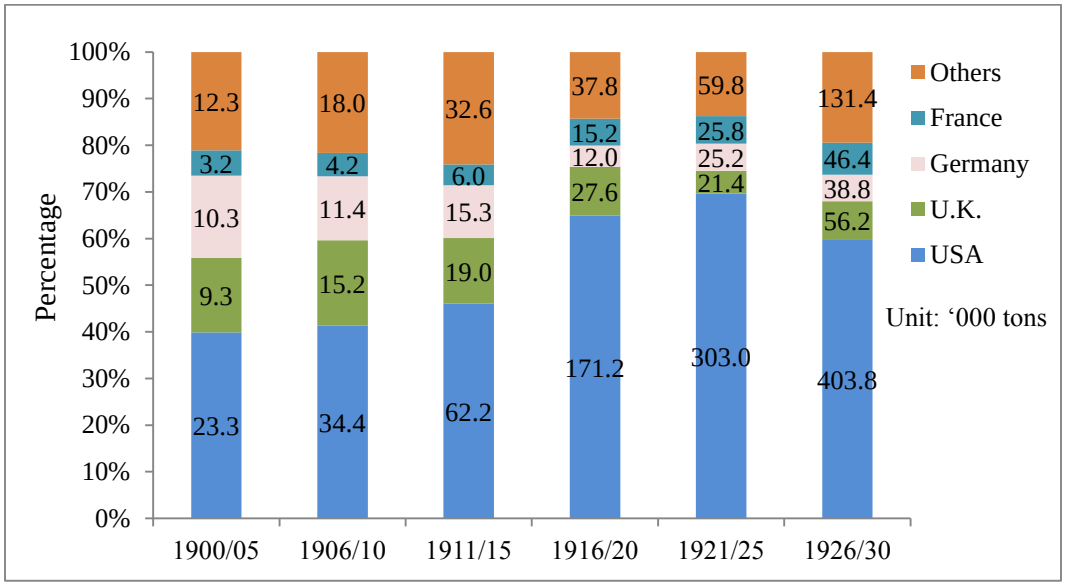

Figure 6-3 Annual average of consumption of natural rubber and its share in the world consumption according to the major consuming countries

Sources: Nehmer, 1959

In 1905, the first price boom occurred when rubber price sharply increase to 1,667.4 dollar per ton or increase about 52.9 % from the price in 1902. Rubber price still rose to peak of 1,733.3 dollar per ton in 1906 corresponding to the increase of vehicle output as Table 6-1. Vehicle output increased from 9,000 units to 34,000 units in 1906. During the 1907-1908, rubber price had fallen down at the beginning of 1907 and further decreased in the 1908 before recovery started. The sharp recession of America economy is important reasons, that steady imported about 40.0% of the annual world since 1900. Over-speculation in financial sector crashed down and the larger industries were adversely affected.

After recession period immediately, rubber industry entered a period of expansion. The rubber price rose rapidly to 2,267.2 dollar per ton in 1910 and falling thereafter. Rubber price rose because Brazilian state of Para authorized a syndicate of the Banco to make cash advances to producers to enable them to withdraw rubber from the market in order to raise prices. Decrease of rubber price corresponds to the plantations in the Asia were producing more rubber output. Moreover, the Brazillian interests were obliged to liquidate stock which caused fallen of price in the end of 1910. Other factors related with the initiation of mass-production by Henry Ford in 1907 that revolutionized and made possible the expansion of production that affected on

increased the demand for rubber to be used in motoring tires industry beyond expectations. It was in turn to rapidly increase growing rubber industry (Drabble, 1973; Barlow, 1978).

Table 6-1 World production, consumption and price of natural rubber during 1900-1933

Year	NR production ('000 tons)	NR consumption ('000 tons)	Diff.	New York (US Dollar/ton)
1901	46	53	-7	1,124.4
1902	43	51	-8	1,090.6
1903	50	58	-8	1,390.2
1904	54	65	-11	1,559.8
1905	57	71	-14	1,667.4
1906	64	76	-12	1,733.3
1907	75	78	-3	1,599.7
1908	71	75	-4	1,291.7
1909	79	87	-8	1,858.9
1910	96	100	-4	2,267.2
1911	96	101	-5	1,828.7
1912	116	124	-8	1,771.9
1913	122	137	-15	1,441.4
1914	125	121	4	1,080.9
1915	174	162	12	1,095.0
1916	207	189	18	1,297.4
1917	282	226	56	1,260.6
1918	224	237	-13	988.6
1919	406	318	88	885.6
1920	358	301	57	943.4
1921	307	282	25	360.5
1922	409	408	1	382.3
1923	411	452	-41	651.5
1924	430	471	-41	574.3
1925	537	563	-26	159.5
1926	633	550	83	1,088.2
1927	619	603	16	833.6
1928	666	693	-27	492.2
1929	874	816	58	451.5
1930	838	721	117	225.8
1931	813	690	123	134.9
1932	721	703	18	75.6
1933	865	833	32	130.1

Source: IRSG, 1966

In 1909-1910, the output of vehicles in America rose sharply which was composed entirely of passenger cars, and thereby there was growing rapidly in scale of rubber industry. After 1910, the consumption of rubber has over 100.0 ton per year. The rubber output from East Asia has shared 11.7% of total world consumption in 1910 and sharply increased to 60.9% in 1914. Rubber price was continued a downward course.

The price in 1911 was about 1,828.7 dollar per ton and was decreased to the lowest price of 1,080.9 dollar per ton in 1914. The growth of consumption 1911-1914 was about 5.6% per year that was declined. The result was the increasing supplies from plantation as show in Table 6-2. Supplies from wild rubber were dropped since 1912 while rubber production from East Asia expanded sharply as the planting boom of the 1905-1907. In 1914, rubber stock was firstly recorded. America was unchanged in the position of major consumer (Nehmer, 1959).

Some puzzle at the extent of the price fall was related to fighting in war between Britain and Germany at the end 1914 that cause to a rapid loss of confidence the trade and was difficult the selling rubber in European and Eastern markets. The main reason of loss to trade in rubber was the ban to supply rubber for Germany. This was possible because average of about 80.0% of total rubber came from British territories. However, a sharp rise in America imports was more to compensate that of the loss, which resulted price fluctuations with downward but overall trend was declined. During the war time 1914-1918, the peak price was about 1,297.4 dollar per ton in 1916, slightly down to 1,260.6 dollar per ton in 1917, and sharply decreased to 988.6 dollar per ton in 1918. In other hand, consumption increased from 121.0 ton in 1917 to 237 ton in 1918 with high growth rate above 18.7% per year. This consumption contributed by a sharp rise of American imports. One of the main factors is a large increasing vehicle output up to 1917 due to new technology for assemble car and cost downs. As well as, rubber industry of tire and tube production for domestic use was sharply increased accordingly.

After WW I, the disorder in economic conditions in European occurred and further sharply risen inflation of whole sale price of what? Output of industry from England, Germany and France had fallen and had declined in export in oversea markets. The recession of economy began to cover European that cause to decline in rubber consumption. The rubber consumption rapidly decreased from 318.0 ton in 1919 to 282 ton in 1921. The price has slightly increased to 943.4 dollar per ton in 1919/20 and fallen to 360.5 dollar per ton in 1921. This situation leads to take action by the British government. The Stevenson scheme was established proposing to reduce supply of rubber into market. In order to control rubber exports, the exportable percentage was initially at 60, which can be adjusted whenever the actual average price moved out of the pivotal price range 0.94 – 1.18 dollar per kg. This was a reasonable return to the rubber producer. Since implementation of the scheme which concerned only British colonies, the price had immediately increased to 382.3 dollar per ton in 1924 and 651.5 dollar per ton in 1923, which was lined within the pivotal range, but thereafter in early 1924 began to decrease again. Reduction of rubber stock by manufacturers and growing rubber production outside the Stevenson shame had anticipated to price decline. This was the change of exportable percentage to 50 by the scheme in November 1924. The consumption of rubber steadily increased from 408.0 ton in 1922 to 471 ton in 1924 or the growth rate of consumption about 7.5% during 1922/1924 but the visible stock immediately dropped in response to rising price. The lowest stock had generated a specula advance in quotations that led to rising rubber price in the end 1925.

The scheme also had raised the exportable percentage to 85 in November 1925 and at 100 in 1926 but in fact a relatively small shortage of supply was occurred. The peak of price was about 1,088.2 dollar per ton. Following the high price, rubber supply exceeded consumption and stock began to increase by production within and outside the scheme. The price had dropped to 833.6 dollar per ton lead to reduce the exportable percentage to 60 in mid 1927. Rubber producers under the scheme were decided to re-assess the policy of restriction and its effect in eroding their competitive positions, which resulted to stop all restrictions in November 1928. The rubber price continued to fall in 1928 and thereafter (Nehmer, 1959; Grilli et al., 1980).

Fortunately the growth rate of rubber consumption also increased about 10.4% per annum during 1925/28. High growth of industrial production has even a continued growth of rubber consumption. Thereafter, the rubber price has decreased to 451.5 dollar per ton in 1929 and declined abruptly to 75.6 dollar per ton in 1932 in response to period of the great depression in America. The consumption of rubber steadily decreased from 816.0 ton in 1929, to 630.0 ton in 1931 and to 703.0 ton in 1932, out of which the consumption of America has rapidly decreased from 467.0 ton in 1929 to 337.0 ton in 1932. One of the important factors was the output of passenger cars in America fell from 4.6 million units in 1929 to 1.1 million units in 1932. At least from the middle 1932, the situation has improved slowly through increase of rubber consumption in response to gain confidence to market and rubber consumption for outside North America. The rubber price increased to 130.1 dollar per ton in 1933 (IRSG, 1966).

1.2) The world production of natural rubber

Table 6-2 shows that supply of rubber was 46,000.0 tons in 1901 and rose to 96,000.0 tons in 1910 by about 8.9 % per annum. The wild rubber from South America and Africa dominated for supplies of natural rubber. Wild rubber is important source for supply of rubber that rose by about 25 % in 1903 but it was not sufficient to meet the demand. Rubber production began in Ceylon and Malaysia in 1876 and 1877 respectively. Rubber plantation from Ceylon was small proportion about 821 tons accounting about 1.8 % of total production. The production of rubber plantation increased and, after 1912, the wild rubber rapidly decreased in share of the world supply from about 70.0 % in 1912 to below 10.0 % in 1921.In other hands, rubber plantation from Malaysia and Indonesia have sharply increased to account about 50.0 % and 22.0 % in 1920 respectively. South-east Asia became the important supply of natural rubber. Malaysia became the largest rubber producers in 1914. In 1933, share in the world rubber production from Malaysia was 51.4 %, 32.5 % from Indonesia and 7.4 % from Ceylon.

In sum, rubber has been one of the fastest growth commodities. The consumption of rubber in demand has been steady in rate of 9.7 per annum from 1900/33. The demand for rubber was influenced first by the development of automobile and industrial tire and tube, and then industrialization progressed of rubber goods. America was a major consumer that has been the major producer of vehicle and progressive technology in rubber application. The share accounted approximately half of the world’s consumption in 1933.

Since the innovative automobile and industrialization, high growth of rubber consumption was derived by a high growth of industrial production. Even during the great depression, the demand for rubber by the rest of the world has increased reflecting share of total consumption by America has steadily declined. The demands of automobile has caused to boom rubber price during the 1900s and then substantial increased rubber production. The growth of rubber production has increased at 11.2 per annum during 1900/33. This growth in output has regarded to extensive plantation in Malaya, Ceylon and Other areas.

Table 6-2 World production of natural rubber during 1900-1933

Unit: tons

Year	Wild rubber		Plantation rubber				Total
	South America	Africa	Ceylon	Malaysia	Indonesia	Siam	
1900	27,784	15,526	821				44,000
1901	30,978	13,840	435				46,000
1902	29,500	12,386	252				43,000
1903	32,168	16,411	773				50,000
1904	32,496	18,660	1,898				54,000
1905	34,634	18,585	2,499	130			57,000
1906	39,293	20,539	2,879	385			64,000
1907	47,115	18,883	7,785	885			75,000
1908	49,309	15,096	5,145	1,639			71,000
1909	54,021	18,593	5,556	3,331			79,000
1910	62,891	20,143	1,600	6,500	2,400		96,000
1911	58,271	18,283	3,200	10,800	2,300		96,000
1912	62,052	18,913	6,700	20,300	3,700		116,000
1913	50,493	15,986	11,400	33,600	6,400		122,000
1914	40,867	7,719	15,800	47,000	10,400		125,000
1915	46,318	8,138	20,800	70,200	20,000		174,000
1916	41,875	10,372	24,400	96,000	33,100		207,000
1917	46,242	10,446	31,900	129,000	44,000		282,000
1918	31,501	7,122	21,100	112,000	42,000		224,000
1919	43,720	7,021	44,800	204,000	85,000		406,000
1920	30,486	6,402	39,000	181,000	80,000		358,000
1921	20,502	3,494	40,200	151,000	71,000		307,000
1922	23,933	2,941	47,400	214,000	94,000	1,000	409,000
1923	26,000	6,000	37,000	182,000	137,000	2,000	411,000
1924	33,000	5,000	37,000	176,000	151,000	3,000	430,000
1925	31,000	8,000	46,000	211,000	194,000	5,000	537,000
1926	37,000	10,000	59,000	277,000	208,000	4,000	633,000
1927	25,000	9,000	56,000	232,000	232,000	5,000	619,000
1928	25,000	7,000	57,000	294,000	228,000	5,000	666,000
1929	16,000	6,000	80,000	456,000	255,000	5,000	874,000
1930	12,000	5,000	76,000	443,000	241,000	4,000	838,000
1931	7,000	3,000	62,000	422,000	257,000	5,000	813,000
1932	10,000	2,000	49,000	406,000	211,000	4,000	721,000
1933	10,000	2,000	64,000	445,000	281,000	7,000	865,000

Sources: Drabble, 1973

South East Asia became important source of rubber production since 1910 as Table 6-2. Variations in output have generally reflected periods of high demand, reduced price, and the scheme effect. Thailand has been the first recorded export in 1906 about 44.6 ton. Small output of rubber did not affect on the world of production and market during 1900/32 (Drabble, 1973).

2. The international rubber regulation between 1934 and 1946

2.1) The world consumption of natural rubber

This section aims to examine the market regulation deriving from the international rubber market regulation scheme and its impacts on production, consumption, and price of rubber including its consequent until 1946. As the study pointed out in the previous section, the development of rubber manufacturing industry in America and Europe is key consumer of rubber since the earlier 1900s.

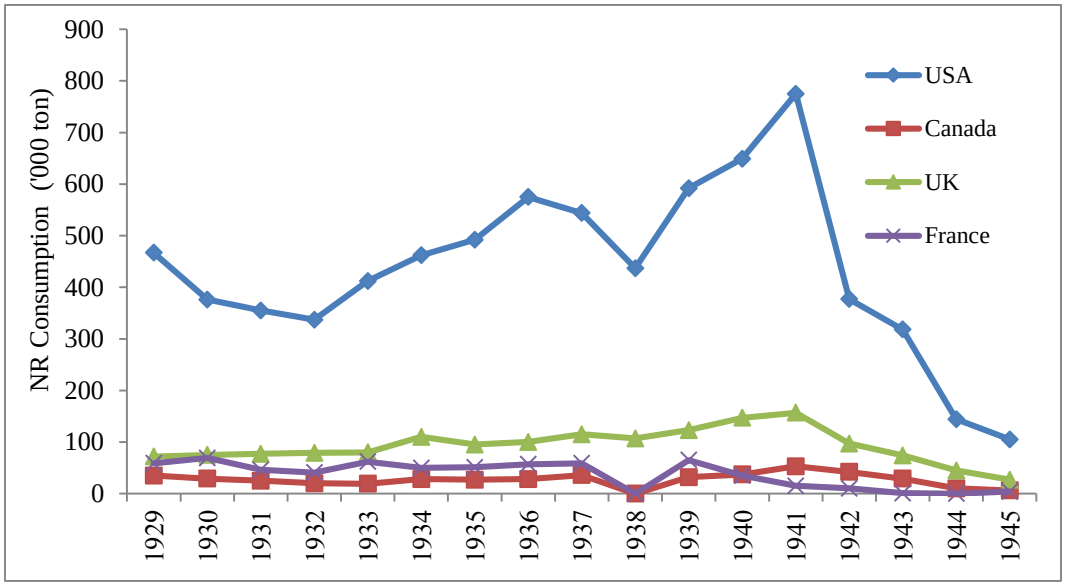

Figure 6-4 Consumption of natural rubber according to the major consuming countries during 1929-1945

Source: IRSG, 1966; Nehmer, 1959

Figure 6-4 shows that during that period USA continues to be far and away the greatest consumer constituted about half of all the rubber consumption in the world. This is due to high growth of automobile in the USA inducing a large demand for tire, tube and rubber goods. Since the 1910s, manufacture of tires and tubes has been a very large demand for rubber and later will be an increasing demand for latex form. Beside the demand of rubber from the automobile industry, there has been in recent year and will continue to grow demand for rubber from aircraft industry and the application of rubber to agriculture and households. By the U.S Census of manufacture, tires manufacturers consumed about 70% of the total rubber consumption.

The growth of other rubber industry was about 30% in year compared with only 10% in 1929. Growth of transportation determined the potential demand for rubber (Nehmer, 1959).

As the great consequence by the collapse of US economy during the Great Depression, the recession has spread through the World. Rubber consumption has declined from 816,000 in 1929 to the lowest of 703,000 in 1932, reflecting deteriorated condition of economy. The lowest of rubber consumption was 690,000 ton in 1931. The rubber price sharply declined the lowest of 75.6 dollar per ton in 1932. Output of passenger cars has reduced from 4.6 million in 1929 to 1.1 million in 1932, reflecting reduction of rubber consumption considerably.

Table 6-3 World production, consumption and price of natural rubber during 1929-1946

Year	NR production ('000 ton)	NR consumption ('000 ton)	NR Diff.	Price, New York (US Dollar/ton)
1929	874	816	58	451.5
1930	838	721	117	225.8
1931	813	690	123	134.9
1932	721	703	18	75.6
1933	865	833	32	130.1
1934	1,049	930	119	284.6
1935	843	952	-109	271.6
1936	880	1,052	-172	362.2
1937	1,185	1,109	76	427
1938	886	948	-62	321
1939	1,006	1,119	-113	385.1
1940	1,417	1,127	290	438.7
1941	1,504	1,259	245	487.4
1942	650	778	-128	496
1943	472	625	-153	496
1944	366	394	-28	496
1945	254	267	-13	496
1946	851	564	287	496

Source: IRSG, 1966; Nehmer, 1959

The reduction of consumption was high in USA from 467,000 ton in 1929 to 337,000 ton in 1932, which was 72.2% of its peak in 1929 or USA's consumption was declined about -9.64 per annul during 1929/32 as Figure 6-4. The consumption of rubber from developed countries has substantially declined. The world NR consumptions also decreased from 816,000 tons in 1929 to 690,000 tons in 1931. A few countries such as Japan have the rising trend of consumption. During 1929/32, the visible stocks become threaten disaster as Table 6-3 shows.

2.2) International Rubber Regulation Agreement (IRRA)

In order to stabilize price and to giants the deterioration of world economic conditions, British and Dutch were renewed for output control. Following negotiation between main producers, the International Rubber Regulation Agreement (IRRA) was implemented in the 7 May 1934. This agreement was a treaty by authorized signature of Governments that effect by French Republic, United Kingdom, the government of India (included Burma), Netherlands, and Siam. Barlow (1978) claimed that Siam was the less significant producer to encourage participating by output quota above potential production. The agreement dealt with the basic quotas, the limitations upon the net exports, the special provisions applicable to French Indo-China, the requirements of certificates of origin for exports and imports from or into the territories covered by the Agreement, the limitations upon the stocks which might be held within these territories, the conditions upon which the planting of rubber might be undertaken, and the prohibition of the export of rubber plants from these territories to areas to which the Agreement did not apply (McFadyean, 1944).

The first Agreement was applied during 1 June 1934 to 31 December 1943, and later the second agreement was followed closely the former agreement. This agreement includes all major plantation rubber producers which produced over 97 % of the world production in 1941. The main idea of the control scheme was to regulate export to the world's market in accordance with the estimated effective demand for rubber. As the introduction of agreement, the objective was to keep a fair and equitable price level which will be reasonably remunerative to efficient producers. Price did not reference to be directly targeted. IRRA Committee was the power to fix the permitted exportable amount for each territory, control necessary new planting and the provisions regards the visible stocks within the controlled area. The control scheme implemented by the IRRA Committee which consisted of nine delegations presenting Malaya, Netherlands, India, Ceylon, French Indo-China, India, Burma, the State of North Borneo, Sarawak, and Siam. The IRRA Committee was taken the decision by majority of voting on the matters as (McFadyean, 1944):

1) Amendment recommended to the agreement
2) Fixing or varying the permissible exportable percentage of the basic quotas
3) Fixing the percentage of the permissible new planting areas
4) Limiting replanting
5) Making, modifying or abrogating the rule of procedures

The formal regulations governing these matter and the adjustable rules in response to marketing conditions were the manner in which they were applied as Table 6-4 shows. During the commencement of regulation scheme in June 1934 to 1935, the IRRA Committee determined gradually reduction of exports.

As shown by Table 6-5, the percentage of exportable rubber was varied from 100% at June/July, 90 % at Aug/Sep, 80% at Oct./Nov, and 70% at December. The result is the reduction of world stock from 735,000 ton in 1 June 1934 to 726,000 in the end of year. In 1935, the percentage of exportable rubber was 75% at first quarter but the price was maintained that was reason to suppose a decrease of production. The committee had announced the exportable percentage at 70.0% for the second quarter that the expectation of supplied would reduce to serve the price but the price had declined. The third and fourth quarters was fixed at the same time at 65.0%. As a result, the world rubber stock was reduced to 645,000 ton in 1935 but the target was achieved at the rate of 100,000 ton per annum. Reduction of USA stock took place from 244,000 in 1934 to 180,000 in 1935 reflecting effective of the scheme as well as rapid decrease stock from stock afloat and stock waiting shipment. The average of price has been slightly declined from 284.6 in 1934 to 271.6 in 1935. It seems that the Committee strongly satisfied in effective of the scheme through the reduction of world stock, the gaining confidence for the users by its prudent policy, and discourages speculation by the moderation of its decision.

Table 6-4 Basic quotas for each territory in the control years

Unit: '000 ton

Countries	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
Straits settlements	504	538	569	589	602	632	642.5	648	651	651.5
Netherlands	352	400	500	520	540	631.5	640	645.5	650	651
Ceylon	77.5	79	80	81	82.5	106	107.5	109	109.5	110
India	6.85	12.5	12.5	12.5	13	17.5	17.75	17.75	17.75	17.75
Burma	5.15	8	8.5	9	9.25	13.5	13.75	13.75	13.75	13.75
State of N. Borneo	12	13	14	15.5	16.5	21	21	21	21	21
Sarawak	24	28	30	31.5	32	43	43.75	44	44	44
Siam	15	40	40	40	40	54.5	55.3	55.7	56	60
Total	996.5	1,118.5	1,254	1,298.5	1,335.3	1,519	1,541.6	1,554.7	1,563	1,569

Source: McFadyean, 1944

In 1936, the exportable percentage was fixed at 60% for the first and second quarter, 65% for the third quarter, and 60% for the fourth quarter. The rise in price was increased since the second quarter in 1936. The total world stock was down to 464,000 ton, which will be used only 5.5 month. Due to a reduction in stock and rising price, the decision of the committee was taken to fix the exportable percentage at 70% at the mid 1937. Price has increased from 13/4d per lb in 30 March and fell to 9d in July 1938 with regarding 4.5 month of the world stock. These raised pressure by USA governments.

The quota was 85% for the third quarter in 1937 accordance to maintain adequate supply to consumer's need. In seems that speculative activity was increased affecting on the rise in price in all commodities that was cause a shortage of spot rubber supplies. A policy of stock reduction has been dominant since the implement of the scheme and thereafter the price level has been dominant factor to decision on the exportable percentage by the IRRA committee. The IRRA Committee was permitted to increase the exportable percentage to 90% for the fourth quarter

1937 in respect to the reduction of the world stock and pressure to increase production from USA. In 1937, the Committee claimed that the scheme proposed to defeat speculation, maintain supplies and a moderate price policy. Consumption of rubber also has exceeded to above 1,100,000 tons and that has increased about 34.7% from 1936. The world rubber stock was 532,000 ton in the end 1937 which were equivalent to over 5 months' requirement.

In 1938, a tendency to low consumption of rubber by USA manufacture and its uncertainty in economic situations cause to reduce the exportable percentage of 70% for the first quarter in 1938. Because the world stock was rising that would have to be reduced, exportable of 60% was fixed for the second quarter, 60% for the second quarter and 45% for the third quarter. During the third quarter, the world stock has increased equivalent to 7.5 month but price had fallen to 225.8 dollar per ton which resulted 45% for the fourth quarter. The world rubber stock has increased to reach maximum of 568,000 ton in the first half of 1938 and soon has moved downward to 465,000 ton in the end of year. Price has decreased to the lowest of 225.8 during the mid year and thereafter rose again to 377.54 dollar per ton. The average of price was about 320.95 dollar per ton.

Table 6-5 The exportable percentage of IRRA during 1934-1941

The exportable percentage	1934	1935	1936	1937	1938	1939	1940	1941
1st quarter	100(Jun/Jul)	75	60	70	70	50	80	100
2nd quarter	90 (Aug/Sept)	70	60	70	60	50	80	100
3rd quarter	80 (Oct/Nov)	65	65	85	45	55	85	100
4th quarter	70 (Dec)	60	60	90	45	70	90	120

Remark: percentage of the basis quota
Source: McFadyean, 1944

The IRRA committee claimed that the reduction of world stock was reflected the manufacturers used their rubber stock to satisfy its requirement and the low price of their stock. In the end 1938, the agreement was renewed that revised the aggregate basic quota and unlimited replanting. The British and Dutch were strong bargaining positions on the scheme. This period had become uncertainty in both politics and economic conditions in respect to outbreak of war. The committee stated that the economic condition has been not pronounced any changes and had not intervened by sound of war. The exportable percentage had been fixed at 50% in the first to second quarter in 1939. The quota of 55% has been used for the third quarter in 1939 according to no change market conditions. The stability of price was changed from 370.65 to 327.94 dollar per ton during the first to third quarter in 1939, that the IRRA committee would be stated on the high degree of efficiency in regulating supplies. The world stock at the middle of year was equivalent to less than four months. With regarding to uncertainty of political and economic conditions before the outbreak of war, the quota has announced at 70% for the fourth quarter in 1939. The world stock of rubber was reduced during 1939 to 359,000 tons, which were equivalent about four month's consumptions. Before the exportable percentage has been announced for the fourth quarter, the barter agreement between the U.K and USA had been

interrupted, which included the 85,000 tons of rubber to exchange with 600,000 bales of cotton in equivalent value affecting on increase of rubber stock for USA. Therefore, the history of the American rubber stockpile began and has been constituted on international market for rubber. Since the outbreak of war on the 21 September 1939, price has risen to the average of 445.12 dollar per ton during the second quarter of year. The need to increase production in short run would become available that would have raised high level of exportable percentage.

During the outbreak of war after 1940, the quota has increased at 80% for the first and second quarter in response to low stock and demand for war purpose. The quota has still increased at 85% for the third and 90% for the fourth quarter in respect with the constitution of rubber stock for wartime and reserve government stock by America. The Rubber Reserve Company, which formed by the USA government has accumulated a large stock of rubber through the barter agreement with U.K government and direct to purchase a reserve stock under the committee. It was still highly accumulated all of available rubber into the stock pile in 1940 and will be purchased a large of rubber in 1941. Over 300,000 tons of rubber had already reserved in the American stockpile in the end of 1941. In fact, it seems that the Rubber Reserve Company would be purchased available of rubber within the price range at not less than 18 nor more than 20 U.S dollar cent a pound with c.i.f New York. Therefore, it allowed one to have full production since the first quarter in 1941. By the fourth quarter in 1941, the exportable percentage was 120 that mean to allow complete freedom of production, which would be able to fulfill America stockpile and the rest of international consumption. During July 1940 to the end November 1941, 2.150 million tons were available of rubber for export and no less than 1.44 million tons had reserved in American rubber stockpile. The average of price was 487.44 U.S dollar per ton. The committee stated that a large accumulation of the stock pile has been achieved through the single buying agency (The Rubber Reserve Company), the government control in commercial use in USA, and the seasonal expansion in production. The scheme has been aid to those of huge reserve stock and stability of price within the regulation scheme.

Since Japanese invasion in South-east Asia, it seems that the scheme has been terminated. Production has dropped supply of rubber in minor quantities which still exported to Japan. Ceylon and India expanded their output with limited capacity of existing trees. The USA has sought to new areas to plant rubber such as South and Central America but it had no impact on the wartime itself (McFadyean, 1944; Barlow, 1978). Despite stabilization price through administration of stock and production quota, the consumption of rubber increased in accordance with the recovery of global economy after 1932. The claims from the USA have influenced on the IRRA committee's decisions to determine the level of exportable proportion that was made benefit by the consuming countries itself. During the outbreak of War, the USA could accumulate a large stockpile with the low price. This evidence provided the loss to rubber producers. Underpin factor is political reason and control rubber with regarding to War.

In Table 6-3 the world productions were recorded level of 886,000 tons in 1938 and rose to the highest of 1,504,000 tons in 1941 or increased by about 70.0 %, reflecting responsible of supply to high price. The world consumptions also have increased from 948,000 tons in 1938 to

1,259,000 tons in 1941. American has remained a huge consumer that had increased absorption of rubber from 437,031 tons in 1938 to 1.029 million tons in the end 1941 (Nehmer, 1959).

2.3) The world supply of natural rubber

Rubber plantation is dominant to supply NR since the mid-1920s. In the early 1930s, the major producers are Malaysia, Indonesia, and Ceylon. Three producing areas accounted about 90.0 % in the total world production. Thailand, which named Siam at that time, produced approximately 0.50 % of the total. The annual average of production from Malaysia during 1930/1933 was 429,000 ton, 247500 tons from Indonesia, 62,750 tons from Ceylon and 5,000 tons from Siam.

Table 6-6 Production of natural rubber by the major producing countries during 1929-1946

Unit: tons

Year	Malaysia	Indonesia	Ceylon	Siam	Other Asia	South America	Africa	World
1929	456,000	255,000	80,000	5,000	32,000	23,000	6,000	868,000
1930	443,000	241,000	76,000	4,000	30,000	16,000	5,000	826,000
1931	422,000	257,000	62,000	5,000	27,000	12,000	3,000	801,000
1932	406,000	211,000	49,000	4,000	16,000	7,000	2,000	710,000
1933	445,000	281,000	64,000	7,000	24,000	10,000	2,000	851,000
1934	480,000	380,000	79,000	18,000	42,000	10,000	3,000	1,033,000
1935	370,000	287,000	54,000	28,000	41,000	13,000	6,000	829,000
1936	359,000	311,000	50,000	35,000	44,000	18,000	8,000	867,000
1937	493,000	434,000	70,000	36,000	57,000	21,000	11,000	1,166,000
1938	345,000	301,000	49,000	42,000	43,000	20,000	12,000	872,000
1939	360,000	378,000	60,000	42,000	60,000	20,000	15,000	1,004,000
1940	547,000	543,000	90,000	44,000	84,000	26,000	16,000	1,417,000
1941	600,000	650,000	100,000	46,000	80,000	25,000	17,000	1,594,000
1942	155,000	200,000	102,000	12,000	29,000	32,000	30,000	637,000
1943	75,000	100,000	106,000	5,000	22,000	42,000	45,000	466,000
1944	25,000	50,000	99,000	-	20,000	50,000	55,000	361,000
1945	9,000	10,000	98,000	-	18,000	43,000	45,000	246,000
1946	404,000	175,000	94,000	24,000	33,000	40,000	47,000	838,000

Source: IRSG, 1966

When IRRA was implemented in the mid-1934, the production from three main producers (Malaysia, Indonesia, and Ceylon) decreased substantially in 1935; but it was not the case for the production from Siam. During IRRA restriction period from 1935 to 1939, Table 6-6 shows that the growth of the world production was about 4.2 % per annum. The annual average production from Malaysia was 385,400 tons, 342,200 tons from Indonesia, 56,600 tons from Ceylon and 36,600 tons from Siam. Production from Malaysia under British territory declined -0.50 % per year. The growth of production has increased at a rate of 6.3 % in Indonesia, 2.2 % in Ceylon, and 10.0 % in Siam as well as other producers. Variations in production in the three major

producers have generally reflected the application of IRRA scheme and its exportable percentage. Since 1940, production substantially increased in response to release of IRRA scheme and high demand from stockpile and the outbreak war. During 1940/41, the annual average production from Malaysia was 573,500 tons or increased by about 48.8 %. There was also a large increase of production in the other producing countries: the annual average increase was 596,500 tons or 74.3 % in Indonesia, 573,500 tons or about 48.8 % in Malaysia, 95,000 tons or 67.8 % in Ceylon and 45,000 tons or 22.0 % in Siam. Increase in production reflected period of increased demand and increased prices (IRSG, 1966).

In the period of World War II, production from Asian countries except Ceylon rapidly declined because of invasion of Southeast Asia by Japan. In other hand, production from South America which was not affected by the War substantially increased from the annual average of 25,500 tons in 1940/41 to 42,000 tons in 1942/45. Production from Africa also increased over the same period from the annual average of 16,500 tons in 1940/41 to 44,000 tons in 1942/45. Production from African also increased over the same period from the annual average of 16,500 in 1940/14 to 44,000 tons in 1942/45. But these productions could be recovered to the demand for NR, however these areas seen a reduction in production after the end of war as Table 6-6.

2.4) Emergence of synthetic rubber

Intensive research on synthetic rubber (SR) began in the early 1900s by private firms in Germany due to high NR price and less accessibility to NR market. SR became strategic production to substitute NR production by the cut off NR during the WW I. The goal was to produce for domestic consumption and it was by heavily subsidized by Germany and the former USSR (Barlow, 1978).

Table 6-7 Production of synthetic rubber by major producing countries during 1937-1946

Unit: ‘000 tons

Year	Germany	The former USSR	USA	World Total
1937	3	25	1	29
1938	5	54	1	60
1939	22	80	2	104
1940	40	80	3	123
1941	70	71	8	150
1942	99	n.a	22	121
1943	118	n.a	235	356
1944	103	n.a	776	915
1945	-	n.a	833	880
1946	16	125	852	970

Source: IRSG, 1966

The USSR began to produce SR on a factory scale around 1933, Germany and the USA started later in 1937. The restriction of NR supplies under British and Dutch territories further increased to have a great strategic to anticipate of conflict and security of rubber consumption.

By 1933, about 2,000 tons of SR was produced, which was mainly produced by the former USSR Germany began to produce SR about 3,000 ton in 1937 and 1,000 tons by the USA. The former USSR has still a large production of 25,000 tons in 1937. SR rose to 123,000 ton in 1940, accounting a large proportion by the former USSR about 80,000 tons and 22,000 tons by Germany which used for the half of national rubber consumption. Only 3000 tons was being produced from the USA (Nehmer, 1959). With the outbreak of the Second World War in September 1939 and later the Japanese invasion in early 1942, these conditions further stimulated SR production in Germany, maybe the former USSR and have a huge investment in manufacture by the USA in 1940.

As Table 6-7, total world of SR production rose from 150,000 tons in 1941 to 915,000 tons in 1944 and soon fell to 880,000 tons in 1945. In Germany, overall SR production has increased to 118,000 tons that covered the three-quarters of country's volume of rubber production in 1943. The cost of SBR, which is usually used to substitute NR, was low about 550 – 900 dollar per ton while the average price of rubber was 1080.0 dollar per ton in 1941. SR consumption replaced about 30-40 % of the total rubber consumption in the last year of war. In the former USSR, SR production also has increased considerably from 80,000 ton in 1939 to 125,000 tons in 1946. NR consumption has dropped below 15% instead by SR in the former USSR at the end of the war (Nehmer, 1959; Grilli et al., 1980).

Table 6-8 Consumption of natural rubber and synthetic rubber by the major consuming countries during 1937-1946

Unit: '000 tons

	USA			Germany			UK			World consumption		
	NR	SR	Total	NR	SR	Total	NR	SR	Total	NR	SR	Total
1937	544	1	545	98	2	100	115	-	115	1,090	43	1,133
1938	437	1	438	-	5	5	107	-	107	955	56	1,011
1939	592	2	594	60	14	74	123	-	123	1,105	76	1,181
1940	649	3	652	37	40	77	147	-	147	1,110	118	1,228
1941	775	6	781	53	51	104	157	-	157	1,240	72	1,312
1942	377	18	395	42	69	111	97	-	97	765	114	879
1943	318	171	489	29	89	118	74	3	77	615	297	912
1944	144	567	711	10	80	90	45	42	87	388	739	1,127
1945	105	694	799	6	23	29	27	64	91	263	868	1,131
1946	278	762	1040	2	12	14	97	30	127	532	914	1,446

Source: IRSG, 1966

Because of Japan invasion in South East Asia that eliminated about the 90 % of the world natural rubber production in 1942, The USA government has accelerated development of new synthetic rubber industry in 1940. This implies that SR had profound impact on international rubber market, and created the constitutions on rubber market. This program has been encouraged by the Rubber Reserves Company that heavily invested a billion dollars to reach production capacity 800,000 tons in 21 April 1942. The USA government have subsidized a large amount of capital for investment and built facilities to produce SR production. Total of 51 plants invested a large capital of almost 700 million dollar which had increased a total capacity from 22,000 tons

in 1942 to 833,000 tons in 1945. Above 705,000 tons were SBR that used to substitute NR consumption. SR production has sharply increased from 3,000 ton in 1940 to 235,000 in 1942 and still reached a peak of 852,000 tons in 1946 as Table 6-7. SR consumption also changed in the same pattern as Table 6-8. As a result, the proportion of NR consumption dropped below 13% in 1945 as Table 6-9. The average cost of SR was estimated about 310 – 480 dollar per tons that has been cheaper than market price of natural market (Barlow, 1978).

Table 6-9 shows that the share of world SR consumption in total rubber consumption sharply increased from estimated 3.8% in 1937 to 76.7% in 1945 of the wartime. It is obvious that production of SR was stimulated by rapid growth of total rubber consumption during the outbreak of war. Adequate supply of SR could meet the demand for rubber during the wartime. In the USA, the substitution of SR for NR consumption rapidly increased from 0.5% to 86.9% of share between 1940 and 1945 in consistent with a major increase in capacity of SR production.

Table 6-9 Share of natural rubber (NR) and synthetic rubber (SR) in the world consumption by the major consuming countries during 1937-1946

Year	USA		Germany		UK		World	
	NR (%)	SR (%)	NR (%)	SR (%)	NR (%)	SR (%)	NR (%)	SR (%)
1937	99.8	0.2	98.0	2.0	100	-	96.2	3.8
1938	99.8	0.2	-	100.0	100	-	94.5	5.5
1939	99.7	0.3	81.1	18.9	100	-	93.6	6.4
1940	99.5	0.5	48.1	51.9	100	-	90.4	9.6
1941	99.2	0.8	51.0	49.0	100	-	94.5	5.5
1942	95.4	4.6	37.8	62.2	100	-	87.0	13.0
1943	65.0	35.0	24.6	75.4	96.1	3.9	67.4	32.6
1944	20.3	79.7	11.1	88.9	51.7	48.3	34.4	65.6
1945	13.1	86.9	20.7	79.3	29.7	70.3	23.3	76.7
1946	26.7	73.3	14.3	85.7	76.4	23.6	36.8	63.2

Source: calculated from the data of IRSG, 1966

Moreover, research was engaged to improve quality of various types of SR, to develop new SR, to reduce costs of production, and to find new applications. These researches were developed under U.S.A government regarded to government fund. The result was a growing substitutability of SR for NR. Technological development encouraged wide application of SR and further raised the SR consumption. During the periods 1935-1946, the market regulations under the IRRA scheme and the war impacted on a large expansion of SR production to ensure an adequate supply of rubber in consuming countries. The development of SR has substituted demand for NR consumption and their applications with regard to low price and advance technologies. During the war time, SR has dominated total rubber consumption in the main consuming countries. Share of NR in the total rubber consumption substantially decreased as shown Table 6-9 (Grilli et al., 1980).

3. Growth of the world rubber market and rising substitute of synthetic rubber, 1947-1960

3.1) The world rubber consumption

After WW II to 1960, the recovery of industrial production and the rapid growth of the automotive industries created strong demand for rubber that led to a period of rapid and steady growth of the world rubber consumption. Total world rubber consumption increased steadily at the average of 12.2 per annum. As Table 6-10 shows, total world rubber consumption has increased from 1.647 million tons in 1946 to 4.462.5 million tons in 1960. Developed countries account for 68% of the world rubber consumption. North America was still predominant rubber consumption due to high level of motorization. But the use of rubber has increased faster in Japan and Western Europe than in North America, reflecting the growth of the automobile industries in these regions. Moreover, rubber consumption has increased faster in Eastern Europe in respect to increase automobile production for private use by the former USSR as well as in Republic of China.

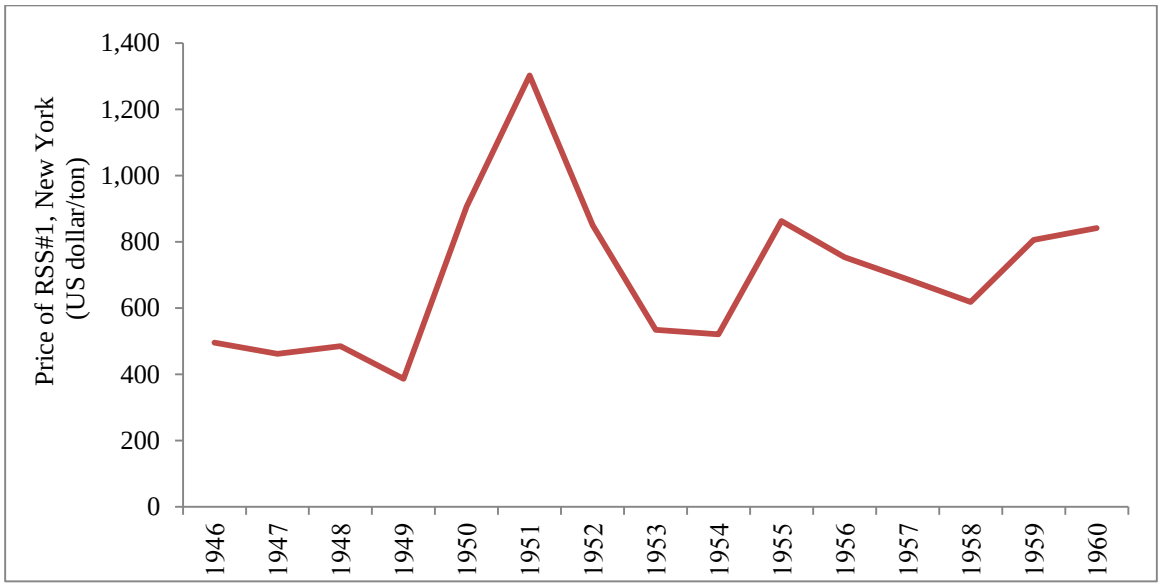

Figure 6-5 Price of natural rubber (RSS#1) at New York
Source: IRSG, 1966

Haque (1972) stated that there has been a significant relationship between the growth of rubber consumption and the growth of gross national productions (GNP) or industrial production. The countries with a high rate of growth of industrial production have even a higher rate of growth of rubber consumption. In this period, industrialization based on automobile industries has been a significant growth demand for rubber. The worldwide recession during the 1930s and the damage caused by WW II led to a sharp reduction in the rubber production and

trade. There was low recovery below market needs when motorization has increased in Western Europe and Japan during the 1950s and 1960s. These generated a large demand for rubber.

At that time, natural rubber was not only used in manufacture of tires and other automobile parts but also expanded to surgical appliances and rubber products for home use. For both natural and synthetic rubber, demand grew faster than supply. Demand for natural rubber has expanded rapidly at 6.2% per annum but the supply of the NR production expanded only at 4.3% per annum. Demand for synthetic rubber has grown at an average of about 13.7% per annum and a rapid rising supply of synthetic rubber was about 10.9% per annum (IRSG, 1966). Grilli et al. (1980) claimed that the demand gap was filled by the synthetic rubber that continued to grow at a rate about 9 % per annum from 1949. The world NR consumption has rapidly increased from 1.405 million ton in 1948 to over 2.112 million tons in 1959. The rate of growth has increased steadily at average of 3.9 % per annum from 1948 to 1960. The world NR consumption was about 1.417 million tons in 1949 to sharply rise to 1.707 million tons in 1950 in response to Korea conflict and America stockpile. This raised consumption suddenly and further increased to peak of price. From 388.6 dollar per tons in March 1950 rose steadily to a peak of 1,851.3 dollar per ton in February 1951 as Figure 6-5.

Table 6-10 World production, consumption and share of SR and NR during 1946-1960

Unit: ‘000 ton

Year	NR production	NR consumption	SR production	SR consumption	Rubber production	Rubber consumption	SR ratio	NR ratio
1946	867.0	590.0	970.0	1,057.5	1,837.0	1,647.5	64.2	35.8
1947	1,275.0	1,132.5	747.5	805.0	2,022.5	1,937.5	41.5	58.5
1948	1,547.5	1,405.0	745.0	690.0	2,292.5	2,095.0	32.9	67.1
1949	1,507.5	1,417.5	680.0	687.0	2,187.5	2,104.5	32.6	67.4
1950	1,887.5	1,707.5	787.5	835.0	2,675.0	2,542.5	32.8	67.2
1951	1,915.0	1,550.0	1,200.0	1,100.0	3,115.0	2,650.0	41.5	58.5
1952	1,817.5	1,505.0	1,195.0	1,197.5	3,012.5	2,702.5	44.3	55.7
1953	1,757.5	1,707.5	1,307.0	1,237.5	3,064.5	2,945.0	42.0	58.0
1954	1,832.5	1,842.5	1,162.0	1,175.0	2,994.5	3,017.5	38.9	61.1
1955	1,950.0	1,927.5	1,542.5	1,522.5	3,492.5	3,450.0	44.1	55.9
1956	1,922.5	1,860.0	1,675.0	1,592.5	3,597.5	3,452.5	46.1	53.9
1957	1,935.0	1,920.0	1,732.0	1,732.5	3,667.0	3,652.5	47.4	52.6
1958	1,972.5	1,950.0	1,722.0	1,727.5	3,694.5	3,677.5	47.0	53.0
1959	2,072.5	2,112.5	2,142.5	2,070.0	4,215.0	4,182.5	49.5	50.5
1960	2,035.0	2,115.0	2,447.5	2,347.5	4,482.5	4,462.5	52.6	47.4

Source: IRSG, 1966

America stockpile was key factor for a large accumulation of rubber stock. This boom was over two years (Barlow, 1978). After the post Korea conflict, a large world NR visible stock rose again of which mostly recorded in USA and UK that followed to drop the world NR consumption during again in 1951 and 1952 due to restriction of a high minimum content of SR. Restriction by the US government was released on content in 1953, which the consumption of NR increased to 1.842 million ton in 1954.

The world NR consumption has slightly increased to reach a level of 2.11 million tons in 1959, indicating steady expansion of NR consumption to compare with high growth of SR consumption. Accordingly, Price declined slowly in the early 1954 and rose again the end of that year as Figure 6-5. Trends in the world NR consumption closely followed that of production. Consequently, share of natural rubber in the world rubber market declined from 67.4 in 1948 to 47.4 in 1960. Share of natural rubber in USA has dropped from 58.66 in 1948 to 30.7 in 1960. In most other countries, natural rubber's share in demand for rubber falls in the range of 40 – 50 %. At the same time, the consumption of USA and UK, the largest consumers of rubber since 1900s, dropped from 61.4 % in 1948/49 to 42.2 in 1960 as shown in Table 6-10 (IRSG, 1966).

In detail of main consumers, USA was still dominant natural rubber consumption of 637,400 tons in 1948 or 45.4% of the world natural rubber consumption's share in 1948 and declined to 23.0 % of the world natural rubber consumption in 1960. The rapid growth of natural rubber consumption from other countries was Japan and Western Europe as Table 6-11 shows.

Table 6-11 Consumption of natural rubber according to the major consuming countries during 1946-1960

Unit: '000 ton

Year	USA	UK	France	Germany	Japan	China	Other	Total
1946	282.1	98.2	30.2	1.7	20.0	10.0	147.8	590.0
1947	571.7	156.1	62.2	8.2	17.6	20.0	296.7	1,132.5
1948	637.4	196.8	87.9	46.3	27.1	22.5	387.0	1,405.0
1949	583.7	187.2	92.6	67.0	35.9	25.0	426.1	1,417.5
1950	731.9	223.2	104.3	79.9	61.0	35.0	472.2	1,707.5
1951	461.3	238.0	121.2	93.0	58.2	40.0	538.3	1,550.0
1952	461.1	200.4	123.6	95.0	65.6	42.5	516.8	1,505.0
1953	562.4	223.1	116.7	107.9	88.7	45.0	563.7	1,707.5
1954	605.9	248.2	129.0	132.1	89.6	47.5	590.2	1,842.5
1955	645.0	252.3	136.5	150.0	87.4	50.0	606.3	1,927.5
1956	571.1	203.4	136.8	136.1	110.7	55.0	646.9	1,860.0
1957	547.4	189.9	137.4	138.2	130.3	65.0	711.8	1,920.0
1958	492.3	185.3	139.1	131.4	129.9	75.0	797.0	1,950.0
1959	564.0	187.3	135.6	146.4	161.2	87.5	830.5	2,112.5
1960	486.7	182.8	129.4	148.0	168.4	97.5	902.2	2,115.0

Source: IRSG, 1966

Before the outbreak of Korean War, it was a one factor influencing on initial recovery of natural rubber production and price. The Korean War fears of a possible rubber shortage in USA, the US government decided to accumulate rubber stockpile again. Import of natural rubber from USA rose from 665,000 ton in 1949 to 815,400 ton in 1952 and fell sharply to 649,500 ton in 1953, which resulted stock of rubber rose from 74,400 tons in 1950 to peak at 354,300 tons in 1952. In the early 1950s, natural rubber price have been fluctuating fairly rapidly and have been characterized by the intervention of stockpile and market forces. The average of natural rubber price was 387.1 dollar per tons in 1949 and rapidly rose to peak of 1,302.3 dollar per tons in

1950. A large accumulation of rubber into stockpile in respect with war reasons and politics have boom price from 388.6 dollar per ton in the early 1950 to the highest of 1,851.9 dollar. The price rise continued through most of 1951 at the average of 1,302.9 dollar per tons and declined to the lower of 850.3 in 1952. It was reflected that the Korean War stimulated a great boom in the rubber price including underpin by the growth of world economic and expansion of automobile industry. The price of 521.2 dollar per tons in 1954 was the lowest price in this period and thereafter has steadily increased to 841.3 dollar per ton in 1960 with high competitive price from synthetic rubber as Figure 6-5 shows.

During the late 1950s to 1960s, the US's share in total import of natural rubber decreased significantly from 50 % in 1948 to 22.0 % in 1960 as well as UK fell from 13.0 to 7.0 % in 1960. Share of natural rubber had replaced by synthetic rubber. Other developed counties have increased their share of natural rubber consumption such as in France, Germany, Other Europe, and Japan namely from 3.0 % in 1948 to 9.0 % in 1960. The share of import natural rubber from developing countries also had climbed from 17.0 % to 32.0 % in 1960. Therefore, the other areas of the world have been increasing their relative share of natural rubber consumption accounted on the growth of rubber consumption in this period. Including, natural rubber producers succeeded in slowing down the declined in their market share by raising productivity. Natural rubber producers emphasized to improve yield, plantation, processing techniques, marketing arrangement and strengthen domestic consumption. It was combined achieve a steady growth of natural rubber in this period (Grilli et al., 1980).

3.2) SR Industry becoming strategic development of the developed countries

Before outbreak of Korean War, the US government also provided support to a large synthetic rubber industry and became the major force behind the recovery of the industry from its post war slump. With regarding the development of technological breakthrough, it not only helped to improve quality and profitability but also enforced to the rapid expansion of the synthetic rubber industry. A large scale production, massive research, and marketing effort helped to be able to maintain growth of SR industry after the 1950s. Synthetic rubber production had spread from USA and Canada to Western Europe and Japan. Western Europe began to produce a large scale in the early 1960s while Japan production began in the mid 1960s. Consequently, share of synthetic rubber had climbed to 20 % in Europe's share in the world synthetic rubber production and about 7 % for Japan. In North America, market share of SR consumption has increased from 41.34% in 1948 to 69.26% in 1960 and later extended through the 1960s. In Western Europe and Japan, market share of SR consumption had risen to level ranging from 26 to 40 % in 1960 as Table 6-12 (IRSG, 1966; Barlow, 1978).

Since the end WW II, the restoration of NR production pressures to reduce SR production. Synthetic rubber production did not spread to developing countries until the late 1960s and accounted about 3.5 % of the world synthetic rubber production. The growth in production of synthetic rubber has not been constant.

After the immediate post-war, synthetic rubber production declined in response to supplies of natural rubber became more available and competitive prices. Synthetic rubber output declined from 970,000 ton in 1946 to 680,000 ton in 1949. After the outbreak of Korea War, it was boom again. Synthetic rubber production has increased over 1.200 million ton in 1951 and followed a reduction in output in 1954. The very slow response to demand of natural rubber output also encouraged SR production. Later, SR has increased each year at the average of 15.8 % per annum, which rose SR production to 2.447 million tons in 1960.

Table 6-12 Production of synthetic rubber by the major procuring countries during 1946-1960

Unit; '000 ton

Year	USA	Canada	Germany	USSR	UK	Other	Total
1946	751.9	51.8	15.9	125.0		25.4	970.0
1947	516.9	43.1	8.3	155.0		24.2	747.5
1948	496.2	41.1	3.4	177.5		26.8	745.0
1949	400.0	47.4		200.0		32.6	680.0
1950	483.8	59.4		205.0		39.3	787.5
1951	858.7	63.3	0.9	227.5		49.6	1,200.0
1952	811.4	75.5	5.0	245.0		58.1	1,195.0
1953	862.1	82.2	6.4	292.5		63.8	1,307.0
1954	632.8	88.0	7.1	367.5		67.1	1,162.5
1955	986.0	105.6	11.1	367.5		72.3	1,542.5
1956	1,096.9	122.6	10.9	372.5		72.1	1,675.0
1957	1,136.1	134.3	11.8	375.0	0.8	74.5	1,732.5
1958	1,071.5	137.3	23.1	375.0	11.5	103.6	1,722.0
1959	1,401.8	102.3	48.9	395.0	57.2	137.3	2,142.5
1960	1,459.5	162.2	81.1	420.0	91.8	232.9	2,447.5

Source: IRSG, 1966

Total SR production in USA fell to reach a low point at 400,000 tons in 1949. The reduction was mainly general purpose of SR but it should maintain through government action to ensure long-term self-sufficiency in rubber. The minimal annual usage of 220,000 tons of SBR has stipulated and to maintain plant capacity at least 650,000 tons, that lead to accumulation of an NR stockpile during the outbreak of Korean War. For USA, SR capacity has increased since the disposal of the Government's plant. SR production for general purpose capacity totaled almost 1.4 million tons. This capacity has obviously been larger than the growth of demand, which have reported the unused capacity. It is interesting to note that SR capacity will have increased to around 2.5 million tons in the end 1960. The major increase in capacity will occur in Europe that added from 30,000 tons in 1957 to over 200,000 tons in the end 1958; capacity is expected to increase over 300,000 tons in 1960 and around 500,000 tons in 1965. UK will have the largest capacity about 175,000 tons, Germany with about 130,000 tons, France 75,000 tons, Italy 60,000 tons, etc. The former USSR also have a large SR capacity about 770,000 tons in the end 1960 as Table 6-13 shows. In addition, it has SR plant under construction in Japan and China. There will be

adequate SR capacity and rapid expansions of SR production in this period that will influence on supplied of and demand for natural rubber in next period (Barlow, 1978).

After the post war, the world SR consumption has increased from 690,000 tons in 1948 to peak of 1.1 millions in Korea War and further rose to 2.347 million tons in 1960. The growth rate of the world SR consumption was about 18.5 % per annum between 1948/60. In the composition of overall SR consumption, USA was a majority of SR consumption with about 65 % of the world SR consumption and declined to 47 % of the world SR consumption, which consumed more SR than NR. SR consumption in USA has increased by 449,200 tons in 1948, rose to 820,000 tons during the Korea War, and fell to 646,900 tons in 1954. Thereafter, it was steadily increased consumption to over 1.089 million tons in 1959. The rate of growth for SR consumption was estimated at 11.08 % per annum. During 1946-1950, the share of SR consumption declined to 43.97 % per annum due to the rise NR consumption by NR import over this period.

Table 6-13 Consumption of synthetic rubber by the major consuming countries during 1946-1960

Unit: '000 ton

Year	USA	UK	France	Germany	Australia	Japan	China	Others	World
1946	773.9	30.6	29.2	12.0	4.5			207.3	1057.5
1947	568.6	2.8	12.7	8.0	0.2			212.7	805
1948	449.2	2.6	7.5	4.5	0.2			226.0	690
1949	421.0	2.4	8.5	2.3	0.2			253.1	687.5
1950	546.9	2.8	7.5	3.4	0.2	0.1		274.1	835.0
1951	771.1	3.9	8.8	5.3	0.2	0.3		310.4	1,100.0
1952	820.0	5.0	11.4	10.0	0.2	0.8		350.1	1,197.5
1953	797.4	4.9	13.1	11.7	0.3	1.7		408.4	1,237.5
1954	646.9	9.6	14.7	17.3	0.5	2.1		483.9	1,175.0
1955	909.2	21.6	19.8	25.8	1.2	4.3		540.6	1,522.5
1956	888.4	41.8	32.1	36.6	9.5	9.0		575.1	1,592.5
1957	940.7	60.1	50.7	47.7	15.5	12.9		604.9	1,732.5
1958	894.0	66.0	56.0	55.2	17.0	16.8		622.5	1,727.5
1959	1,089.9	81.5	67.3	74.6	20.0	35.0	2.5	699.2	2,070.0
1960	1,096.6	117.7	92.2	106.1	24.3	61.6	7.5	841.5	2,347.5

Source: IRSG, 1966

Other developed countries have been low SR consumption during 1946/54 and soon SR consumption has rapidly increased more than double in 1955. It was shifted again in 1960 with regarding to their outputs of plants. The Korea conflict may accounts for the high level of rubber consumption for military purpose during this period. SR consumption has been increasing important role and substantially increased taking place in Europe and Japan. The growths of SR consumption in this period have been not only relationship between economic growth and

growing of rubber consumption leading by automotive industry but also start production of their SR plants in each of the main consuming countries (Grilli et al., 1980; Barlow, 1978).

Although total substitution of NR by SR is not possible, the market for NR and SR is highly competitive and prices influence the consumption of NR and SR. Table 6-14 shows that the average of SBR price was lower than NR and has been stable price of 18.5 cents/lb in 1947/1949 and 23.0 cents/lb during 1953/58. Fluctuation of NR price was high. The average of NR price was 20.19 cents/lb in 1948 and declined to 16.12 cents/lb in 1949. After the Korea war, price has increased from 22.45 cents/lb to 38.40 cents/lb in 1955 and slightly declined to 26.38 cents/lb in 1938. Relative prices of SR and NR were characterized by a view of the relative consumption of both rubbers under restriction of the US government.

Table 6-14 Price of NR and SR, consumption share by USA during 1947-1958

Year	Natural Rubber		Synthetic Rubber	
	NR Price (c.i.f New York, cents/lb)	% of consumption	SBR price (fob, New York cents/lb)	% of consumption
1947	19.01	50.1	18.5	49.9
1948	20.19	58.7	18.5	41.3
1949	16.12	58.1	18.5	41.9
1950	n.a.	57.2	n.a.	42.8
1951	n.a.	37.4	n.a.	62.6
1952	n.a.	36.0	n.a.	64.0
1953	22.45	41.3	23	58.7
1954	23.32	48.3	23	51.7
1955	38.4	41.5	23	58.5
1956	33.47	39.1	23	60.9
1957	30.55	36.8	23	63.2
1958	26.38	35.7	23	64.3

Source: IRSG, 1966; Nehmer, 1959

During June 1941 to May 1953, the US government controls all amounts of NR and SR but the manufacturers have been free to choose between the use of SR or NR. During December 1950 to July 1952, the US government was a major importer of NR. During 1947 to 1949, NR price was lower than SR price that has been price competitive with SR and NR consumption has therefore increased. Since 1954, NR price was higher than SR price while SR price was stabilized at 23.0 cents/lb. Consequently, SR's share of total rubber consumption substantially increased from 51.7 % in 1954 to 64.3 % in 1958. Competitiveness of SR raised to continue slowdown in NR's share of the world rubber consumption.

A key reason to establish SR industry in the consuming countries was national development strategy with recognition sufficient supply of rubber and for securing to anticipate with the future and uncertainty. SR industry has initially been a large subsidy by government that could have advantage the competitive in price and share in the rubber consumption (Grilli et al., 1980). The competition between NR and SR will discuss in next section.

3.3) The world supply of natural rubber

The production of natural rubber is concentrated in Southeast Asia. The three major producers, Malaysia, Indonesia, and Thailand, accounted for over 80 % of the world production. The major producers fully recovered for the natural production in 1947. In Malaysia, after the WW II, production of natural rubber recovered rapidly to peak of 707,000 tons in 1947, rose to 784,600 tons in 1950, fell to the lowest of 623,400 tons in 1953, and recovered to 764,000 tons in 1960 as Table 6-15.

Table 6-15 Production of natural rubber by the major producing countries during 1946-1960

Unit: ‘000 tons

Year	Malaysia	Indonesia	Thailand	Sri Lanka	Vietnam	Others	World
1946	437.5	178.0	25.0	95.5	13.7	117.8	867.5
1947	707.0	282.4	53.9	90.5	25.5	115.7	1,275.0
1948	769.1	439.3	95.7	96.5	28.3	118.6	1,547.5
1949	740.4	440.0	96.4	91.0	25.1	114.6	1,507.5
1950	784.6	707.7	114.5	115.3	33.9	131.5	1,887.5
1951	678.8	827.5	111.1	106.7	37.3	153.6	1,915.0
1952	643.4	762.5	99.9	98.0	45.6	168.1	1,817.5
1953	623.4	705.7	97.6	100.2	53.3	177.3	1,757.5
1954	635.2	756.3	112.1	95.4	54.9	178.6	1,832.5
1955	707.7	748.9	132.8	95.3	66.3	199.0	1,950.0
1956	678.1	697.7	136.2	96.9	70.2	243.4	1,922.5
1957	688.7	695.5	133.0	99.7	69.7	248.4	1,935.0
1958	706.9	696.2	140.6	101.8	71.7	210.3	1,927.5
1959	745.9	704.6	174.0	93.2	75.4	279.4	2,072.5
1960	764.0	620.0	170.8	98.8	76.6	309.8	2,040.0

Source: IRSG, 1966

After 1950, the decline in production was due to the first internal insurrection during which estates operations were disrupted and rubber slashed and then to declining yields of old trees and their replacement with new high yield trees. Variation in production is affected by several factors both the diminishing yield, the replanting, economic situation and political reasons in countries. The growth rate of production was about 0.60 % per annum. In 1957, approximately 75.0 % of productions come from estates and the balance was small holding which yields are the same as estate yield and a bit differ in the quality of product. Smallholder owned about 1.50 million acres or 42.0 % of the total. In this period, replanting of old or low yield trees with high yield clone has become a major activity in Malaysia (Nehmer, 1959; Barlow, 1978).

Indonesia has become the leading producers of natural rubber just before the outbreak of Korean War. Because of the advent of the war and the political problems after immediate post-war period, rubber production was lagged behind that of Malaysia. Natural rubber production sharply increased from 282,400 tons in 1947 to peak of 827,500 tons in 1951 and thereafter fell steadily to 620,000 tons in 1960. Until the peak of production during 1951, Indonesia again

becomes the largest producers of natural rubber, after that time the production has been downward trend. It was reflected the large proportion of smallholders and the inadequate level of replanting. About two-third productions accounted by smallholders that have poor cultivation, using low-yield material, and the poor quality of product. Estates, which owned by Dutch, is in much more favorable position than small holders with regarded to yield and quality but estates face seriously problem related to Dutch-Indonesian political relations and lease land nearing expiration which adversely affected on their production, new investment, and slightly replanting.

In Sri Lanka, during the WW II, production expanded substantially because the country was not directly affected by the War. Production declined at the end of war but increased again during the Korean conflict in response to high price. Production has leveled the annual average of 98,500 tons per annum. In 1957, about 50.0 % of areas were estates which accounted above 80.0 % of total production. Estates have been high yield and good quality of production but they faced the nationalization and decline in a large landholding. Production from smallholding was poor similar to those in Indonesia. The government established replanting program and instituted a subsidy program to replanting in 1953 but it has lagged to expansion of replanting.

In Thailand, the growth on rubber production has been rapid since the pre-war period. After the war, production rapidly increased from 53,900 tons in 1947 to 114,500 tons in 1950, fell steadily to 97,600 tons in 1953, and increased steadily to 170,800 tons in 1960. The growth rate of production was by about 15.5 % per annum. IRSG indicates that 90 % of the rubber land was smallholding in 1954. Over the period around 90 % or more of Thailand's annual production has generally been exported to the USA and declined to 76 % in 1957. In 1955, a replanting program was under consideration but was not approved by the government. New planting are taking place for increase of production (Nehmer, 1959; IRSG, 1966).

In 1960, Malaysia's share in the world production was about 37.5 %, 30.4 % from Indonesia, 8.4 % from Thailand, and 4.8 % from Sri Lanka. The proportion of the world production accounted by Malaysia declined while Indonesia increased in this period. During that period, natural rubber was mostly produced by smallholders. Most of rubber estates previously owned by European companies have been returned to local companies or government authorities. IRSG (1992) estimated that 63 % of the rubber produced in Indonesia and 42 % of that produced in Malaysia was accounted for by smallholding in 1957. The major producing countries: Malaysia, Indonesia, and Sri Lanka faced low-yield trees that need to replace with high yield clone.

4. Market uncertainty and high competition in the world rubber markets, 1961-2000

4.1) The world rubber consumption

The world rubber economy strongly depends on global economic and relatively influenced by the development of industrial output in particular vehicle industries and non-tires industries. The consumption of rubber has grown following the growth of industrial production in developed countries and industrialization in developing countries. Since the end of the WW II, the world economic growth and the recovery of industrial production created a strong demand of rubber. The rapid growth of automobile and non-tire industries in Western and Japan parallel with the expansion of automotive production in North America are key drivers of high rubber consumption (Grilli et al., 1980). The world rubber consumption almost doubled in each decade up to 1970 after that rate of growth slowed in the 1980s-1990s as shown in Table 6-16. It raised high consumption once more during the 2000s regarding to industrialization and open economy of China and Asian counties.

The world rubber consumption as combine of natural rubber (NR) and synthetic rubber (SR) has increased dramatically during 1960s which total consumption of rubber increased 9.6 per annum. The world rubber consumption doubled from 4.42 million tons in 1960 to 8.7 million tons in 1970. The world recession in the early 1980s depressed the rubber market. The rubber consumption increased steadily with a compound annual growth rate of 1.9 % during the 1980s. The rubber consumption increased from 12.54 million tons in 1980 to 14.51 million tons in 1990. The recession of global economy continued slowdown trend along the period 1990s, which resulted the world rubber consumption steadily increased from 15.22 million tons and still rose to 18.145 million tons in 2000. During the early 1990s, rubber consumption declined in the Western Europe and well performing consumption in North America and Asia. A broad picture of the development of rubber consumption is the world rubber consumption has increased at the annual average growth of 3.5 per annum during 1960-2000. There has been a decade of suffer for rubber economy during the 1980s-1990s. These consumption movement reflected macroeconomic developments, which was influenced by disparate regional economy. At the beginning of the period, the economy was driven by North America and Western Europe which declined in share during the 1980s. Japan and Asian economies became dominant during 1980s-1990s. But then China and new developing countries emerged with a large share consumption during the 2000s and next period (IRSG, 1992, 2002).

Before the 1980s, the developed countries rubber use grew about 6.0 per annum and accounted for 63 % of total world rubber consumption, out of which Japan and Western Europe increased faster than America reflecting the high growth of Automobile industries in these regions. The data indicates that the rubber consumption also increased rapidly in China during the 1950s-1960s but the available data is low.

Table 6-16 World production, consumption, and share of SR and NR during 1960-2000

Unit: ‘000 ton

Year	World Production	World Consumption	Share of SR (%)	Share of NR (%)
1960	4,490	4,420	52.9	47.1
1961	4,680	4,710	53.1	46.9
1962	4,995	5,020	55.0	45.0
1963	5,255	5,290	56.9	43.1
1964	5,860	5,700	60.4	39.6
1965	6,150	6,160	60.6	39.4
1966	6,635	6,710	61.5	38.5
1967	6,890	6,790	62.6	37.4
1968	7,640	7,700	63.0	37.0
1969	8,530	8,300	64.2	35.8
1970	9,020	8,700	64.5	35.5
1971	9,355	9,310	66.5	33.5
1972	9,930	10,000	67.6	32.4
1973	11,295	11,030	68.6	31.4
1974	11,050	11,060	67.5	32.5
1975	10,230	10,470	67.5	32.5
1976	11,655	11,490	68.9	31.1
1977	12,285	12,360	69.7	30.3
1978	12,730	12,600	70.2	29.8
1979	13,240	13,120	70.5	29.5
1980	12,540	12,540	69.9	30.1
1981	12,230	12,290	69.7	30.3
1982	11,580	11,710	68.7	31.3
1983	12,330	12,350	67.4	32.6
1984	13,315	13,280	67.7	32.3
1985	13,360	13,420	67.1	32.9
1986	13,750	13,740	67.5	32.5
1987	14,310	14,400	66.7	33.3
1988	15,180	14,950	66.4	33.6
1989	15,250	14,840	65.4	34.6
1990	15,030	14,510	64.2	35.8
1991	14,440	14,430	64.7	35.3
1992	14,700	14,720	63.4	36.6
1993	14,900	14,030	61.7	38.3
1994	14,520	14,490	61.2	38.8
1995	15,550	15,220	60.9	39.1
1996	16,200	15,670	61.0	39.0
1997	16,550	16,460	60.8	39.2
1998	16,700	16,440	60.0	40.0
1999	17,203	16,840	60.6	39.4
2000	17,580	18,145	59.3	40.7

Source: IRSG, 1992, 2002

4.2) Substitutions and competitions between SR and NR

The damage caused by WW II had led to sharp reduction in rubber plantation and production potential of NR was far below market needs when the motorizations in Western Europe and Japan during the 1950s and 1960s that generate a large demand for rubber. During the 1948-1973, the world synthetic rubber production increased more than 9.0% per annum while natural rubber production grew less than 3%per annum. The demand of synthetic rubber expands rapidly to grow about 9 % per annum. When the outbreak of Korea War has possible to fear rubber shortage, USA decided a large support for synthetic rubber industry. Including technological change resulted great structural changes in the world rubber economy. The major forces behind the expansion of synthetic rubber gained continually large production, low cost, massive research, development and market effort and predominant use in the world market. Production of synthetic rubber was a forward vertical integrations with petro chemical producers and backward integration by tire manufacturers. There was a competitive advantage in the world market. Synthetic rubber production speared quickly from USA and Canada to Western Europe and Japan. Western Europe began to produce synthetic rubber on a large scale in the early 1960s and the mid 1960s for Japan, which resulted of increasing share of synthetic rubber to 20% for Western Europe, 7% for Japan, and 70% for USA. These trends extended through the early 1970s to continue dominant rubber market by synthetic rubber. Until the late 1960s, the developing countries were the first to establish their own synthetic rubber such as Brazil and India and followed by Argentina, Mexico and Korea that account for about 3.5% of world synthetic rubber production. Since 1960, SR's share in the world consumption of SR was higher than NR and substantially increased from 53.0 % in 1961 to 60.4 % in 1964 and reached to 70.5 % in 1979. There has been structural change of the rubber market in the global (Barlow, 1978; Grilli et al., 1980).

In other hand, after the post war, the consumption of natural rubber increased at 3.3 % per annum during 1948-1973 while the consumption of synthetic rubber increased at 9.3% per annum. Share of natural rubber dropped from 57.3% in 1951 to 32.7% in 1971. The market share of natural rubber dramatically declined in USA rather than Western Europe and Japan. It indicated steady innovation and strong market for synthetic rubber. In parallel, natural rubber risen their productivity through more emphasize on research into high-yield clone. Even slowdown share of the world rubber consumption, the development in plantation, processing technique, marketing arrangement and new products helped to achieve a steady growth about 3% per annum. As consequence of replanting, natural rubber yield increased dramatically from the mid-1950s to mid-1970 to allow NR to withstand the market pressure caused by continuously falling SR price.

Moreover, the competitive standing of NR was improved by the introduction of technical specified rubber grade for NR or TSR. Rubber block have identified technical tests. This produce blocks rubber which was then graded by the new method. TSR accounted for over one-third of rubber export during 1970s and will be increased. These rubber save transport, handling, and

storage cost for both producers and users to gain direct economic and technical use in manufacturers. The introduction of TSR can demonstrate that NR has been ability to meet the changing requirement of market (Grilli et al., 1980; Pee, 1982). This is the time for competition between SR and NR.

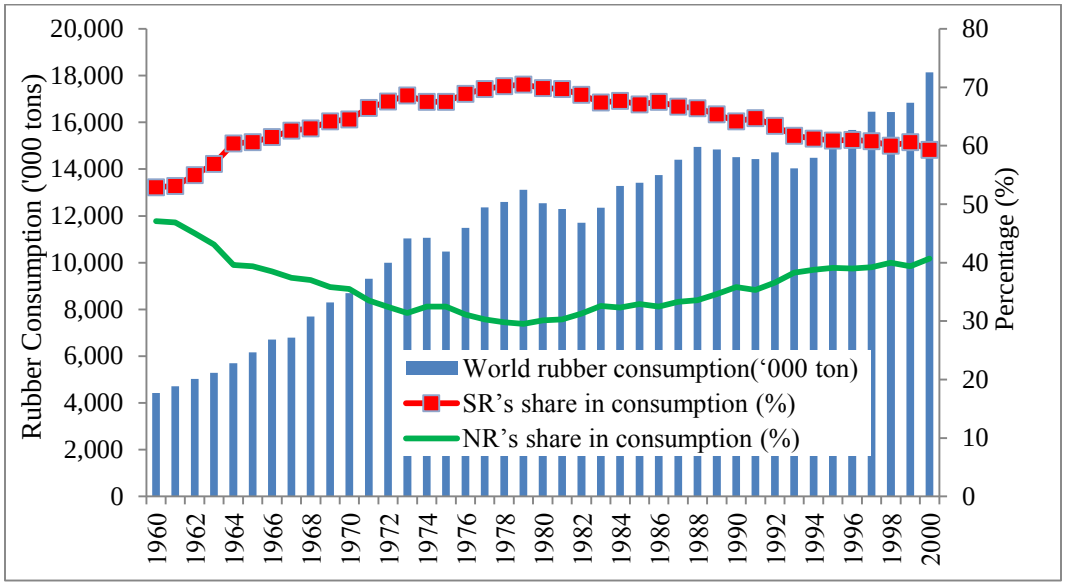

Figure 6-6 The evolution of the world rubber consumption, share of SR and NR during 1960-2000

Source: IRSG, 1992, 2002

SR could be advantage more than NR at two levels: availability and price. Synthetic rubber producers were able to rapidly increase their supplies to meet the growth of market needs and were able to reduce the production cost and price of their product. Technological innovation and scale economies played a considerable role in making synthetic rubber less expensive to produce. However, the key to success of the industry was seemingly unlimited availability of chemical monomers at continuously declining prices. Synthetic rubber price declined sharply over 40% during the 1960s while natural rubber price followed. It seems that change in relative price did encourage substitution of one type of rubber for another. Moreover, these products presented the different supply elasticity: the supply of natural rubber is more prices inelastic in the short run than that of synthetic rubber. Demand for all rubber which is by nature a derive demand is quite insensitive to price change but very sensitive to change in aggregate economic activity. Synthetic rubber production can adjust their supplies to variations in market demand is much greater than that of natural rubber (Grilli et al., 1980).

The first critical event occurred in 1973 when the world rubber economy suffered its first severs exogenous shock: oil crisis and subsequent sharp rise in crude oil price. It was a major force affecting on cost of SR production when the sudden drastic increase in crude oil and feedstock reflected a major change in production cost and price of SR. NR was less affected directly but was still subject to all the indirect effect of the oil crisis such as the world inflation,

change in consumer expectations, and rising doubts about long term demand for automotive sector. In 1974-1975, the serious economic recession strongly affected the industrial countries that also doubted concerning the future of rubber industry. The output of automotive industry and industrial production in general fell dramatically of which caused decline in demand for rubber consumption.

The second critical events also was marked in 1978-1979 when the price of crude oil sharply increased again which bring the cumulative price increase since 1973 to more than 400%. The sharp rise in crude oil prices affected the production cost of SR much more than that of NR. The production cost of SR depends heavily on the costs of chemical feedstock, which was increased more than double. The average of production cost of SR increased about 75-100%. However, the direct effect of the oil price change on the production cost of NR was relatively increased less than 10%. The long term cost competitiveness of NR appears to have been strengthening even further by the recent drastic change in crude oil price. The crude oil price increase expected in the 1980s will further improve the long term competitiveness of NR due to the high cost of SR.

However, the economic slowdown in the most developed countries severely declined the world rubber demand for all rubber since 1974. Output of automotive industry was heavily affected to low production. Consequently, consumption of rubber declined substantially. The world rubber consumption remained at the same level as in 1973. From the excess demand at the beginning of the year of 1974, price of SR declined by 10-15% in the second half of 1974 and natural rubber price also continued slide downward. In term of rubber consumption, NR is a typical export commodity about 90% of the world production is exported. The use of producers was about 8.5% in 1974 compare with 2.5 in 1954. In contrast, SR is used mostly in the producing countries. About 25% of the world production is exported. Developed countries are still the main importers of NR but their import share has decreased substantially during 1960-1980 from 67.2% in 1950 to 35.8% in 1970 and fell to 29.5% in 1980. This decline trend appears to have change in the early 1980s because of the increased demand for NR resulting from the introduction of radial tires in North America and Japan. At the same time, developing counties have increased their share of NR imports namely from 5.8% in 1955/57 to 9.5% in 1972/74. Trade of SR is relation to the volume of production of which produced among developed countries. Developed counties account for 87% of the world exports and 74% of world import. USA is the largest net exporter of SR and later has replaced by Japan. Developing countries are the largest net importer of SR (Pee, 1982).

4.3) The world consumption of natural rubber

In this period, the consumption of NR is the same as the previous period. Over 70% of NR consumption used in global tire industry and the rest to consumer goods and rubber industrial parts. Due to dominant use by tire industry, the rubber industry is very heavily depends upon trends in the automotive industry. As shown by Figure 6-7, in this period before the first oil

crisis, the growth of NR consumption has increased from 2.080 million tons in 1960 to 3.460 million tons in 1973. The growth of NR consumption was about 4.74% per annum much lower than the high growth of SR that was about 15.96% per annum. The developed countries were major consuming countries accounting a large share from USA, Europe and Japan. USA was the largest absorbing the world rubber. UK used to be the second largest consumer but it has declined and surpassed by Japan and China. Japan's share in the world consumption of NR was about 8.0 % in 1960 and steadily increased to 9.5 % in 1970.

For Europe, the pattern of consumption has not varies since 1960. The level of consumption marginally increased in France, Germany, and Italy of which these countries presented decline in proportion of the world NR consumption. Other countries in Western Europe have increased as well as Eastern Europe and USSR. The relative decline in NR consumption in developed countries has been accompanied by an increase in relative consumption in the developing countries. The developing countries have strongly grown in the NR consumption. During the early 1970s, it has been estimated that for the world as whole about 68% of NR was used in the tires industries and automotive parts. This trend was increased until 2010 (Grilli et al., 1980; IRSG, 1992).

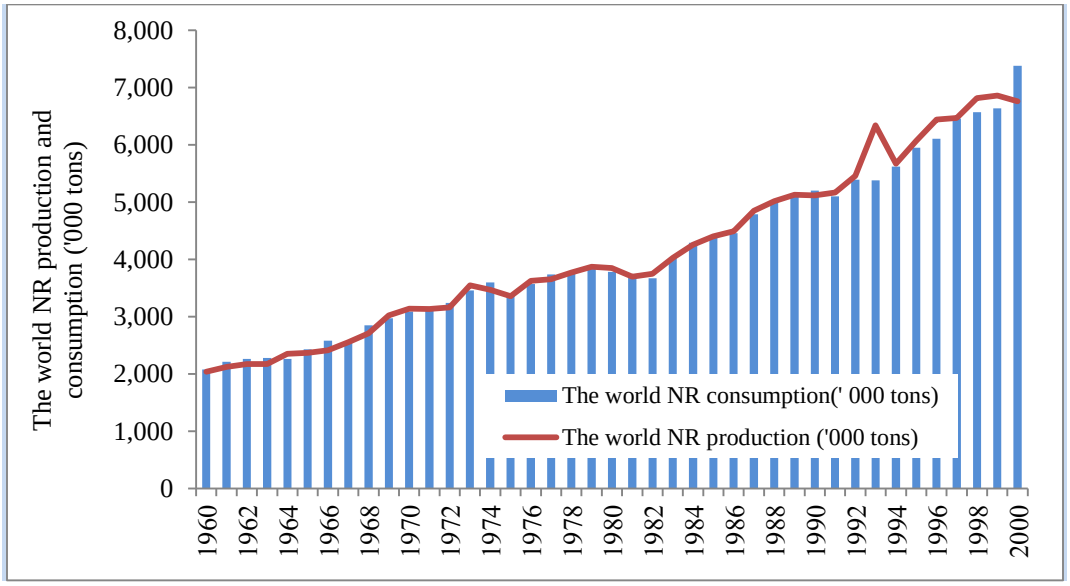

Figure 6-7 The evolution of the world production and consumption of natural rubber during 1960-2000
Source: IRSG, 1992, 2002

During the period of oil crisis, the world consumption of NR increased from 3.46 million tons in 1973 to 3.87 million tons in 1979. The growth of NR consumption was about 17.0 % in 1973/79 even the growth rate of 1.3 % was lower than previous period due to depress world economic recession. In other hand, the growth of SR was about 2.2 % per annum presenting the rapid slowdown trend in the SR consumption to compare with the previous period. NR's share has been the minimum of 29.5 in 1979 and steadily increased in thereafter. One important factor

after 1980 is the relative share in the consumption of NR between the developed and developing countries. Consumption of NR in the developing countries rose by over 6% per annum while it was increased by 1.0 % from the developed countries. Consequently, the share of the developing countries in the world consumption of NR has increased, especially Asian countries (IRSG, 2002).

In the 1980s, the world consumption of NR exceeded production but there was only a little improvement in prices. FAO (1990) stated that in the current term, average price during 1987-1989 were virtually the same as in 1977-1979 but the real term was below 40%. Low price mainly reflected the large stocks which had accumulated in the early 1980s and that of continued to pressure the market. Price has been stabilized through buffer stock under International Natural Rubber Organization (INRO), which created world stock of NR representing over 40% of annual consumption in the early 1980s, and still representing 32% in 1991. High level of INRO stock remained to depress level of price. Share of NR in the world rubber consumption reached the lowest level of 29.5% in 1979 and steadily increased thereafter to 33.0% in 1987. Price of RSS3 has been competitive SR price in the early 1980s. This is because increased production cost of SR.

In 1987-1989, the world demand for NR exceeds supplies for the second consecutive year and the global NR stock has declined. The world consumption of NR has been upsurge rate of growth about 4.0% to over 5.0 million tons. NR price had been on a rising trend since September 1987 and rose sharply during the second half of May 1988 regarding to strong demand and speculative purchase. The INRO indicator price peaked to 323.0 Malaysian cent/kg in early June 1988. Subsequently, prices fell rapidly as speculative buying declined and supplied recovered. The sales from the INRO buffer stocks associated with the reduction of demand from Western Europe contributed to the decline in prices. Price declined until the end 1988 but it remained still the highest on average since 1980. High output of automotive manufacture in several major industrialized countries associated with better than expected economic growth and a rapid increase in the consumption of latex concentrate used in the manufacture of surgical/medical gloves and other protective goods required to combat AIDS boosted overall demand for NR. In the USA, a higher usage of latex in gloves and other insulation products and of other automotive goods increased demand for NR about 2.7% to 810,000 tons. Consumption has increased more than 4.0% in Japan as a result of sharp increase both tires and non-tires products. Demand from Western Europe also increased by about 2.0%. The major Asian counties producing NR also used significant amount of rubber especially latex concentrate since the establishment a large number of factories to manufacture medical/surgical gloves and other related products (FAO, 1990, 1994).

In the early 1990s, the world consumption increased by 2.3% from 5.0 million tons in 1988 to 5.9 million tons in 1995 compared with a 4.8 % increase in 1988/1987. This slower growth reflected economic recession which adversely affected automobile and tyre industries in all major markets. World consumption of NR began slightly fell in 1990, compare with a 4% rise in 1989. The second recession economy resulted from the slowdown in economic activity in the

developed countries, especially the United State, Canada, the UK and some other Europe. The slowdown in these economies and the rise in oil price following the Gulf crisis adversely affected the demand for new car, which largely determined the demand for new car.

In 1990, NR consumption from USA fell by 8.0% following a 6.0% drop in car production to 10.2 million units. Output of tires declined substantially as the drop of new car and commercial vehicles by about 10.0%. Consumption of rubber in the non-tire sector also declined. This economic recession slightly affected in the demand for rubber from Japan, Western Europe and the developing countries. The recession economy has expanded to major developed counties in 1991 and further were recorded recession economy in most counties of Europe and Japan during 1991-1995. However, USA has recovered to increase NR consumption since 1993 by increase about 3.0% to 0.94 million tons after declining by 13.0% for 1991-1992. The increase in 1993 restored the long term upward trend interrupted by the start of economic recession in 1990. Japan that was the second largest demand for NR has still declined. The recession affected domestic demand for automobile and reduced export due to slow growth in importing countries. NR consumption from Europe also declined except in UK recorded small increase (FAO, 1999, 2000a).

In contrast, utilization of NR from developing countries has increased by 4.0% in 1993 and accounted for haft of world consumption reflecting continues rapid growth in Asia and Latin America especially China. The large consumption of NR was used to meet increase demand from their expanding automobile industries. In 1995, the world consumption of rubber increased by 5.8 % to 5.9 million tons. The increase partly reflected recovery in demand. The growth in global demand for NR began accelerated in 1994 due to recovery in the tyre and non-tyre sector in Japan and Western Europe. From 1990-1995, the world production was increased only 1.0 %, reflected the prolong period of depressed prices in many producing countries associated with decline in production of Malaysia. The price trend has gradually declined during 1990-1993 and slightly increased somewhat during 1994-1995 even though there was a lot of instability (FAO, 2000a).

During 1996-2001, the world consumption of NR increased by about 4.1 % from 6.11 million tons in 1996 to over 7.38 million tons in 2000. The Consumption increased from China, Canada, Europe, India and USA. Consumption is estimated to have increased by more than 5 % in China and India. The developing countries also registered high consumption by Malaysia, Indonesia, and Korea. However, price of NR continued to trend down after 1997 to 1999. The depressed price reflected a large accumulation of stock during 1998-1999 together with forecasts of the slowdown of global economic growth. Moreover, price declined to be under downward pressure of increase production capacities and the disposal of the buffer stock of INRO (FAO, 2003).

In the 1990s, the world consumption of NR rose by about 32% while that of SR increased by only 4.0 %. The key factor is the relative share in the consumption of NR by the developing countries has increased and rose by over 4.0% per annum against less than 2.0% in the developed countries. One of the reasons may be related to the collapse of the Soviet Union, which

consumed a massive amount of rubber about 10% of the world NR consumption. Typically, the decades also saw the demise of the international Natural Rubber Organization which presented to have fail attempt to influence markets through managing buffer stocks. More than 60% of NR is used for tires, which is that major driving forces behind changes in NR demand. The share of NR in the tire sector was about 50% in 2000 and is likely to remain around this level in next decade. The general rubber goods have been to decline share of NR from 29% in 2000 to expectation about 22.0% in 2010. This decline reflected partly a continuation of shift to speciality rubber and other materials together with a projected shortage of NR (FAO, 2003).

Share of NR in overall rubber rose from 35.8% in 1990 to 40.7% in 2000. Share of NR grew due to the growth of NR consumption in developing countries and domestic consumption in the producing countries. In the late 1990s, Asia counties accounted for more than 86 % of total NR consumption from the developing countries' demand, among which China is the largest consumers with high growth rate. China has become the second largest consumption of NR since 1994. The NR consumption from China grew by about 8.3% per annum and reached to 1.15 million tons in 2000, reflecting largely growing demand for tires and industrialization. The developed countries are the largest importer especially USA, which is still the largest NR consumption at least before 2000. Demand in the developed countries increased steadily last decade while high growth import from developing countries was the major determinant of imports, which grew by 3.5% per annum. Economic growth in developing countries which induces greater demand for cars and tires is major factor responsible for the higher growth rate. China accounted for almost import growth in the developing countries. China overtook the USA to become the world's NR consumers in next period. NR consumption from China grew sharply by an average 12% per annum to reach over 1.15 tons in 2000 (FAO, 2003). Therefore, economic growth in developing countries have become increasingly important the consumer of NR. These trends are expected to continue in the next periods.

4.4) Market price and dynamics of price

Natural rubber (NR) is homogenous commodity. The most common forms consist of rubber sheet, block rubber and latex concentrate. NR is sold in international market under condition of perfect competition. Demand for NR is quite sensitive to change in price change in the short term but is more sensitive to change in economic activity and changes in the balance of supply and demand. Economic recession and political uncertainties strongly influenced the market price of natural rubber. Supply of NR is very insensitive to price movements in the short term. The low price elasticity of demand and supply causes NR price to fluctuate in the short term (Grilli et al., 1980; World Bank, 1986).

During 1960-2000, there were two major price peaks when NR price rose substantially above trend: 1979-1980 and 1995-1996 can largely be attributed to exogenous factors by the oil crisis and the growth in global demand for rubber as Figure 6-8 shows.

During 1960-1972, the annual average price for NR has declined from 780.2 dollar per tons in 1960 to the lowest of 332.5 dollar per tons in 1972. This was mainly due to high expansion to substitution by SR in major consuming countries and a large stockpile by the USA and UK. Stockpile and its release still depressed to continue decline in NR price. Price fell by an average -3.3 % per annum. In 1973/74 the first oil shock occurred. The first short peak in NR price trend occurred as a consequence of sharply rise in crude oil price. High oil price heavily affected on production cost of SR and stimulated increase global demand for NR and its price increased. Strong demands for rubber and speculative buying have influenced on NR price increased from 332.5 dollar per tons to peak of 744.6 dollar per ton in 1974. This price reflected the scarcity of rubber and expected to increase price of SR. Speculation has also been to characterize the NR market. Price of general SR substantially increased from 374.8 dollar per ton to 705.5 – 727.5 dollar per ton in 1974. The different price between NR and general purpose SR was low and further could be competed. NR has been advantaged by the increase proportion for radial tire technology and stipulated increase of price (Barlow, 1978).

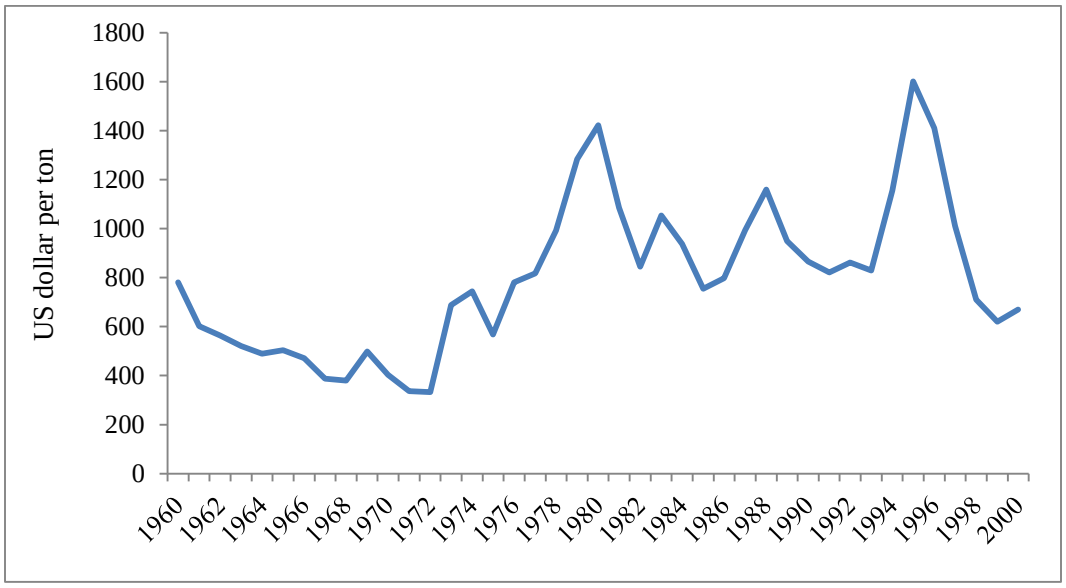

Figure 6-8 The evolution of natural rubber price during 1960-2000
Source: UNCTAD, 2013

In 1979, the second oil crisis occurred again. A sharp oil price adversely affected high growth of demand for NR and rise to peak of price in 1979-1980. NR price has doubled from 688.2 dollar per ton in 1973 to peak of 1422.7 dollar per ton in 1980 even the world rubber consumption grew at average of 1.7 % per annum. The oil crisis in the 1970s not only caused to high production cost and declined in the production of SR but it also followed the recession in the world economy. The world economic recession cause to decline in demand for rubber. At that time, NR price was stabilized through market agreement of the International Natural Rubber Organization (INRO), which was established in 1980 to operate stabilization of price through buffer stock arrangement. During the 1980-1983, a total of 273,000 tons of NR was purchased by

INRO for the buffer stock to stabilize price. The buffer stock has increased to 357000 tons in the mid 1985. This buffer stock helped to intervene downward price and its fluctuate. Price of NR declined in the late 1980 and ranged by annual average of 754.9 dollar per ton to 1085.1 dollar per ton, of which INRO intervened in price of NR during the declined demand for NR. The INRO was able to maintain a relative stable price for 1981-1985 against major economic recession in developed countries (UNTACD, 1997).

Because of a large buffer stock accumulates by INRO during the low price. Price rose sharply by from 797.9 dollar per ton in 1986 to 1159.2 dollar per ton in 1988 corresponding to high growth of the world NR consumption, strong speculation, and demand exceeded supplied due to unfavorable weather affected in the producing countries. The price peaked in June 1988 and fell rapidly in the end of this year as speculative declined, supplies recover, reduction of demand for NR from USA and sales of buffer stock from INRO. INRO stated that the entire buffer stock had been sold in this period in attempt to limit upward price movement. Since the second quarter of 1989, price fell to 949.0 dollar per ton correspond to the report of slower economic growth and declining sales in automotive industries in the industrialized countries. The world economy continued to suffer from economic recession and reported the huge losses by major automobile and tire manufacturers forcing to reduction of production. The slow-down in economic in developed countries especially USA and Europe associated with the rise in oil prices and followed the Gulf crisis adversely affected to new car and tires declined by about 3.0 % in 1991 that stipulated to decline demand for NR by 2.0% in 1991. Consequently, price continued to declined in 1990 and fell sharply in 1991 to reach the lowest level in the end 1991.

During the 1990-1991, the INRO intervened for the buffer stock to support price in the first quarter of 1990 amount 34,500 tons and the last quarter of 1991 amount 76,000 tons. The price rise in the first haft of 1992 by resurgence of demand from China and the former USSR associated with intervention for buffer stock by the INRO about 69,000 tons in the last quarter of 1992 thus bring total buffer stock to 179,575 tons in the end 1992. This level was closed to the limit of buying. Price remained weak during 1992 and 1993. Price has decreased from 862.3 dollar per ton in 1992 to 829.6 dollar per ton in 1993. The world NR consumption restored to interrupt the long upward trend by economic recession since 1990 associated with the intervention of the INRO during the last quarter of 1993 helped to against slow-down trend in price. Price rose strongly in through 1994 by an average 39.25 % from the basis price in 1993 and to peak of 1,600.8 dollar per ton in 1995 reflecting improved the world economy and promoting demand for vehicles in North America, Japan, and Europe including the rise of demand from China. However, a trend upward price movement is intervened by the INRO to sale the buffer stock in the third quarter 1994. Price declined steadily after 1996 to an annual average of 1,410.0 dollar per ton and fell to 1011.0 dollar per ton in 1997 (UNCTAD, 1997; FAO, 2000b, 2003).

In 1997, economic crisis in Asia led to depreciation of Asian currencies that further significantly fell in NR price to 709.8 dollar in 1998 and continued trend down in price. Accordingly, the world consumption of NR was slightly decreased due to the slowdown of

global economic growth forcing to reduce demand for NR. This situation forced to continue decline in price to the lowest in 1999. An annual average price in 2000 improved before falling again in 2001. Since 1997, the INRO could not regulate price fluctuations and was considered not effective by the point of views of the majority of producer members that was consequently terminated in October 1999 (FAO, 2003).

4.5) Demand characteristics of main rubber consuming countries

Demand for NR mainly comes from the industrialized countries, which have the great portion to consume by USA and Western Europe. NR consumption from USA has steadily increased from 487,000 tons per year in 1961 to 651,000 tons in 1972 but the relative share of USA in the world NR consumption has steadily declined from 23.4 % to 20.1 % in the same period. Growth of vehicle industry is key factor to drive demand for NR as well as the trend growing economy. US consumption still increased from 712,000 in 1973 to peak of 802,000 tons in 1977 and fell to the lowest of 585,000 tons in 1980, which adversely declined share of the USA in the world consumption to 15.5 %. NR consumption recovered in the early 1981. The annual average of consumption was about 628,300 tons in 1981/83 and grew to 844300 tons in 1988/90. The rate of growth was about 2.7 % per annum while the relative share of the world consumption has slightly increased to 16.8 %.

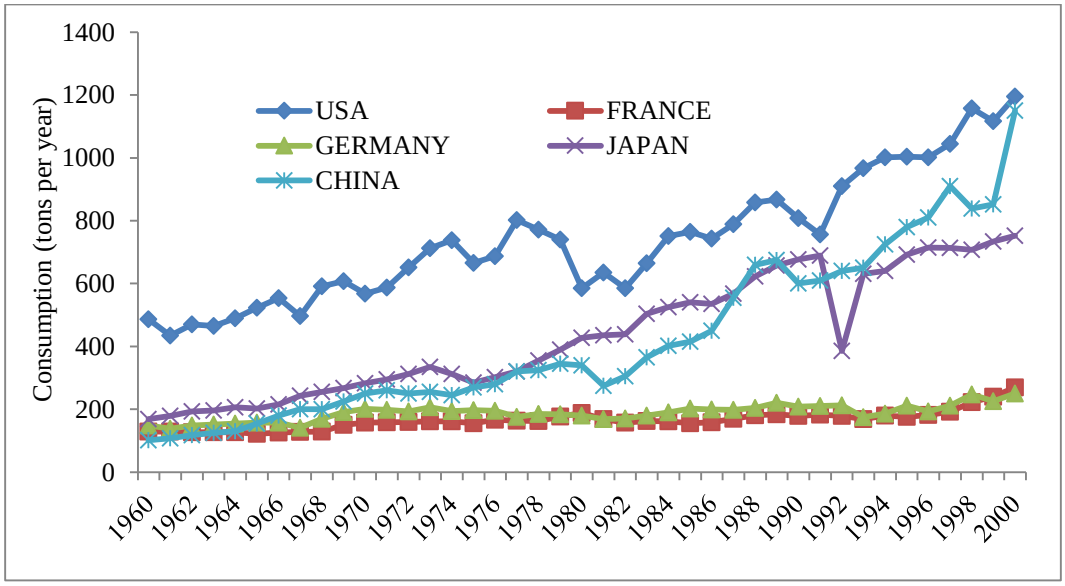

Figure 6-9 The evolution of NR consumption by the major consuming countries
Source: IRSG, 1992, 2002

In 1991, NR consumption fell to the lowest of 755,400 tons and rose to more than 1.19 million tons in 2000. The growth rate of consumption was about 5.8 % per annum. The relative share of USA has decreased to 16.2 % in 2000. Thus, the share of USA has to continue a trend downward relative share of the world consumption. In comparison, NR consumption from

Western Europe has steadily increased during 1960-1973. During the period of oil crisis, the average annual consumption therefore dropped except France and Germany continued a trend growth of consumption, therefore increased by about 0.10 % per annum during 1978-1988. An annual average of NR consumption consumed a little growth by about 0.8 % during 1988-2000. The Western Europe counties consumed about 20.11 % of the world consumption leading by France and Germany. In 2000, Western Europe and USA consumed about 39.13 % of total world consumption that has strongly declined to compare with 51.5 % of the world consumption in 1978 (IRSG, 2002).

Japan is the second consuming countries. NR consumption has increased at annual average of 232,000 tons during 1960-1972, which has been at an average growth of 6.6 % per annum. The period of oil crisis also has been the growth of NR consumption at annual average of 340,800 tons during 1973-1980 but has slow-down of consumption by about 3.4 % to compare with previous period. Throughout the 1960s-1970s, economic boom in Japan based on heavily manufacture such important of automobile that stipulated to high demand for NR. Japan becomes the world third largest economy behind USA and the former USSR in the 1980s. The annual consumption of NR still grew at annual average of 5.5 %. The annual average of consumption increased from 459,700 tons in 1981/83 to 652,000 tons in 1988/90. The growth of NR consumption in this period regarded to high economic growth in Japan. In 1992, NR consumption has gradually declined from 689,500 tons in 1991 to the lowest of 385,400 tons in 1992, reflected to enter to economic recessionary period in Japan. The recession economic in Japan continued to depress a trend slowdown consumption of NR throughout the 1990s. The annual average of consumption has steadily increased from 654,000 tons in 1993/95 to 731,000 tons in 1998/2000. The annual average of growth was by about 0.90 %. Japan's share in the world consumption has increased from about average 8.7 % in the 1960s to annual average of share 12.2 % in the 1980s and fell to 11.0 % in the 1990s. In 2000, Japan consumes 751,800 tons or a 10.2 % share. Japan is an important importer of NR from Thailand since the 1970s and later surpassed by China in the 2000s (FAO, 2000b, 2003).

For China, demand for NR has steadily increased at annual average of 177,000 tons in the 1960s to 297,500 tons during 1973-1980, which was low relative share in the world consumption about 8.10 %. Since 1978, the reform economic was made to industrialization and will adversely increase NR consumption. The NR consumption grew from 315000 tons in 1981/83 to 645,000 tons in 1988/90. The growth of consumption has doubled or rate of growth by about 11.2 % regarded to the reform economic in the mid 1980s. Open economy and industrialization continued to a trend growing upward of NR consumption throughout the 1990s to 2000s. The annual average of consumption grew from 633,000 tons in 1991/93 to 867,000 tons in 1997/99 and rose substantially to 1.50 million tons. The relative share in the world consumption has increased to 10.5 % during the 1990s and reached 15 % of the world consumption in 2000. China was the second largest NR consumption since 1992. Automotive industry and industrialization have been rapidly expansion since the early 1990s that stipulate to grow fastest NR consumption.

China will be the largest consuming countries with the highest growth rate in next decade (IRSG, 2002; FAO, 2000b, 2003).

Developed countries are the largest consuming countries in the world market. Demand for NR in developed countries increased steadily by about 1.2 % in 1978-1988 and continued slow-down to 1.0 % in 1988 to 1998/2000. The result was the relative share from the developed countries in total world demand declined from 66.6 in 1978 to 55.9 in 1988 and further fell to 50.5 in 1998/2000 as Table 6-17. The large reduction of share was observed in Europe and North America in 1988 and further continued in 1998/2000. They remained important consuming countries at least before 2000 (FAO, 1990). On other hand, the developing countries consumed about 1.257 million tons in 1978, rose to 2.259 million tons in 1988 and continued a trend fastest growth of demand by about 3.262 million tons in 1998-2000 with regarding to industrialization and the grow of economic. The relative share has sharply increased from 33.1 % in 1978 to 44.1 % in 1988 and still grew to 47.6 % in 1989/2000. The proportion of NR consumption from the developing countries would share to above 50.0 % in the 2000s. There has been the structural change in the market structure (FAO, 2000b, 2003).

Table 6-17 Consumption of natural rubber according to developed countries and developing countries during 1978-2000

Unit: tons

Regions	1978	1988	1998-2000 Average	Growth rate 1978-1988	Growth rate 1988-1998/2000
Developed countries	2,527.7	2,862.0	3,460	1.2	1.0
North America	862.0	926.6	1,302	0.7	3.4
Europe	1,093.4	1,109.0	1,377	0.1	0.8
Japan	355.0	616	731	5.7	1.1
Developing countries	1,257.2	2,259.2	3,262	6.0	4.3
China	430	748.3	924	5.7	4.5
India	156.3	307.3	612	7.0	3.7
Korea	143.3	221.7	315	4.5	2.7
Malaysia	51.0	102.5	341	7.2	9.6
Thailand	30.4	60.7	218	7.1	10.8
World	3,795.0	5121.2	6,847	3.0	2.9

Source: FAO, 1990, 2000b, 2003

Among developing countries, China was the world's second largest NR consuming countries since 1988. Similarly, demand in other countries in Asia region such as India, Malaysia, Korea, and Thailand grew more than 4.0 % in 1978-1988 and continued a trend grown upward in the period of 1990s. Therefore, the developing countries become strong growth of NR consumption and more important importers. There has been structural change of the market in the utilization of NR from the developed countries to the developing countries. The developing countries have become important importers in the world NR market (FAO, 1990, 2003).

4.6) Supply of natural rubber and structural changes in rubber producing countries

The evolution of overall NR production after 1960 is shown in Figure 6-10. In 1961, the major producing countries are Malaysia, Indonesia, Thailand, Sri Lanka, Viet Nam, India, and China. Malaysia accounts for approximately 37.2 % of the world NR production or about 789000 tons. After Malaysia, the other most important producing countries are Indonesia (32.7%), Thailand (8.8%), Sri Lanka (4.6%), and Viet Nam (3.7%) as shown in Figure 6-11. Rubber production has increased from 2.040 million tons in 1960 to 3.1 million tons in 1973 or growth rate about 4.2 per annum. Malaysia and Indonesia have continued to lead production. Before 1975, Malaysia production grew over 4.0 % per annum and increased share of NR production from 39.35% in 1960 to 48.78% in 1975. These have been due to government replanting schemes and wind spread of high-yield clone. In this time, the share of world production from Indonesia declined from 31.0 % in 1960 to 24 % in 1975 as Figure 6-11 shows. There were few replanting scheme. However, total production increased at average 1.9 % per annum. NR production from Thailand has increased both in terms of output and share to world production. The share of NR production was roughly 8.0 % in 1960 to 10.0 % in 1975, reflecting an annual rate of output growth about 5.0 %. Like Malaysia, a replanting scheme has been implemented since 1960.

During 1974-1987, the production grew very slowly about 1.9 % per annum but the growth of NR consumption was about 2.0 per annum. Production and consumption increased rapidly during the second haft of the 1980s and have a big upsurge of demand in 1988-1989 that created a supply shortage and promoted a sharp increase in world price.

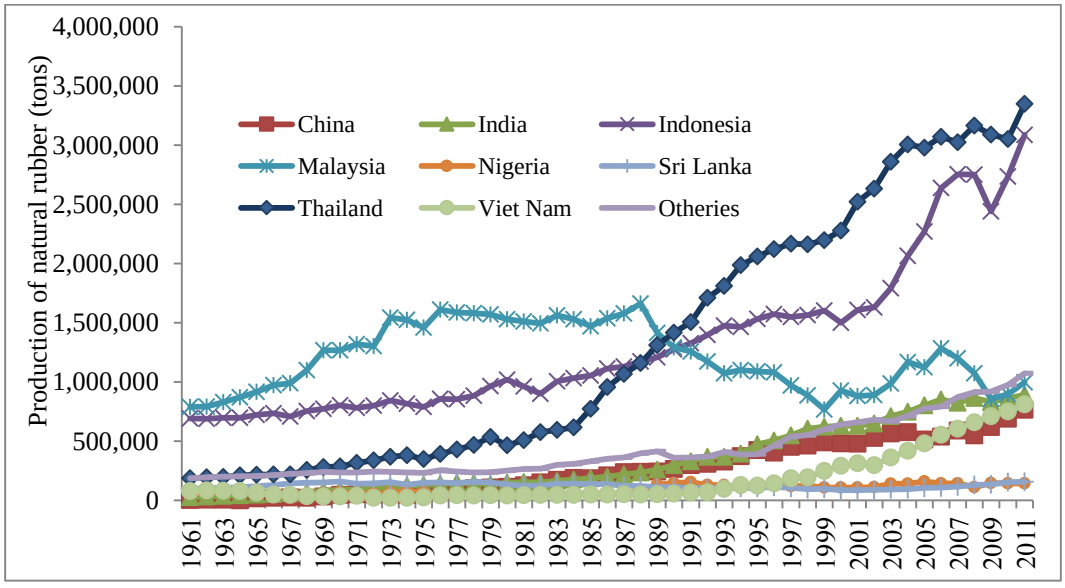

Figure 6-10 Production of natural rubber according to the major producing countries during 1960-2011

Source: FAOSTAT, 2012

In 1988, the world production of NR rose by about 4.8 % to over 5.0 million tons. Production rose in three major producers: Malaysia, Indonesia and Thailand by 5.1, 2.6 and 4.5 % respectively. The large gains reflected the coming into bearing new areas planted to higher yield clones. After that, world production of NR grew from 5.020 million tons in 1988 to 6.07 million tons in 1995 by an average of 2.6 % per annum from 1988-1995. The world NR production slowed down in the early 1990s because of the decline in production in Malaysia and Sri Lanka.

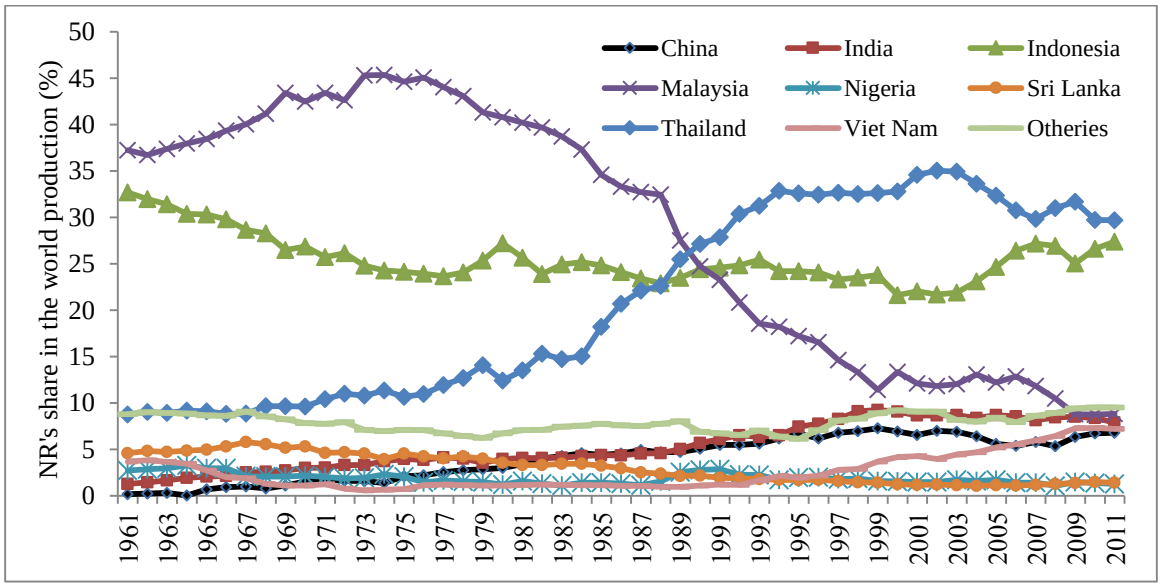

Figure 6-11 Share of NR in the world production according to the major producing countries during 1960-2011

Source: Calculated from FAOSTAT, 2012

Malaysia production has declined since the late 1980s which were results of lower prices, production constraint and labor problems leading farmers to shift other crops. Malaysia has had the most lack performance in rubber production affecting lost share in NR production. The average growth rate was -4.0 % per annum during 1989-1995. The decline in Sri Lanka resulted from civil disturbances, leaf diseases and erratic weather. Other producing countries increased their output substantially and Thailand becomes the largest producer of NR in 1991. Thailand has been ongoing replanting schemes to more than double their production. This trend continued into the 1990s. Indonesia remained the second largest producers which increased at about 2.0 % per annum during 1988-1995. Philippine, Vietnam and Cambodia also has increased well in production. There appears to be plenty of scope for expansion. Sri Lanka was the only stagnating NR production due to diversification of land in this period.

The world production of NR has been stagnant after 1990 due to new planting and replanting scheme in traditional areas associated with the impact of low price. Indeed, during 1996-2000, the NR production has some stagnated, largely as a result of low rubber prices and increasing production cost. Accordingly, average price continued to trend down in this period.

The depressed price reflected largely the significant accumulation of stock in previous year as higher production in major producing countries. It was not matched by growth in demand. The world production of NR slightly increased from 6.44 million tons in 1996 to 6.762 million tons in 2000. Production in Thailand remained above 2.0 million tons. Production in Indonesia reached above 1.7 million tons. Malaysia has slightly change in its production and may signal the stabilization of Malaysian production after many estates and smallholders switched from rubber to palm oil production over the past few year. China and Vietnam also have a trend to increase as their new planting. Production remained static in India and Sri Lanka (Ridwan et al., 1997; FAO, 1999, 2000a; RRIT, 2013).

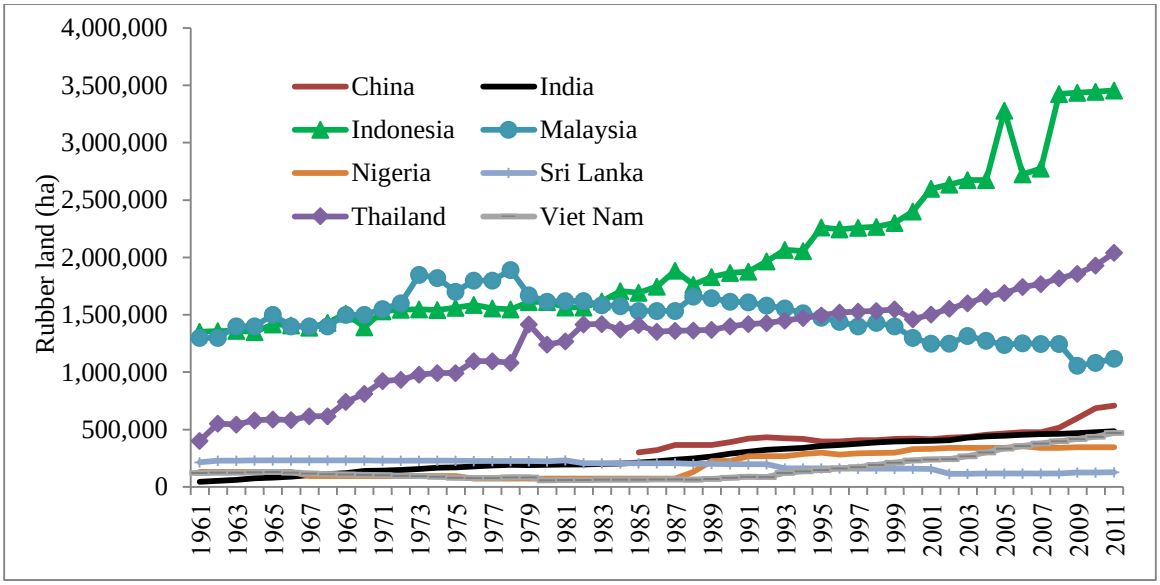

Figure 6-12 The evolution of rubber areas according to the major producing countries during 1961-2011

Source: FAOSTAT, 2012

In detailed by producing countries, Malaysia's NR production was dominated by estate, which are mostly foreign-controlled. Malaysia government increased the support available for the smallholder sector in 1957. During 1960s-1970s, Malaysia has strongly grown in terms of areas, production, and yield. Area of rubber was about 1.30 million ha in 1961 and rose to peak of 1.89 million ha in 1978 and then has been declining. The increase in rubber area in Malaysia during 1960s – 1970s was the result of the new cultivation land or virgin land. In 1980, the smallholders accounted for about 75 % and increased for about 80 % of the total areas. The large area of NR production is located in Peninsula Malaysia. Production has increased from 0.789 million tons in 1961 to 1.27 million tons in 1970 as a trend of growth by about 6.1 % per annum and fell to by about 1.4 % per annum during the 1970s, although level of production continued growth of production to peak of 1.61 million tons in 1988. NR production from Malaysia account about 37.2 % in 1961 and substantially grew to 45.4 % in 1978, which resulted to become the largest rubber producer from 1960-1990. Share in the world NR production slightly

declined during 1975-1980 and continued a trend slow-down of production corresponding to rise the problems of labor shortage and high proportion of total production cost until 1990, which resulted overtake the largest producer by Thailand as Figure 6-12 shows.

Indonesia is the second largest producer of NR in the world. In 1996, 84% of total rubber area is planted by smallholders and remained land under government estate about 8% and private estate about 8%, of which they account for about 30% of the total annual production. Areas of rubber have steadily increased from 1.35 million ha in 1961 to 1.61 million ha in 1983 as a annual average growth appropriately 1.0 % per annum. Area under rubber from 1981-2000 has substantially increased over 2.0 % per annum, out of which private estates showed a higher growth of 4.0 % during 1988-1996 as Figure 6-12 shows. The largest expansion of rubber land took place in Java. Indonesia is the largest rubber area and has substantial land for expansion of rubber in the future. In 1961, Indonesia produces over 0.69 million tons and rose to 0.81 million tons in 1970 as an annual average growth of 1.6 %. Production continued a trend growth over 2.0 % from during 1970s to 1980s and fell by about 1.20 % in the 1990s. Production rose to over 1.00 million tons in 1983 and continued a trend substantial growth of production after 2000. Share of NR production from Indonesia account about 32.7 % in 1961 and fell substantially to the lowest of 23.7 % in 1973. Share of NR market continued a trend decline of share in NR production in the 1990s. NR has historically been an important source of foreign exchange earning of Indonesia. About 90 % of Indonesia's natural rubber production is exported. The volume of export rose steadily in parallel by the rising of NR price. The main export destination is USA which accounts for accounts for appropriately 71 % in 1995 to compare with over 40.0 % in 1980.

The other important producing countries are Sri Lanka, Vietnam, China and India. Production from these countries has steadily increased during the 1960s-1990s and rose to expansion of rubber area in response to foreseen good price and growth of NR consumption. India was very impressive in increase of rubber area, production and yield. Production grew at the rate of 23.3 % during the 1960s to improve the based from 26,992 tons in 1961 to 89,905 tons in 1970. The production grew by about 3.9 % in the 1970s and continued to a trend of growth at the rate of over 4.0 % during the 1980s-1990s, taking it from 148,400 tons in 1980 to 631,000 tons in 2000. China's production also sharply increased. Production was approximately increased by about over 5.0 % per annum during the 1970s to 1990s. Production reached about 480,000 tons in 2000 to compare with 264,000 tons in 1990. Viet Nam's production decline steadily before 1970 and has been stable in production during the 1980s. Since 1992, production has increased approximately 7.8 % per annum which took its production from 67,000 tons in 1992 to 290,800 tons in 2000. On the average, Sri Lanka's production has experienced a decreasing trend in NR production during the 1980s to 1990s by about 1.0 % per annum. The production slightly increased by about 6.3 % per annum during the 1960s to peak of production about 159,000 tons in 1970 and thereafter its declined very slowly to 87,640 ton in 2000 or the rate of decline by about 1.9 % per annum (Ridwan et al., 1997; FAO, 2000b, 2003; RRIT, 2013).

4.7) Competition between Natural rubber and Synthetic rubber

Natural rubber (NR) has experienced increasing competition from synthetic rubber (SR) after the 1950s. SR has been relative low and stable prices rather than NR. It was associated with scale of production and technological development together with marketing effort. SR producers not only achieve to rapidly increases their supplies to meet the growing market needs but also able to progressively reduce the production costs and price (Nehmer, 1959). Price of SR sharply declined by about 40 % during the 1960s. This is due to a large economic scale and low oil price, which was major cost of production. SR producers can adjust their supplies to variations in market demand both general purpose and special synthetic rubber. General purpose of synthetic rubber named SBR to be competed substitution between SR and NR. Perhaps the growing role of SR can be attributed to the absence of adequate supplies of NR (Grilli et al., 1980). The production of SR is concentrated in developed countries such important as USA, Europe and Japan account for 67.3 % and 28 % from the former USSR, Easter Europe and China in 1980. This compared to 77.5 % and 20.0 % in 1968. The consumption is contributed in the same proportion of production. UNCTAD (2003) stated that three major factors influencing the competition between NR and SR: the structure of the SR industry, research and development and cost and price relationship (Grilli et al., 1979, 1980; Bakar & Blandford, 1980).

1) The structure of synthetic rubber industry

In term of industry structure, SR industry can be characterized as an oligopolistic industry due to dominant of a few firm manufacturing and selling the product. It also exhibits high backward and forward integration. A large consumption of SR depended on tire manufacturers that encouraged them to integrate backward into rubber industry. Similarly, the petrochemical production who sold primary feedstock to SR production was considered incentive for forward integration. The petrochemical has controlled over 50% of the existing production capacity of SR and the rubber manufacturers owned another 40% of total capacity. Typically, most of SR producers are owned or supported by government for strategic necessity to consider to be promoted the initial growth of industry and further sustained growth of SR industry. For instance by the USA in the 1970s, the largest SR producers are the tire producers. More than 55% of SBR are owned by the five major tire companies (Good year, Firestone, General tire, Uniroyal, and BF Goodrich) which accounted for 95% of US tire production. The tire manufacturers have developed SR production for their own consumption and further have integrated back into petrochemical production. The companies of petrochemical owned SR manufacturers and dominated production about 70% in Western Europe and about 91.4 % in Japan. A large proportion of SR is produced by tires manufacturers and petrochemical companies that clearly characterized oligopolistic in structure and limit price competition among the SR producers. There was an important factor to determine in the competition between NR and SR. The production and consumption within conglomerate business guarantee demand for SR and shields the industry from stochastic shocks.

2) Research and development

SR can be classified about 95 % of SR for general purpose rubber and 5 % for specialty SR. General-purposes of SR are the cheapest and better quantity which competed with NR for the use of tires industry but it is unsuitable for heavy tires. SR have been extensive and successful in terms of quality and production cost. Production cost has decreased and quality has been improved that not only able to use SR closely resemble NR but in some case is superior in meeting requirement of tire maker and the end users. Then, SR is uniform in quality by manufacture that can be controlled to suit specific needs. It also was flexibility to adjust supply to appropriate with marketing needs. The massive research and development appears the major factor behind the fast growth of general-purpose SR in the post war, which resulted the cheapest and quality of SR. Because superior qualities, SR have advantage in the lies of the cheaper than NR and it can be readily adapted to the modern technologies in tires requirement and other customers. The specialty SR is kind of special properties suitable for specific usage that cannot be replaced by NR such as Butyl rubber, Neoprene, and Nitrile rubber. Specialty SR has lower levels of world consumption in respect to superior quality which supplies to meet specific needs of certain manufactured products.

3) Stability in price and price relationships

Figure 6-13 shows that SR price generally lower than NR price and very stable in short run. This price differential exists over a long period of time. Price stability has been an additional factor that helped SR to share a large consumption. Prices of SR have steadily declined overtime during 1960-1972. Since the early 1950, the economies of scale and technological innovation caused the steady fall of SR price associated with low cost of feedstock from low oil price. SR price became to set a trend downward of price in both NR and SR. World bank state that the declining trend in NR price from the early 1950s-1970s was influenced by the decline in general-purpose SR prices. The break occurred in 1973-1974 and 1978-1979, when a consequence of the oil crisis and the sharp rise in crude oil price drastically increased the cost of production. SR prices rose and also shifted to higher trend level. It also was affected substantially to shift price with increasing trend in NR price. However, SR price has steadily increased relative to the NR price which presented highly degree of instability of price. In fact, the actual extent of price competition is difficult to determine due to low available precise data. From 1960-1973, it was estimated that an average price of NR about 542.0 dollar per tons and 532.1 dollar per ton for SR and then rose sharply correspond to oil crisis. NR price has highly fluctuated and would be clearly higher than SR price. The instability of NR price led to establish the International Natural Rubber Agreement (INRA) in October 1980. INRA aims to stabilize NR price and to obtain a steady growth in the export earning of the producer countries. The formation of INRA helped to stabilize NR price in the early 1980s. The stability in SR price is the result of an oligopolistic market structure. SR industry has been the less interplay market forces and depended on production cost, which 70 % of SR production constituted by cost of oil feedstock and energy inputs. The relative stability of the price of inputs and the quarantine demand from forward

integration contributes to short run stability in SR price. By the instability in price, it was observed the competitive price between NR and SR since the second oil crisis.

In here, share of total consumption would characterize the competition between NR and SR. SR's share has increased from 52.9 % in 1960 to the highest of 70.5 in 1979, in contrast NR's share has declined 47.1% in 1960 to the lowest of 29.5 % in 1979, reflect the fast rate of growing consumption of SR as Figure 6-13 shows. As well as, it would have to be more prices competitive in terms of relative price levels and stability. Competition between NR and SR is clearly illustrated at the oil crisis 1973/1974 and 1978/1979, when market faced with high price and competitive price between with SR and NR.

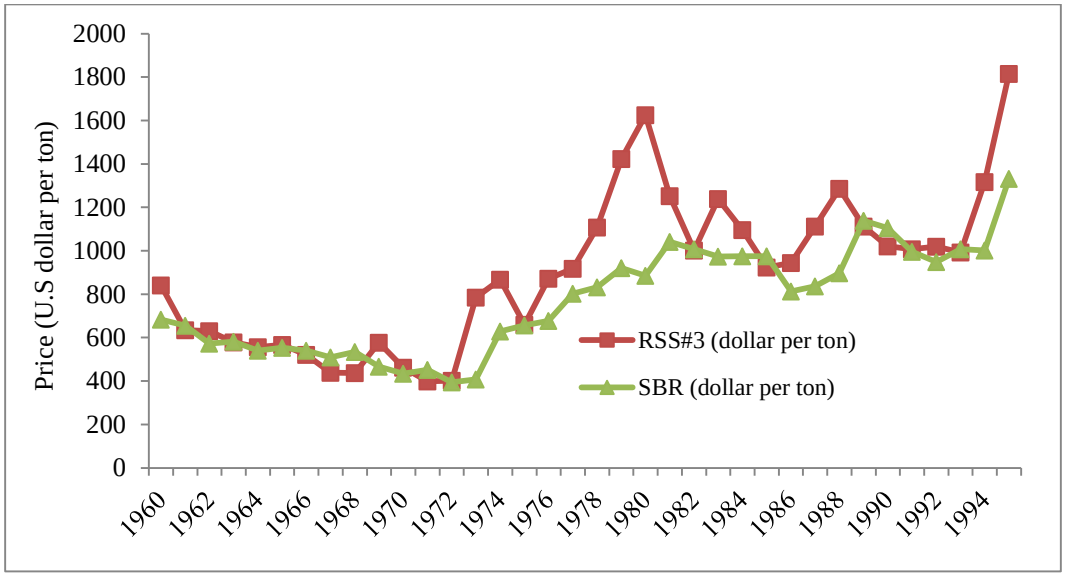

Figure 6-13 Price of SR (SBR) and NR (RSS#1, CIF) at New York during 1960-1995
Sources: Grilli et al., 1980; IRSG, 1966, 2002

FAO (2003) argued that SBR was being sold at high discount in order to prevent shifting to NR. In parallel, SR price has sharply increased and stabilized in price corresponding to oil crisis following high cost of feedstock as a result of competitive price with NR after 1980s. The following characteristics of price suggest that a change in price of NR was relative to the price of general purpose SR. In the long term, price of NR has competed effectively with price of SR that subsequently increased NR's shared. This is because of the cost of NR production to decrease through high yield clone and replanting scheme. NR production can still be profitable at lower prices due to lower cost of production than that of SR production. This contrast with SR would project the possibility rising price in the future regarding to high cost of crude oil. Therefore, NR has the share of total rubber and relative price to competitive. Moreover, the major reason for the rapid growth of SR after the post war was the growth of the world demands for rubber which NR has inadequate in supply. The reasons for inadequate in supply of NR are several such important as 1) the damage of plantation during the WW II, 2) insufficient program of planting and replanting after WW II and 3) the uncertainties of expanding production in the facing uncertainty of political environment in the producing countries.

5. Liberal trade and price boom, 2001-2010

5.1) The world rubber consumption

The world rubber consumption enter period of boom during the early 2000s corresponds to the strong economic growth in developing countries essentially driving by China economics. Price rose once more than the out of break of Korean War but it have been high instability and a trend slow-down in the end of period. The world consumption of rubber has increased from the lowest of 17.586 million tons in 2001 to over 20.593 million tons in 2004 and rose to peak of 24.864 million tons in 2011 as Table 6-18 shows.

Table 6-18 World production, consumption and share of SR and NR during 2000-2011

Unit: '000 tons

Year	Rubber production	Rubber consumption	SR's share (%)	NR's share (%)
2000	17,580.0	18,145.0	59.3	40.7
2001	17,815.0	17,586.0	58.3	41.7
2002	18,203.0	18,430.0	59.0	41.0
2003	19,344.0	19,287.0	58.8	41.2
2004	20,721.0	20,593.0	57.7	42.3
2005	20,980.0	21,095.0	56.4	43.6
2006	22,439.0	22,365.0	56.7	43.3
2007	23,237.0	23,474.0	56.6	43.4
2008	22,839.0	22,923.0	55.6	44.4
2009	22,075.0	21,577.0	56.8	43.2
2010	24,481.0	24,864.0	56.7	43.3
2011	24,481.0	24,864.0	56.7	43.3

Source: RRIT, 2013

The rate of growth was by about 4.1 % per annum. The growing consumption reflected the movement of economic development and its growth, which was grew in specific regional trends. The production of the world rubber has been lower than consumption since 2005. By the supply side, the growth rate of production grew by about 3.7 % per annum, which resulted to have a trend deficit of production along the period. The world rubber production has increased from 17.815 million tons in 2001 to over 20.721 million tons in 2004 and rose to 24.481 million tons in 2011. On the basis of the world rubber consumption, share of NR consumption has steadily increased from 41.7 % in the world rubber consumption to over 43.0 % in 2005 and then thereafter have been stabilized in market share. It reflected the growth of demand for NR at faster rate during the 2000s.

On other hand, share of SR consumption declined from 58.3 % in 2001 to lower 55.6 % in 2008 and steadily increased over 56.7 % during 2009-2011. The rated of SR share in the world consumption has decreased by about -2.8 % per annum. The major reason for the decline expansion of SR consumption was the high peak oil price during 2003-2008. The oil price rose above 30 U.S dollar per barrel during 2003 and reached to the average of 60 dollar per barrel in

2005 and peaked at 147.30 U.S dollar per barrel in 2008. The period of peak oil price has affected to increase production cost in SR production which stipulated to decline of SR's share in the world rubber consumption. This trend continued into the early 2010s corresponding to uncertainty of politics and the world recession in developed countries (FAO, 2003; RRIT, 2012).

Table 6-19 Consumption of natural rubber by the major consuming countries during 2000-2011

Unit: '000 tons

Year	U.S.A.	Japan	China	India	Malaysia	Korea	France	Germany
2000	1,194.8	751.8	1,150.0	637.7	363.7	332.4	270.0	250.0
2001	974.1	729.2	1,330.0	630.6	400.9	331.8	282.0	246.0
2002	1,110.8	749	1,395.0	680.0	407.9	325.6	226.4	247.0
2003	1,078.5	784.2	1,537.8	717.1	420.8	332.6	214.3	258.1
2004	1,143.6	814.8	2,000.0	745.3	402.8	351.7	226.1	242.3
2005	1,159.2	857.4	2,775.0	789.2	386.5	369.8	225.7	258.9
2006	1,003.1	873.7	2,769.2	815.1	383.3	363.6	216.3	268.9
2007	1,018.4	887.4	2,842.7	850.7	446.3	377.3	220.2	281.7
2008	1,041.0	877.9	2,946.8	880.8	469.0	358.2	199.6	246.9
2009	687.1	635.6	3,383.6	904.7	469.8	330.1	108.9	174.6
2010	925.5	750.4	3,646.0	944.3	457.8	384.0	136.1	291.3
2011	1,029.3	765.1	3,454.3	958.2	409.8	401.5	163.2	201.6

Source: RRIT, 2013

Table 6-19 shows the levels of consumption in major consuming countries. There has been structural change in rubber market from the developed countries into the developing countries. China is the world largest consuming countries since 2001. The consumption was about 1.330 million tons in 2001 and rose to over 2.00 million tons in 2004 and peaked at 3.646 million tons in 2010, reflecting the economic growth and high demand for motor vehicles and rubber goods. NR consumption has doubled since 2003. About 16 % per annum was the highest growth of NR consumption. Share of NR consumption in the world NR consumption has increased gradually during this period from 18.1 % in 2001 to peak of 36.3 % in 2009 and slightly declined to 32.0 % in 2011 as Figure 6-14 shows. This indicates that the boom of NR in this period driven by the great NR consumption from China.

USA is the second largest consumer. NR consumption was about 0.974 million tons in 2001 and rose to the annual average of 1.07 million tons during 2002-2008 and fell sharply to 0.687 million tons in 2009 corresponding to economic crisis to mark by the great recession economics and subprime mortgage crisis in the end of 2008. The consumption began to recover by about 1.029 million tons in 2001 reflected on stable situation in economic recovery and possibility against with Fiscal cliff, even through this problem will be forced a trend slow-down in growth of consumption. During the 2000s, NR consumption from USA has declined and their share in the world NR consumption has decreased substantially from 13.3 % to 9.6 % in 2011. This declining trend appears largely because of the increase demand for NR from China.

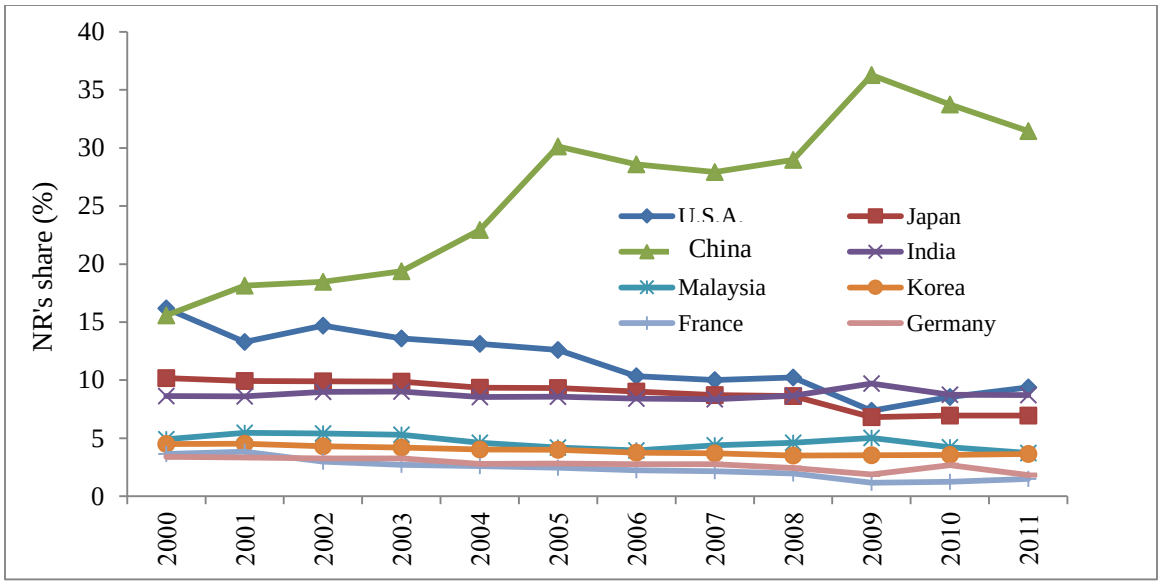

Figure 6-14 Relative share of NR in the world natural rubber consumption according to the major consuming countries during 2000-2011
Source: RRIT, 2013

In Japan, the pattern of NR consumption has similarly to USA. The NR consumption also has increased during 2001 – 2008 from 0.729 million tons to 0.877 million tons in 2008 and fell to 0.635 million ton in 2009. The consumption has recovered during 2010-2011 from 750.4 to 765.1 million tons. Japan's share in the world NR consumption steadily declined from 9.9 % in 2001 to 7.1 % in 2011. The consumption from Japan has stable to compare with the 1990s. The pattern of consumption for France and Germany has varies during 2002-2008. The annual average consumption was about 0.218 million tons for France and 0.257 million tons for Germany, which has increased to compare with the 1990s reflected the growth of Europe economy and expansion of economic activities in Euro zone. The level of consumption has increase marginally in Germany. After 2008, France and Germany have been a trend slow-down in growth of consumption in response to the great recession in USA and the recession economics in Euro zone. In 2011, Europe has presented a declining proportion of world NR consumption corresponding to financial crisis and the ongoing sovereign debt crisis affecting the decreasing industrial output (FAO, 2003; RRIT, 2013).

Moreover, Table 6-19 presents that developing countries such important as India, Korea and Malaysia are becoming the major consuming countries to be surpassed the proportion of developed countries. This increase in consumption has increased by about 5.2 % per annum for India, 2.1 % per annum for Korea, and 1.4 % per annum for Malaysia. Since 2000s, these consumptions continued a trend upward growth of consumption reflected the growth of economics and demand for new car in these counties. Growth in natural rubber consumption will be highly uneven among the developing countries leading by China, India, Korea, Malaysia and Thailand, with their fast-growing automotive and tire industries. The developing countries exhibited the largest and fastest growth among the consuming countries (RRIT, 2012).

Table 6-20 Consumption of natural rubber according to the world regions during 2000-2012

Unit:'000 tons

Year	Asia		Americas		Europe		Africa		Total
	Volume	%	Volume	%	Volume	%	Volume	%	
2000	4,007	54.3	1,794	24.3	1,433	19.4	115	1.6	7,378
2001	4,212	57.4	1,520	20.7	1,434	19.6	108	1.5	7,331
2002	4,407	57.7	1,698	22.2	1,335	17.5	118	1.5	7,635
2003	4,685	59	1,697	21.4	1,437	18.1	118	1.5	7,937
2004	5,280	60.6	1,814	20.8	1,499	17.2	123	1.4	8,716
2005	5,687	61.8	1,856	20.2	1,552	16.9	110	1.2	9,205
2006	6,325	65.3	1,673	17.3	1,571	16.2	109	1.1	9,690
2007	6,685	65.7	1,731	17	1,648	16.2	110	1.1	10,178
2008	6,854	67.4	1,767	17.4	1,482	14.6	126	1.2	10,173
2009	6,984	74.9	1,277	13.7	1,005	10.8	94	1	9,330
2010	7,653	70.8	1,690	15.6	1,359	12.6	101	0.9	10,806
2011	7,629	69.5	1,786	16.3	1,475	13.4	91	0.8	10,981
2012	7,838	71.7	1,684	15.4	1,302	11.9	97	0.9	10,924

Source: IRSG, 2013

Figure 6-14 also shows that China is the largest NR consumer. NR share from China has doubled from below 15.0 % in the early 2000s to above 30.0 % in 2011. It was reflected China economic directing the world consumption. Other consuming countries from Asia countries also increased accordingly. In other hand, NR share from USA and other developed countries declined steadily. In order to present structural change in rubber market from the developed countries to the developing countries, Table 6-20 also presents that the consumption of NR from Asia regions accounted about 54.3 % in 2000 and increased to 71.7 % in 2012, reflecting the growth of economic in this region.

5.2) The world consumption of synthetic rubber

Table 6-21 shows the level of SR consumption by major consuming countries. China was the world largest consumers with the growth rate by about 6.5 % per annum, which was lower to compare with 16.0 % per annum by NR consumption, taking rose from 1.575 million tons in 2001 to 4.442 million tons in 2010. SR consumption continued a trend upward growth of consumption. The relative share of SR in total rubber consumption from China was higher than NR consumption and their SR consumption has increased from 54.2 % 2001 to 58.8 and fell to 48.3 % in 2005, and then rose to 54.9 % in 2010 as Figure 6-15, reflected higher substitution between SR and NR in competitive market.

SR still accounted a large share of total consumption in each of developed countries even the annual growth rate of SR consumption has declined for example by about -8.3 % for USA, -48.6 for France, and -9.7 % for Germany during 2001-2008. The annual average of SR consumption was about 1.89 million tons by USA, 1.133 million tons by Japan, 0.605 million tons by Germany and 0.393 million tons by France. These consumptions have been never over

the annual average of consumption in 2000. A trend slow down of SR consumption corresponds to high production cost during peak of oil price and economic recessions. SR consumption has slightly recovered during 2009-2010.

Table 6-21 Consumption of synthetic rubber according to the major consuming countries during 2000-2010

Unit: '000 tons

Year	U.S.A.	Japan	China	Brazil	Korea	France	Germany
2000	2,189.5	1,137.5	1,455.0	357.2	382.0	481.5	632.0
2001	1,839.5	1,085.1	1,575.0	333.8	373.0	464.5	613.0
2002	1,895.0	1,096.0	1,940.6	344.4	365.0	469.3	612.0
2003	1,926.4	1,110.7	2,193.3	352.4	352.2	493.2	615.0
2004	1,906.8	1,146.3	2,466.6	430.7	349.1	420.1	624.5
2005	2,002.1	1,156.0	2,588.1	404.8	343.7	354.9	635.0
2006	2,000.8	1,170.8	3,037.9	425.1	363.8	310.8	617.3
2007	1,890.3	1,162.2	3,537.0	477.3	347.0	316.0	570.1
2008	1,694.9	1,137.6	3,430.0	483.9	329.0	316.0	558.5
2009	1,447.7	831.9	4,230.0	448.5	278.2	236.8	508.9
2010	1,731.9	987.2	4,442.2	536.1	330.3	305.5	563.2

Source: RRIT, 2013

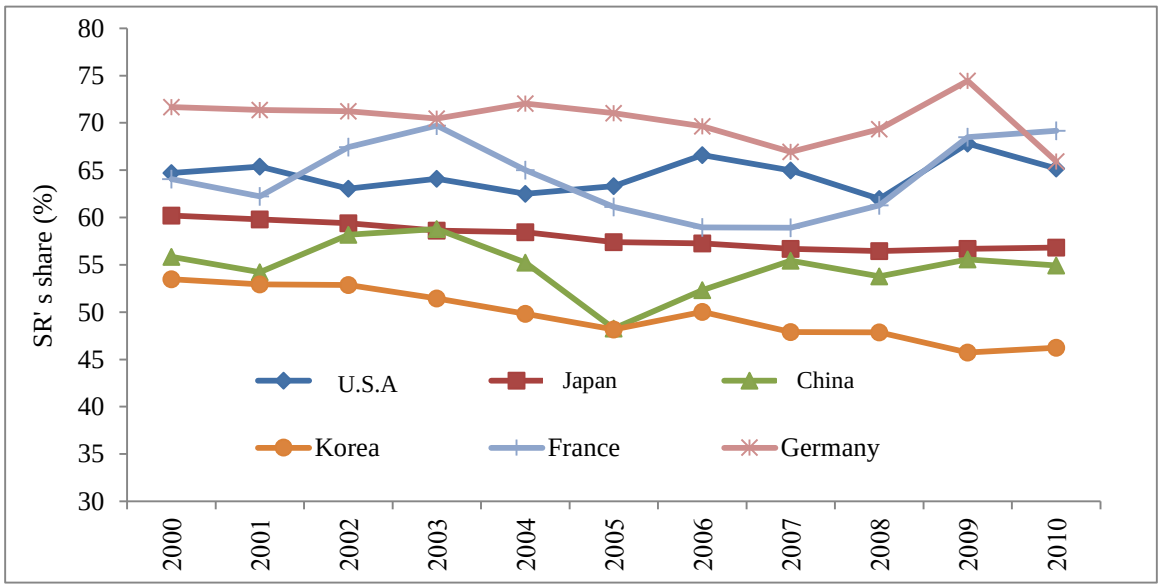

Figure 6-15 Relative share of SR in the world consumption by the major consuming countries during 2000-2011

Source: calculated from the data of RRIT, 2013

Figure 6-15 shows that the relative share of SR has been stable at the average of 64.0 % for USA, 63.1 % for France and 70.3 % for Germany during 2001-2008 and thereafter has been a noticeable increase in Franc and USA. The relative share of SR in Japan and Korea has shown a generally downward trend. There was a decline in SR share in 2001 compared to that of 2011 by about -3.0 % for Japan and -6.7 % for Korea. Then, the pattern of SR consumption for the

developed countries has not varied greatly during the 2000s. The level of SR consumption has increase marginally in USA, Japan, and Germany during 2001-2008 and then has been slump in their SR consumptions the end of 2008. SR consumption has increased during 2009-2010 and their important have been surpassed by the developing countries such as China and Asian countries (FAO, 2003; RRIT, 2013).

5.3) The world production of natural rubber

In the 2000s, the major NR producing countries are Thailand, Malaysia and Indonesia, which accounts about 73.2 % of the world NR production in 2011. Thailand was the world largest producers. NR production from Thailand has increased at the annual growth 4.7 % per annum from 2.319 million tons in 2001 to 3.527 million tons in 2011 as shown in Table 6-22. The relative share in the world production increased to 33.9 % in 2011. Indonesia was the second largest NR producer. NR production has sharply increased from 1.607 million tons in 2001 to 2.066 million tons in 2004 and rose to 3.093 million tons in 2011. Production still continued a trend upward growth at annual rate of production growth about 7.1 %. Indonesia's share in the world production increased from 21.9 % in 2001 to 29.7 % in 2011.

Table 6-22 Production of natural rubber according to the major producing countries during 2000-2010

Unit: '000 tons

Year	Thailand	Malaysia	Indonesia	China	India	Sri Lanka	Total
2000	2,346.4	927.6	1,501.1	445	629	87.6	6,762
2001	2,319.5	882.1	1,607.3	478	631.5	86.2	7,332
2002	2,615.1	889.8	1,630.0	527	640.8	90.5	7,326
2003	2,876.0	985.6	1,792.2	565	707.1	92.0	8,006
2004	2,984.3	1,168.7	2,066.2	573	742.6	94.7	8,744
2005	2,937.2	1,126.0	2,271.0	510	771.5	104.4	8,907
2006	3,137.0	1,283.6	2,637.0	533	853.3	109.2	9,827
2007	3,056.0	1,199.6	2,755.2	590	811.1	117.5	9,890
2008	3,089.8	1,072.4	2,751.0	560	881.3	129.2	10,128
2009	3,164.4	857.0	2,440.0	644	820.3	137.0	9,690
2010	3,252.1	939.0	2,736.0	665	850.8	153.0	10,399
2011	3,527.3	996.3	3,093.0	710.7	892.7	157.8	10,399

Source: RRIT, 2013

Dislike Thailand and Indonesia, NR production from Malaysia has shown a trend decline and has varies during the 2000s. NR production has sharply increased from 0.882 million tons in 2001 to 1.283 million tons in 2006 and fell steadily to the lowest of 0.857 million tons in 2009, and thereafter it has been recovered again after 2010. Then, Malaysia has steadily lost share of NR production to other producing countries, which cause decline of the relative share of NR production from 12.0 % in 2001 to 9.6 % in 2011 as Figure 6-16 shows. These three producers accounted for about 73.0 % in the world production of natural rubber.

Elsewhere in Asia, the NR production has also increased especially from China and India, which mostly used for domestic consumption. Sri Lanka recovered in production to compare with previous period that production has increased even the proportion of the world production was low.

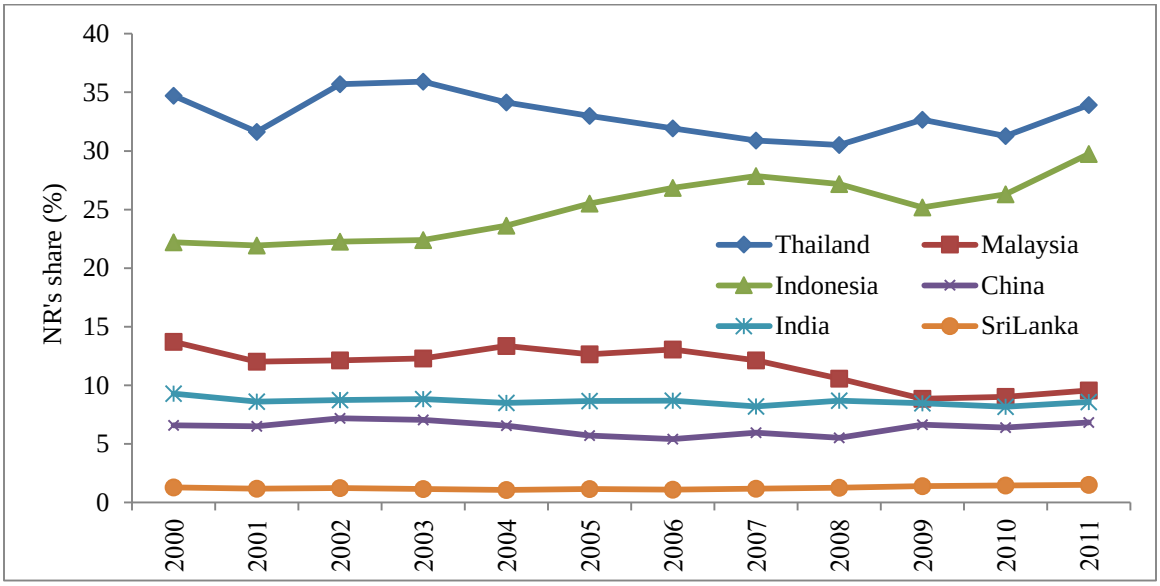

Figure 6-16 Share of NR in the world natural rubber production according to the major producing countries during 2000-2011
Source: RRIT, 2013

The bulk of NR production in producing counties is exported over 90.0 % for their production during the 1990s. Proportion of export steadily decreased in the period 2000s, reflecting growth of domestic consumption. Malaysia has been impressed for increasing proportion of domestic consumption above 40.0 % of total production. The percentage of export in the total production from Thailand and Indonesia has slightly decreased, which have made effort to increase domestic consumption. In Thailand, the export has increased from 2.042 million tons in 2001 to 2.952 million tons in 2011 with the annual average 4.46 % per annum. The proportion of export in the total production was 86.1 % in 2011 compare with about 89.1 % in 2001, reflected it steadily increased in the proportion of domestic consumption even this export accounted for a larger proportion than domestic consumption (Table 6-23). Domestic consumption totaled 490,400 tons in 2011 compared with 253,100 tons in 2001. The growth of domestic consumption increased at annual average of 9.4 % as Table 6-24.

Like Thailand, the proportion of export in Indonesia has been a large share in the total production. The export increased from 1.496 million tons in 2001 to about 2.568 million tons in 2011. The growth of export grew at annual average of 7.16 %. The proportion of export in total production decreased from 91.2 % in 2001 to 86.4 % in 2011 in parallel the domestic consumption rapidly grew at annual average of 23.15 per annum. Domestic consumption totaled 476,000 tons in 2011 compare with 142,000 tons in 2011. This has comparable volume of

domestic consumption in the same level with Thailand and Malaysia as Table 6-24. The main export destination is USA which still account about haft of total export. Some proportion is re-exported from Singapore (ANRPC, 2012).

Table 6-23 Total export of natural rubber according to three major rubber producing countries

Unit: '000 tons

Year	Thailand	Malaysia	Indonesia
2000	2,166.20	196.4	1,379.60
2001	2,042.10	162.1	1,496.90
2002	2,354.40	887	1,502.20
2003	2,573.50	946.5	1,660.50
2004	2,637.10	1,106.10	1,875.10
2005	2,632.40	1,143.30	2,025.10
2006	2,771.60	1,285.20	2,290.30
2007	2,703.80	1,212.90	2,415.70
2008	2,675.30	1,154.50	2,297.30
2009	2,726.20	1,087.70	2,061.30
2010	2,866.40	1,245.40	2,368.70
2011	2,952.10	1,247.10	2,568.00

Source: RRIT, 2013

Table 6-24 Domestic consumption of natural rubber and its proportion by three major rubber producing countries during 2000-2011

Unit: '000 tons

Year	Thailand		Malaysia		Indonesia	
	Volume	%	Volume	%	Volume	%
2000	242.5	10.3	363.7	39.2	139	9.3
2001	253.1	10.9	400.9	45.4	142	8.8
2002	278.4	10.6	407.9	45.8	145	8.9
2003	298.7	10.4	420.8	42.7	156	8.7
2004	318.6	10.7	402.8	34.5	196	9.5
2005	334.6	11.4	386.5	34.3	220.9	9.7
2006	320.8	10.2	383.3	29.9	351.7	13.3
2007	373.7	12.2	446.3	37.2	382.7	13.9
2008	397.6	12.9	469	43.7	412.3	15.0
2009	399.4	12.6	469.8	54.8	352	14.4
2010	458.7	14.1	457.8	48.8	421.3	15.4
2011	490.4	13.9	409.8	41.1	476.4	15.4

Source: RRIT, 2013

Before 2001, the export of NR production from Malaysia has been declining in the overall picture. This decrease mostly affected by the reduction of production and increase of domestic consumption. Nevertheless, the volume of export has been larger than the domestic consumption. The volume of export was about 1.247 million tons in 2011 to compare with 0.887 million tons in 2002 but this included re-export of NR. The export account for 54.6 % in 2001, increased to 70.1 % in 2006 and declined to 58.9 % in 2011 while Malaysia has been high level

of domestic consumption since 2001 to compare with the major producers. The domestic consumption has increased at annual average 2.1 % during 2001-2009. Domestic consumption totaled 400,000 tons in 2001 and steadily increased to 469,800 tons in 2009, and fell to 409,000 tons in 2011 (RRIT, 2012).

5.4) Pricing boom and dynamics of price

During the 2000s, global commodities boom occurred after the long depression of commodities during the 1980s-2000s. Price boom was driven by a strong demand from emerging Asia economies, the low availability of supply, and high peak of oil price and thereafter diminished concerns about financial turbulence in Europe and Financial Clift in USA. The price boom was one of the longest and broadest after the post WW II period (UNTACD, 2012). The initial acceleration in prices was firstly visible by the development in oil price and thereafter began to rise sharply in rubber price in 2003. There has also been a sharp rise in the price of oil from the average of 25 U.S dollar per barrel to an average of 108 U.S dollar per barrel in the first haft of 2008 and rose to 147 U.S dollar in July 2008, and fell to 125 U.S dollar per barrel. The oil price would be up 400 % compared with the average monthly price in 2002. Consequently, price of rubber began to rise in 2002. There have been notable price increases over the period from 2002 – 2008 and has declined during the end of 2008 to 2009, reached to peak of price in 2011, and fell in price after 2012. Rubber price was the lowest of 575.0 U.S dollar per ton in 2001. Price has steadily increased to 765.1 U.S dollar per ton in 2002 and rose to 1,083.9 U.S dollar per ton in 2003 which rose by about 41.7 %. Price continued a trend upward increase during 2003 to 2008. Price boom rally reached the first peak of 2,618.3 U.S dollar per ton in 2008. Price of NR would be up 242.0 % compared to the annual average price in 2002. The annual average price boom was by about 34.0 % per annum (RRIT, 2013).

In July 2008, the subsequent global economic slow-down coupled with financial crisis induced sharply decline in price. Price has declined to the lowest of 1,250.8 U.S dollar per ton in December 2008. Price is set to continue upward trend in 2009 due to a combination of factors related to market fundamentals and the recovery of the global economy. Price appears to be recovery since the first quarter in 2009 and continued to be upward corresponding to a growth of the world economy. The annual average price of 1,921.7 dollar per ton was high compared with price in 2002. Rubber price continued its upward trend over 2010-2011 throughout to reach the peak of price in February 2011. The annual average of price rose rapidly from 1,921.7 U.S dollar per ton in 2009 to peak 4,817.4 U.S dollar per ton in 2011. Price boom was about 530.0 % compared with price in 2002. Financial turmoil in the Euro zone has been a sign to break this trend after the second haft of 2011. The slow growth rate for 2011-2012 has been a significant sign to slow-down in rubber price as well as the global economic activity. The fall of price was particularly sharp since the last quarter of 2011 as increasing concern in the debt crisis in Europe and China’s growth slowed.

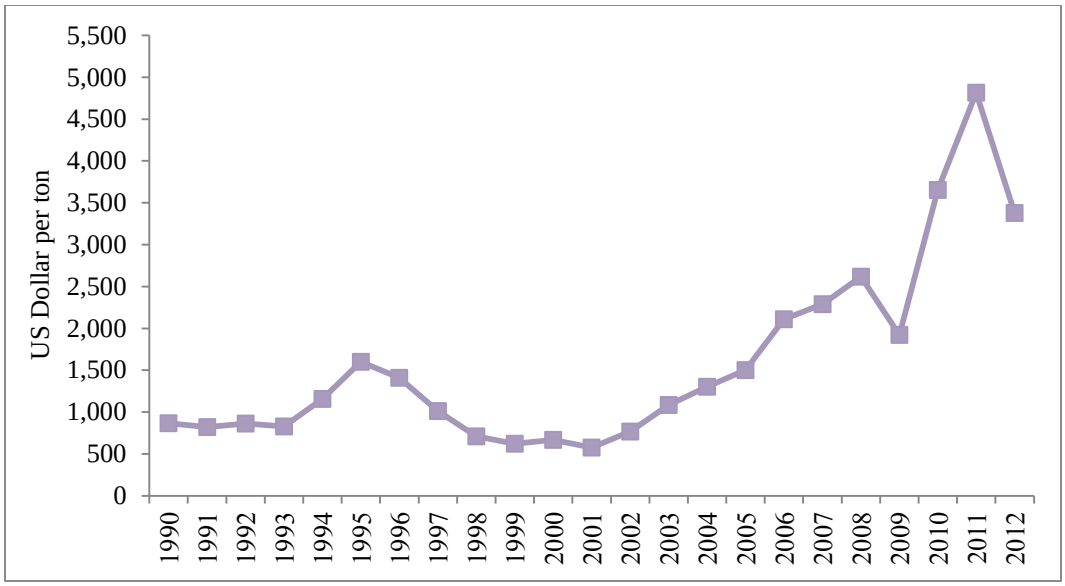

Figure 6-17 Price of Natural rubber (Nominal price) during 1990-2012
Source: RRIT, 2013

The factors driving the last price boom in rubber have been a combination of strong growth global demand, primarily from developing countries led by China and countries, growth of automobile industry, a slow supply response and low stock in supply of rubber together with speculation in future market. The strength and duration of the price boom mainly reflected the resilience of economic growth during 2003-2008. The global real economic growth was historically high about 3.5 % and was a growing faster by the developing countries in Asia. The strong economic growth highly contributed to provide the demand shock a result of the fast economic expansion. Indeed, China and India are presently passing through a development stage and high growth demand for motor vehicles and new cars that is much more intensive in rubber use. China's share in the world rubber consumption was double from 1.33 million tons to 3.45 million tons, which has increased by about 145 %. This demand included other important of developing Asia overwhelmed that of the OECD. There has been a corresponding shift in global demand toward industrialization and high growth of demand for cars and rubber goods. The supply of NR production has been sluggish to rising demand for rubber. The expansion of production was low due to prolonged period of low price and reduction of rubber areas led to slow capacity growth for many years, which has been a sharp decline in production from Malaysia(FAO, 2010; UNTACD, 2012).

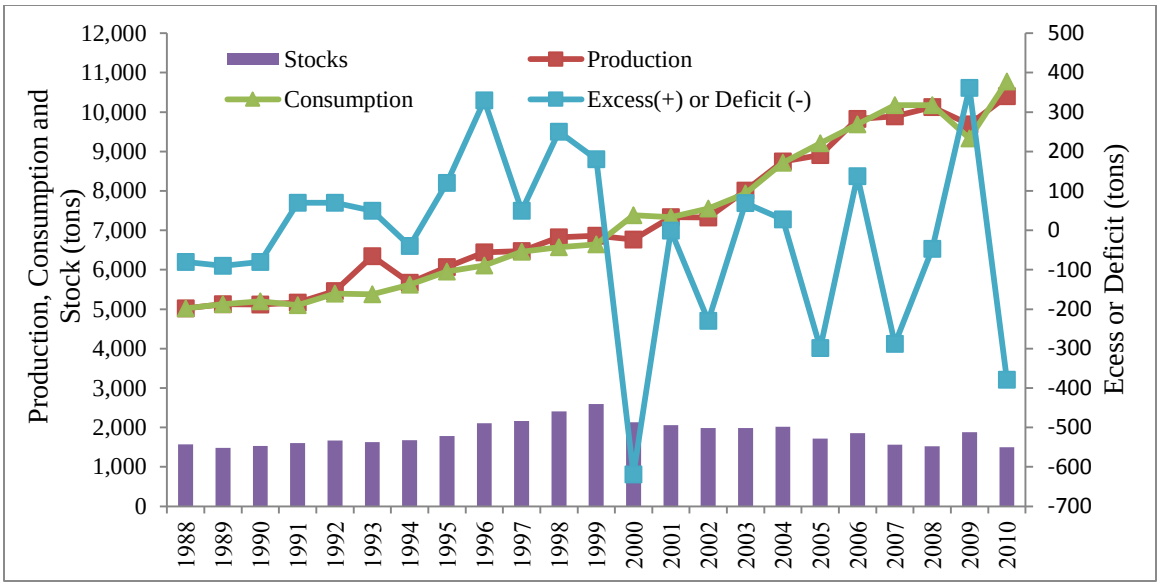

Figure 6-18 World production, consumption and stock of natural rubber during 1988-2011
Source: Calculated from the data of RRIT, 2013

Figure 6-18 shows that the deficit in supply of rubber was high during 2002-2008. Production has been relatively shortage of supply, which cause to reduction of rubber stock. Even this gap could be filled by synthetic rubber. NR production has also been shortfall due to weather conditions in 2010-2011 (ANRPC, 2012). Moreover, Price of rubber has also been influenced by speculation. Increase in dollar depreciation associated with high liquidity in international financial markets and relative low interest rate lead to seek higher returns in comparison to equity and debt securities forced to high speculation in rubber price in the future market. Devaluation in dollar which dominated for rubber trade boosts demand for NR. Thus, speculative activity added substantially to the demand for NR. Underpin factor was because of the low price of the 1980s and 1990s, which autonomously reduced NR production and area of rubber in producing countries. It was associated with the problem of labor shortage, high production cost and shift of rubber land to other economic crops or non-farm sector led to slow-down supply of NR. Price of rubber has fallen sharply since the second quarter 2011, reflecting slow-down global economic growth, increasing supplies and revised expectations. The recovery of global economic and oil price continued to influence on price of rubber but it was the significant slowdown in major consuming countries, notably China. China's authorities have pursued policies for slowing the economy to more sustainable and moderated growth affecting the decline in price (UNTACD, 2012).

6. Analysis of the structural transformation in the world rubber market

The propose of this section is to describe structural transformation in the world rubber market in order to explore and highlight determinants to drive transformation in the world rubber market that further has had a profound influences on structural transformation in the rubber economy in Thailand as following;

6.1) Structural change in demand for rubber: from the developed countries to the developing countries

Demand for natural rubber depended on the growth of world economic and output of automotive industries and non-tire goods. Industrialization and motorization have become important economic activities of both the developed countries and the developing countries that further indicate sustainable rubber consumption. The demand for rubber has been closely related to growth in gross national production and industrial production. The measurement of the estimates of the future growth in GNP and industrial output can provide the basis for estimating future demand for natural rubber. Countries with high rate growth on industrial production have been a higher rate growth of rubber consumption. This is true even the driver of the world economy shift from the USA and Western Europe to the Asia countries.

The world rubber consumption has been virtually grown steady and in some instance more than doubled every decade since the 1900s. The major proportion of NR has been consumed by industrialized countries leading by the USA and Western Europe and later Japan. Variation in the consumption in each of industrialized countries reflected to period of economic growth and its economic recession from time to time. Before the WW II, USA was the largest consumer. The industrialization and growth of industrial output were driven the demand for NR. The supply of rubber is entirely produced by territorial countries that could be gained to control chain of supply and to guide the demand for NR. For example, during the period of the great depression forcing to the lowest demand for NR. The producers have been created marketing regulation to guide the world rubber marketing into their attention. They had controlled both output from producers and visible stock in the market which resulted to maintain price at the level of remunerative into producers. Political reasons in international trade also enforced to shape the rubber marketing. In this period, USA was the greatest consumer accounting over half of the rubber consumption in the world. Other Western Europe was the second consumers such as UK, France, and Germany. This was structure of market since the early 1900s to before the WW II. The control output associated political reasons have been influenced to drive market for their interests. Underpin factor is no competition or substitution production in the world market. Therefore, NR producers could be taken premium price and controlled profitable in supply chain over the rubber market.

Since the introduction of synthetic rubber in the mid-1930, SR industry has widely established by the major consumers to anticipate the control of rubber supply under territories and has seen for securing rubber consumption. Indeed, during the WW II, the USA government has heavily subsidized the expansion of SR capacity and its research development that pursued to

have adequate supply of rubber consumption during the time war. SR had have substituted a large proportion of the demand for NR. There have been advantages of economies of scale, technological innovation, and marketing effort able to maintain growth of SR industry. After the post war, SR industry becomes national strategic plan and originated adequately supply of rubber in the major consumers widespread from North America, Europe to Japan. We found that decline in proportion of NR consumption is substituted by SR. SR accounted the largest share of rubber consumption in each of the major rubber consumption with high competitiveness both technique and price. The rubber market was dominated by SR to gain with low price, stability of price and supply of SR as requirement of manufactures. SR price has seen to govern the trend of NR price. During 1960-1973, NR price has declined in the relative low price of SR. The sharp rise of oil price in 1973/74 and 1978 /79 was set back high production cost. It further reduced SR competitive and become closely the relative price between NR and SR. Oil crisis provided the change in the structure of rubber market in next periods. Therefore, SR created structural change in the rubber market from period of substitution (during the war time) to period of product competition. There was contingent event providing structural change in rubber market.

After the post war, North America was still the largest rubber consumption. The use of rubber also sharply increased in Japan and Western Europe. The industrialization and high growth of automotive industries have been strong demand for NR in the industrialized countries. Developed countries account for 68% of the world rubber consumption. Even USA was the largest of NR consumption but NR share in the total rubber consumption has declined from 45.4% in 1948 to 23.0% in 1960 and still fell in the total share of rubber consumption similar the characteristics in other developed countries. It was reflected that SR' share substituted demand for NR and created the change in structure of rubber market in developed countries. World Bank argued that the expansion of SR consumption in this period was due to lack of supply of NR (World Bank 1960). For such, the data reveals that vertical integration from petrochemical, SR industry and tire manufacture in USA was driven the growth of SR consumption. This was due to they could purchase SR from domestic industry at low price to compare with NR and securing supply. In other hand, NR share of the world consumption from the developing countries has increased from 17% in 1948 to 32% in 1960 reflecting the growth of economic in these countries.

During the 1960s-1980s, North America, Europe and Japan are still the major consuming countries and have seen steadily growth of the world rubber consumption. SR continued to gain substitution of demand for NR and rose to peak of share about 79.0 % of the world rubber consumption in 1979. With regarding to threats of oil price and stability of price, the developed countries were driven the rubber market through economic power and international trade order to govern the rubber market for their own interest. The implementation of IRA was the important evident that can be characterized driven of marketing attention. SR was larger share in the rubber consumption than NR in the developed countries. After the mid-1980s, the competitiveness of NR has steadily increased as consequences of technological development, productivity increase, and the competitive price due to high production cost of SR and the

replanting with high yield. NR share in the world consumption has steadily increased even SR still accounted a large share in the world rubber consumption. The slow growth of SR consumption was observed by developed countries until the 2000s regarded to high production cost and economic recessions. In other hand, the developing countries accounted above 50% of the world consumption of NR in 2000 and continued growth of rubber consumption. Economic growth and industrialization in the developing countries were driven demand for NR and further increased share of NR in the world rubber consumption. The major NR consumptions from the developing countries are China, India, and other Asia countries. By the proportion of consumption, the market structure has shifted from the developed countries to the developing countries since the early 2000s. The change in the structure of the world rubber market was driven by industrialization in the developing countries and it became to guide the position of rubber market.

From above discussion, rubber is a derive demand and is likely to be inelastic. A major demand for natural rubber arises in the automotive industry that need primarily for tires and for other automotive parts. Rubber is an input to tire and the several auto-parts. Tire and auto-parts have been assembly to passenger cars and commercials vehicles to be used in new ones or in use. Demand for new cars or replaced tires in the use cars will be transmitted to demand for natural rubber accordingly. Demand for natural rubber is sensitivity to any change in the world economic activity and external shocks, which could have shift of demand or negative. Changes in the price of NR do not sensitivity to demand for NR. It can be argued that changes in the price of NR will not appreciably changes in the price of tires, thus demand for NR will continue to be unchanged. The users in rubber manufacturers have been sensitivity to external stocks and the expectation of economic situations. Thus, the price was highly fluctuated (Haque, 1971, 1972).

6.2) From market regulations to demand driven market

Natural rubber is a homogenous commodity. The different quality is graded on the basis scientific method such important as ash, the dirty content, moisture, and degradation ratio. Historically, price formation is not only derived from interplay between supply and demand but also derived by market regulation guiding by governments and/or international agreements.

During the mid-1900s to the mid-1910s, demand for NR has rapidly increased in response to industrialization and technological progress being car industry that stretched price boom. Decline in the price was characterized by oversupply of NR after 1910 according to a large output from Malaysia and Ceylon that planted during 1900s as well as the effect of the World War I during 1914-1918. Price has been stable after the Stevenson scheme implemented after 1922 that help to regulate rubber market for price at remunerative producers. The great depression in the USA during 1929-1932 had greatly impacted on the lowest demand for Cars and vehicles, of which transmitted to the lowest demand for NR. Price was the lowest in history of rubber economy. This situation again required to intervene market by territorial producers under the agreement of International Rubber Regulation (IRR).

Before the WW II, two market regulations were the Stevenson scheme during 1922-1928, International Rubber Regulation (IRR) (1934-1943). By the period of low demand for NR and

fallen in the price, the Stevenson scheme and International Rubber Regulation are created by the major producers. These regulations are similar mechanism of market regulations through control level of production, exportable percentage and stock. The main objectives were to control supply of rubber and to assure a remunerative price to the producers. Under the Stevenson scheme, price did not show upward movement as their expectation due to scope of restriction only in British territories. The Stevenson scheme has seen fail to implement but it had experienced for scope of restriction and management of scheme which but it could be solved in later regulation. In response to the great depression, the producers created International Rubber Regulation (IRR) in 1934. About 98 % of production included to control by IRR, which mostly come from territorial producers. The producers can be regulated market through the control of production, exportable percentage of quota and stock. This attention aimed to have price in the level of remunerative producers. IRR helped to increase price and presented upward trend of price. Due to the outbreak of WW II, the IRR had to be dismantled and terminated after the WW II.

In the post war, it seems that rubber market have free market driven by the needs from the industrial countries. The recovery of industrial production and the rapid growth of automotive industries in the developed countries created a strong growth of demand for natural rubber. Price boom occurred again in 1950/51regraded to stockpile of the US government. The price has substantially declined thereafter. The securing supply of rubber and price fluctuation become major concerns by the consumer countries that led to create International Rubber Agreement (IRA) (1980-2002) in order to securing supply and stabilization of price. IRA came to exist co-operate between producers and consumers. The mechanism of market regulation consisted of finding out a reference price daily from the official quoted prices in main rubber markets. The reference price determined whether or not selling-buying for the buffer stock. The intervention mechanism was conducted by International Natural Rubber Organization (INRO) and had changed over time according to the price. IRA was relatively successful in market intervention for price stability during 1981-1990. Thereafter, producers claimed that IRA was failed for price stability. Buffer stock under INRO had deteriorated in upward trend of rubber price and beneficial for consumers rather than producers. INRO had stop market intervention activities since 1997 and then terminated in 2002.

Thus, the study found that rubber market is often regulated by international cooperation. During the restriction scheme in 1930s and 1940s, NR had entirely produced under control of the sterling companies of British Empire and territories areas under Dutch and France. Then, market intervention guiding by them had been successful to restrict supply that led to regulate price as their attention. This has districted from the situation during the IRA, when substitution of SR existed and demand for NR driven by worldwide rubber manufactures. The different structure of marketing was made the difficult to regulate market and the price. Enter to the period of liberal trade after 2001, price of rubber depended on the need of market when the high growth of global economic was driving by China and Asia countries that created a large demand for rubber during the 2000s. Price boom occurred again during 2003-2011, and thereafter price declined and fluctuated widely in response to the change of economic activity. Thus, demand for NR and the

resulting supply-demand balance have been determined the change of price. NR price is governed by the competitive circumstances.

6.3) Substitution and competition between natural rubber and synthetic rubber

The introduction of synthetic rubber (SR) and it expansion created substitute effect and competition between natural rubber (NR) and synthetic rubber (SR). The competitions between NR and SR were remarkably made both in price, technique and availability. Up to the WW II, NR was a near monopoly position the use in rubber manufactures. Natural rubber (NR) experienced no competition from substitution products (World Bank 1959). Rubber industry rapidly changed to be challenged by synthetic rubber (SR). SR has been substantially expansion as a consequence of technological change, improved competitiveness due to reductions in relative costs, quality and better marketing efforts, vertical integration in the SR producing and consuming industries, and insufficient availability of NR.

Before the WW II, the prices of NR had have advantage premium price without competitions and perhaps continued to command a premium over the base price of SR during the first decade of post war. This is because it is not expected that SR can characterize property of NR, and then NR has been higher priced than SR. At that time, a large expansion in SR production capacity is now taking place in the developed countries thereby there has substantially been increase in SR consumption and progress technology. It seems that competitive price have been developed in this period. During the period 1960s, technological innovation and economies of scale in SR industry reduced production cost and price of SR, thereby depressing NR price. This can be explained the decline in price during 1960-1973 affecting on a large increase in SR' share in the world market. The study found that SR prices are generally lower than NR prices. The different prices exist despite SR industry facing increase of production cost during the two periods of the oil crisis. The price differential between NR and SR will be continuously reduced where increasing oil price will be costly for SR industry. The relative price between NR and SR has shifted to change in the structure of rubber demand with recognize to increased competitive of NR price. Moreover, the price of SR has been very stable while the price of NR has fluctuated widely. The stability of SR price is the result of oligopolistic market structure where SR productions do not interplay of market forces. The relative stability of the price of input and the demand contributes to short run stability in SR industry in respect to integration forward and backward industry, thereby SR price was administrated while NR price are allowed to fluctuate through the interplay between demand and supply and relevant of market regulations. Then, NR producers became to a large extent as price takers.

Since the mid-1960s, SR production capacity had rapidly extended on to have economies of scale in the developed countries and become to dominate in the rubber consumption. These trends extended through the 1970s. At the same time, NR's share in the world rubber consumption has decreased steadily and surpassed by SR. This substantial growth in SR consumption has not meant a decline in the consumption of NR. SR industries also became strategic plan of national development. Technological development in both NR and SR is key factor in competition. The increase of NR content in new technology of radial tires in the 1970s

caused beneficial to NR consumption, which has been the reduce demand for the combination of SR. However, strong market efforts and technological progress sustained the growth of SR industry.

Oil price determined the cost structure of SR, which heavily depends upon petrochemical feedstock. During the period of low oil price, SR price has been substantially lower than NR price and also has been very stable in price, and thereby substantially increased a large SR's share in the world market. In other hand, since the oil crisis during 1980s and again in 2000s, high oil price had impacted to shift production cost in SR industries, which has increased substantially. The price of NR was roughly competitive with SR price, and then NR's share has increased. One of the important factors to induce the dynamic growth of SR is structure of SR industry. SR industry is characterized backward and forward integration. The dependence of tire manufactures on SR forced them backward integration while input of production depends on those of petrochemical production encouraged them for forward integration. Structure of SR industry exists today and therefore they have been securing demand for SR and limited price competition among producers. With regarding to competition with SR, the competitiveness of NR have been strengthened and is increasing as a consequent of improved research and development, reduced relative production cost, the replanting with high yield, and marketing efforts. Despite to compete with SR, these measures help to achieve steady growth of NR production and NR share has steadily increased after 1990s.

6.4) Structural change in the rubber producing countries

The study found that there has been structural change in the world rubber production. Since the turn of the twenty century, structure of rubber industry consisted for wild rubber and plantation rubber. Wild natural rubber from South of America and Africa dominated in the world rubber consumption while the proportion of plantation rubber grew from Ceylon and Malaysia under British territories. Output of wild rubber has declined since the early 1910s where had surpassed by new source supply of the plantation rubber from Ceylon and Malaysia under British territories and later from Indonesia under Dutch territories. The growing demand for NR was strongly forced to search the possibility for plantation in colonies where environmental condition and weather are similar to originate rubber trees. It was associated with technological development and it achieved in capital investment that led to commercial plantation under companies. The estates were totally owned by European companies. This investment was high return and profitable plantation thereby the rubber plantation has substantially grew and originated to supply of natural rubber. These companies had have control productions and dominated the market from the 1900s to the 1950s. The estate sector grew rapidly with the attention from overseas investors that could earn excellent profits and recovered their capital investment within 2-3 year (Barlow, 1978). The politics from colonial also supported for the growth of estate regarded to immigrated labor and land policy. The estates under corporate capital, which formed association of rubber producers and trade, were entirely control supply of rubber in the world market and have the various strategies adoption to drive the market. The Stevenson scheme and International Rubber Regulation are the policy of producers that originate

to manage the supply by their attention to regulate the market for price increase and to keep profitability.

From the 1900s to the early 1940s, the main producers are Malaysia and Ceylon under British territories and Indonesia under Dutch. Malaysia is the largest producer in the world with shares nearly half of the world production. Indonesia is the second largest producers and up to the world's largest producer during 1950-1959. About 70 % of the world production is produced by these countries. Ceylon is recorded the first export natural rubber since the 1900s and continued the third producers until the end 1950s. Other producing countries are Thailand, India, Viet Nam, China, South America and African, which produced a few proportion in the world output. Then, British Empire and Dutch territories have controlled over 90 % of supply of rubber. This was evident to illustrate fundamental structure of the world rubber industry. There was period of producers driven supply of rubber and the world rubber market.

After the post war, natural rubber production recovered rapidly. The world production had mostly returned to the pre-war peak of 1941 in 1948 and continued a trend of growth of production in accordance with the increase of demand, Korean War, and the world political conflicts. Malaysia production grew at the impressive rate since the 1950s and its share in the world production was over for about one-third of the world output and rose to peak of 45 % in the world production in the mid-1970. This is due to government replanting scheme and the spread of high-yield clones. Due to high production cost, labor constraints, and low price since the early 1980s, production has declined during the early 1980s and continued a trend slow-down of production in the 1990s and surpassed the largest producer by Thailand in the early 1990s. Indonesia was the second largest producers and surpassed to the first producers during 1951 to 1957. Production has steadily increased with annual average growth of 1.6 % during 1960s, continued a trend growth over 2.0 % from during 1970s to 1980s and fell by about 1.20 % in the 1990s. The slow-growth of production regarded to lack of implemented replanting scheme and mostly affected by the expansion of rubber land. In Thailand, production was small proportion in the world production after the post war (1950s-1960s) but it continued a trend of growth of production and doubled share in the world production during the 1970s – 1980s. This growth has been the several deliberate efforts in rubber expansion policy and the replanting scheme of the government. Other elsewhere Asia countries have also increased and growth continued such as Philippines, Vietnam, Cambodia, India and China where steadily grew after the 2010s.

The structure of the world production illustrated internal transformation that was consequences of long term research and development purposed for improvement productivity in production, technical progress in the NR processing, the replanting scheme in each of producing countries, and exchange of production technologies to be adopted within and cross producing countries. One of important factors was the competition between SR and NR. SR had overtaken a large share of demand for NR in the world consumption during the 1960s-1970s. NR producers have been achieved through increase of productivity, technological innovation, and the competitive relative price (due to high production cost of SR) over the period. The strong growth of the world demand for NR is clearly the most important factor to maintain supply to meet the

world market and further was guided into rubber policies in each of producing countries. The international rubber agreement during 1980-2002 originated to manage for securing supply of NR and stabilization of price for producers but this agreement may be more benefit to consuming countries and did not change in the structure of the world rubber industry. Thus, there was the change in structure of the world production driven by marketing forces to compare with the previous period.

In the early 1990, the world production of NR has been stagnation as consequences of low rubber price and increasing production cost since the early 1980. Malaysia production has declined as a result of shift by farmers to others and the reduction of rubber land. In Thailand, the ongoing replanting scheme during the 1970s- 1980s has been achieved a double of production with high growth rate in the 1990s and continued a trend growth upward into the 2000s. Thailand becomes the largest producers in the world production ahead of Malaysia and Indonesia. Output from Indonesia steadily increased during the same period with variation in growth trend. Indonesia is the second most important producing countries. India and China also produced more than double within the 1990s, which was sufficient for domestic consume. Production also appears to be plenty for expansion in other Asia countries and South America even it has been a few proportion of share in the world production. Three major producers accounted over 70 % of the world production in 2000. In the period of price boom, Thailand still was the world largest producers with the annual average at 4.7 %. Indonesia was the second world producers with high growth rate at annual average 7.1 %. Malaysia production has declined during the mid-2000s and steadily increased with regarding to price boom and rubber policy to maintain level of production. The NR production from China and India has doubled which mostly used for domestic consumption. Sri Lanka also recovered in production to compare with previous period. The expected growth of the world demand and price were driven the growth of production during the 2000s. Since Thailand surpassed to leading producer in 1991, there has been structural change within the producing countries in parallel with structural change in the world rubber demand as above discussion. The recent structure of the world rubber production reflected the different government policies and their new investment decisions among major producing countries in the 1990s – 2000s. Supply of NR under this structure could be grown at potential market needs beyond the period 2000s.

From above discussion, the study found that natural rubber rule is inelasticity of supply in natural rubber production and production structure. Output of rubber tree cannot be increased in response to rising price, reflecting that supply of NR in the short run is highly price inelastic. On other hand, decline in rubber price does not result in reduction in output since farms devoted to invest in rubber plantation. Stock of rubber was made to adjust the supply responding to the amount of demand. When level of commercial stocks relative to the turnover rise abnormally, the NR price can be expected to decline, and conversely when the stock was low. Rubber tree could be tapped for its latex at least after 7.0 year (in Thailand). Rubber tree can be productive for about 25-35 year even the rapid diminished yield was observed after 25 year. Increase of supply is generally determined by the extensive replanting and new planting of rubber areas. The cutting

down rubber tree for replanting is a decrease in production in the short run but an increase in the long run because new replanting will have a higher yield. However, farm may move out into other crops in response to decline of price. New high yield clone have been mainly responsible in improving the productivity and reduced the relative production cost. The yield of the existing plantation can be realized by the application of stimulation. The world production is dominated by an agglomeration of small producers. Rubber production in each of countries has historically been a smallholder industry accounted above 90 % in the world production. Three main producing countries: Thailand, Indonesia, and Malaysia accounted above 70.0 % of the world production in 2011 and the rest produced by other countries in the tropical zone. These suppliers did not have enough level of leverage over the whole distribution of NR production. By the global picture, supply of NR has increased at the different rate of growth reflecting periods of increase of demand and price.

6.5) World politics, liberal trade and the impacts on rubber market

The world political conflicts and wars are non-economic factors that have influenced on the change of demand for NR and price. For such, during the outbreak of war in 1940-1941 of the WW II and the Korean War in 1950-1951, the stockpile pursuing to build securing supply of rubber and War reasons built by the government of USA and United Kingdom created the shock of demand for NR. The results were price boom and the high growth of production before the outbreak of war. After the post war, the recovery of economic and industrial output needs to consume NR at high growth rate of consumption that consequently affected on the expansion of rubber production at farm level and policy decision in producing countries in the later decade. In case of price boom in 1950/1951, it had impacted on a large expansion of rubber land in Thailand in the next two decade. However, stockpile following the termination of Korea War had depressed on the price and leftward shift in the demand in next decade. Similarity, the relaxing tension of the cold war has seen rightward shift of demand for NR from the former USSR and China.

The study has observed that trade liberalization that institutionalized international trade since the mid-1990s underpin and influences on the growth of the world consumption of NR in next decade. This was due to the tendency of the industrialized policy to govern economic development among the developing countries. Liberal trade appears to enhance international trade between the industrial countries and the developing countries and further helps to increase demand for NR in manufactured products. For example, China's joining WTO in 2001 gained to rapid growth of the world economy. China recorded high growth of automobile industries and the exported manufacturing products. To drive rapid growth China's economy, China became the largest natural rubber consumption since 2001 with rate of growth 16.0 % per annum. NR's share from China in the world consumption was about 32.0 % in 2011 to compare with 9.6 % of USA. Similarity, other Asia countries has seen to gain the growth of international trade, which stipulated to increase demand for NR or high growth of domestic consumption in the producing countries.

Annex C

Results of the statistical analysis

Table 1 Number of farmers surveyed, samples analyzed, no. subsamples and experts

Village	Number of farmers surveyed	Number of samples analyzed	Number of subsample	Number of experts interviewed
Ban Mai	120	68	28	2
Koa Phra	90	50	17	3
Ban Lohan	88	50	18	2
Ban Kok Muang	95	52	18	2
Total	393	220	81	9

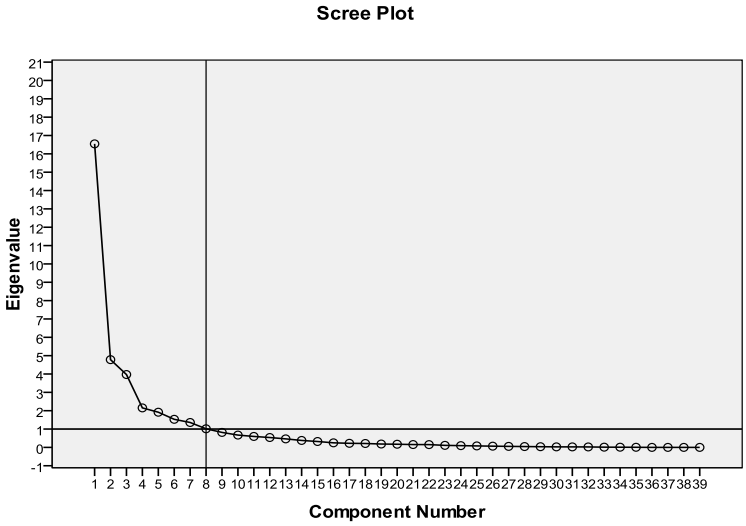

Figure 1 Screen plot of Eigenvalue in a total of 220 samples

Table 2 KMO and Bartlett's Test in a total of 220 samples

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.800
Bartlett's Test of Sphericity	Approx. Chi-Square	17835.71
	df	741
	Sig.	.000

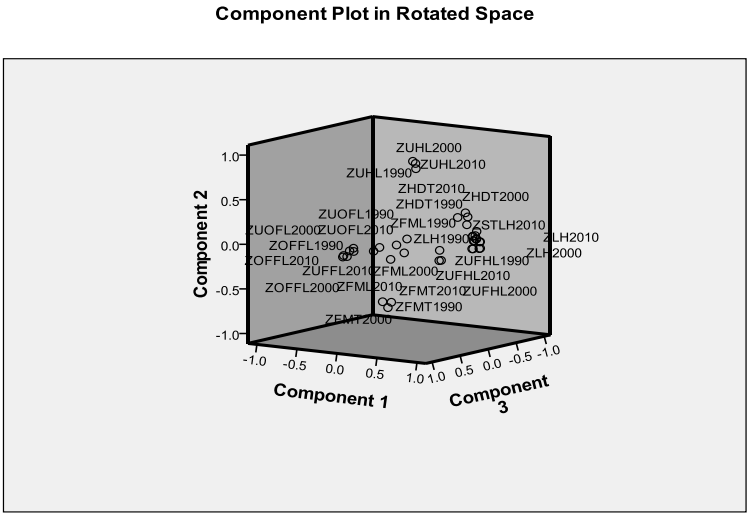

Figure 2 Positioning of the variables in factorial plane of a total of 220 samples

Table 3 Eigenvalue and Canonical correlation in a total of 220 samples

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	28.482[a]	63.8	63.8	.983
2	7.675[a]	17.2	80.9	.941
3	4.076[a]	9.1	90.1	.896
4	2.833[a]	6.3	96.4	.860
5	1.611[a]	3.6	100.0	.786

a. First 5 canonical discriminant functions were used in the analysis.

Table 4 Wilks' Lambda in a total of 220 samples

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 5	.000	1889.709	155	.000
2 through 5	.002	1214.643	120	.000
3 through 5	.020	783.634	87	.000
4 through 5	.100	459.551	56	.000
5	.383	191.503	27	.000

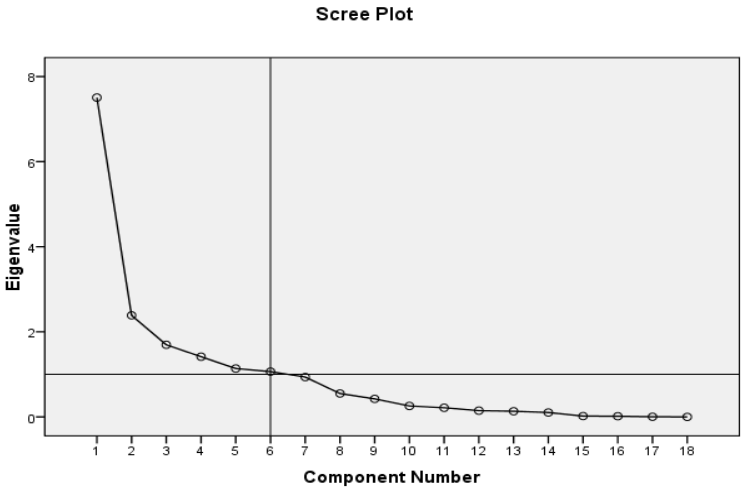

Figure 3 Screen plot of Eigenvalue in the value of variables in 2010

Table 5 KMO and Bartlett's Test of the value of variables in 2010

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.718
Bartlett's Test of Sphericity	Approx. Chi-Square	6144.978
	df	120
	Sig.	.000

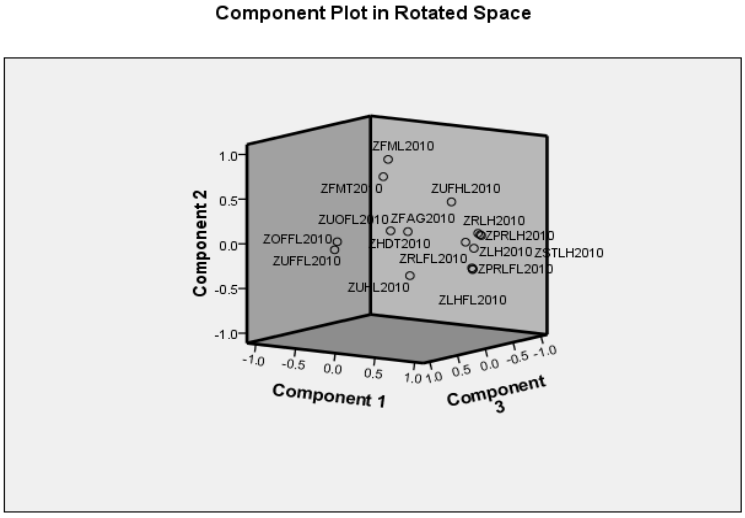

Figure 4 Positioning of the variables in factorial plane of the value of variables in 2010

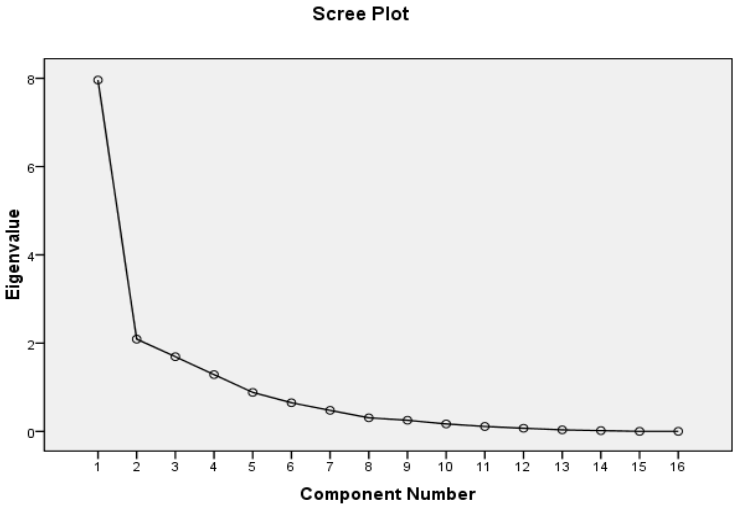

Figure 5 Screen plot of Eigenvalue in the value of variables in 2000

Table 6 KMO and Bartlett's Test of the value of variables in 2000

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.772
Bartlett's Test of Sphericity	Approx. Chi-Square	6377.796
	df	120
	Sig.	.000

Table 7 Principal components selected, eigenvalue, explained and accumulated variance, and correlation coefficients of the variables with the different PC for the value of variables in 2000

PC	Eigenvalue	%Varian explained	% Varian accumulated	Variables	Correlation with the PC
PC1	7.96	49.76	49.76	LHH_2000	0.963
				MRLH_2000	0.962
				RLH_2000	0.961
				SLH_2000	0.952
				RLFL_2000	0.945
				MRFL_2000	0.935
				LHFL_2000	0.927
				HTP_2000	0.894
				UFHL_2000	0.614
PC2	2.09	13.07	62.83	FTP_2000	0.875
				UHL_2000	-0.827
PC3	1.69	10.58	73.41	OFFL_2000	0.909
				UOFL_2000	0.749
				UFFL_2000	0.639
PC4	1.29	8.04	81.44	FML_2000	0.767
				FAG_2000	0.732

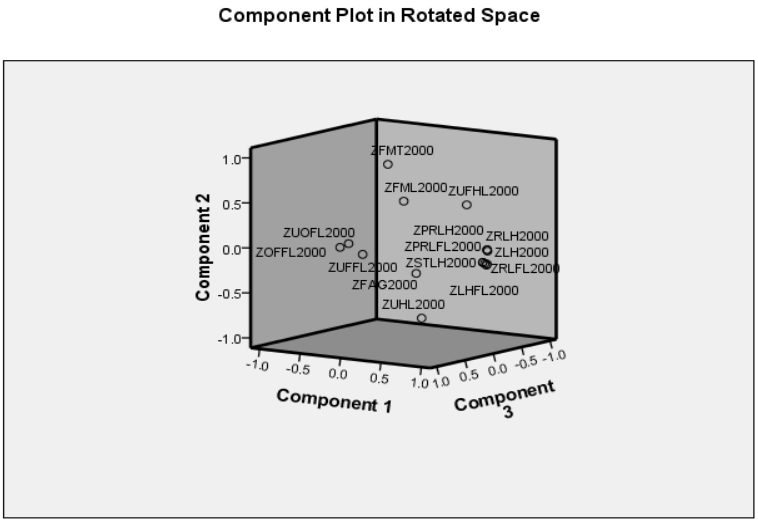

Figure 6 Positioning of the variables in factorial plane of the value of variables in 2000

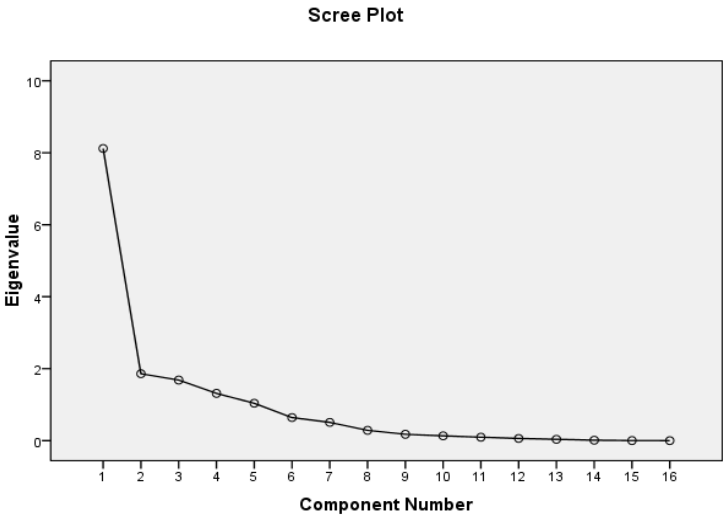

Figure 7 Screen plot of Eigenvalue in the value of variables in 1990

Table 8 KMO and Bartlett's Test of the value of variables in 1990

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.741
Bartlett's Test of Sphericity	Approx. Chi-Square	6545.866
	df	120
	Sig.	.000

Table 9 Principal components selected, eigenvalue, explained and accumulated variance, and correlation coefficients of the variables with the different PC for the value of variables in 1990

PC	Eigenvalue	%Varian explained	% Varian accumulated	Variables	Correlation with the PC
PC1	8.12	50.88	50.88	RLFL_1990	0.975
				LHFL_1990	0.974
				MRLH_1990	0.958
				RLH_1990	0.956
				LHH_1990	0.955
				MRFL_1990	0.955
				STLH_1990	0.938
				HTP_1990	0.894
				UFHL_1990	0.660
PC2	1.86	11.65	62.53	UHL_1990	0.876
				FMT_1990	-0.856
PC3	1.68	10.55	73.08	UOFL_1990	0.956
				OFFL_1990	0.795
PC4	1.29	8.23	81.31	FML_1990	0.827
				FAG_1990	0.800
PC5	1.04	6.51	87.82	UFFL_1990	0.979
				OFFL_1990	0.522

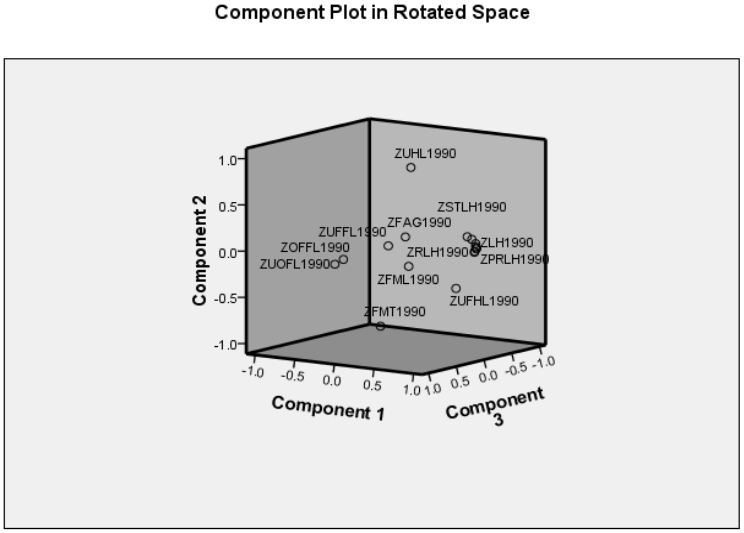

Figure 8 Positioning of the variables in factorial plane of the value of variables in 1990

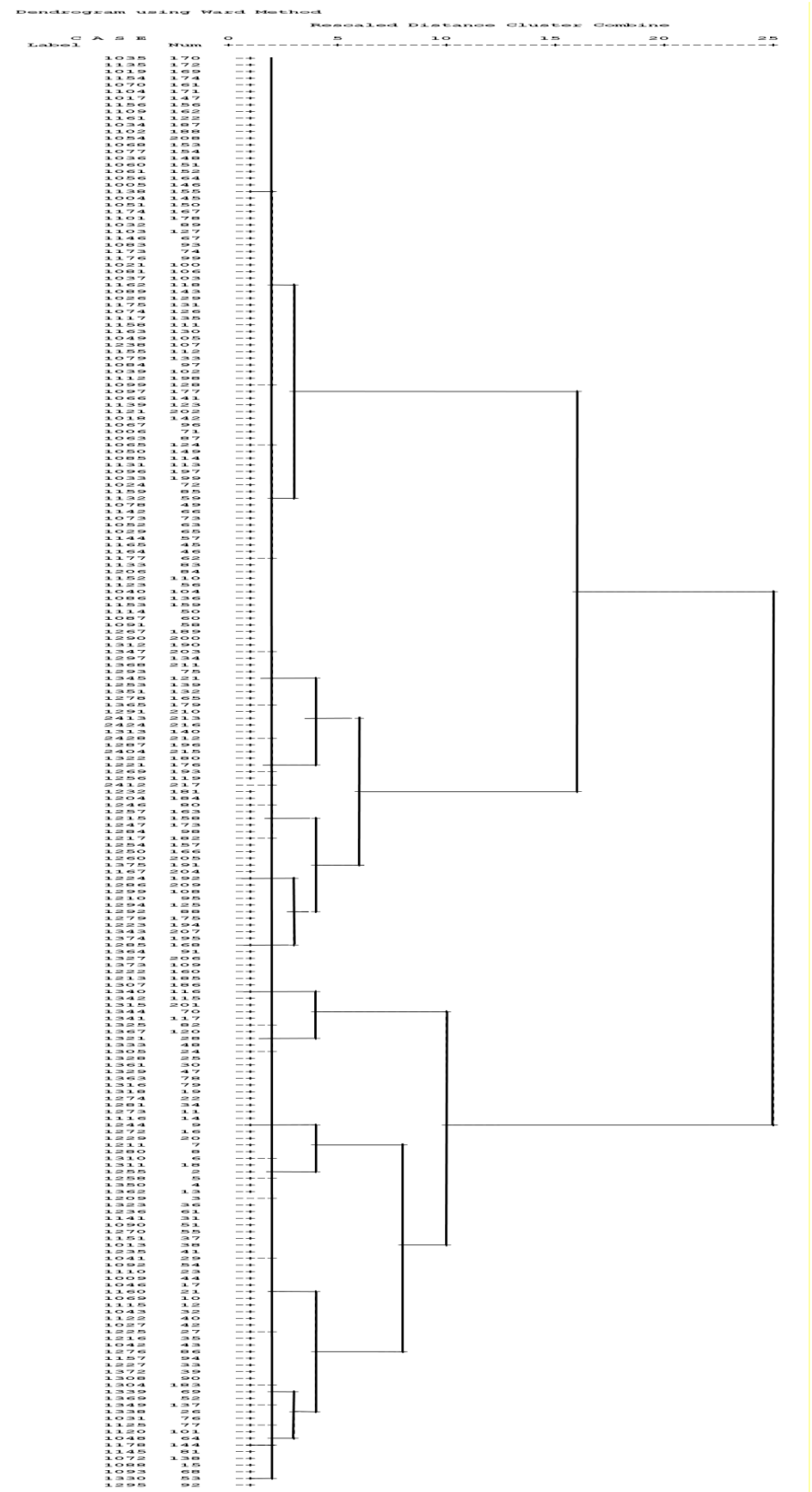

Figure 9 Dendogram resulted by clustering analysis in a total of 220 samples

Annex D

Questionnaires for household survey in 2011

Date of Survey: ……../……../……
Name-Surname: ……
Address: ……
The place of interview: …… Time: …….

Part 1 General information

1. How old are you? ..... yrs.
2. Sex □ 1. Male □ 2.Female
3. What is your highest level of education? Total years of education …….yrs.
   □ 1.Primary level □ 2.junior primary level
   □ 3. Secondary level □ 4.High school level
   □ 5. Diploma □ 6.Bachelor degree
   □ 7. Master degree □ 8.Others……
4. Religion
   □ 1.Buddhist □ 2.Muslim □ 3.Christ □ 4.Others (describe).....
5. Status
   □ 1.Single □ 2.Marriage □ 3.Divorce □ 4.Widow
6. Main Occupation
   □ 1.Para rubber □ 2.Fruit tree (describe).....
   □ 3.Rice □ 4. Agronomy crop (describe).....
   □ 5.Livestock(describe)..... □ 6.Aquaculture(describe).....
   □ 7.Trade □ 8.Government sector
   □ 9.Others (describe).....
7. Additional Occupation (Can choose more 1 answers)
   □ 1.Para Rubber □ 2. Fruit tree (describe).....
   □ 3. Rice □ 4.Agronomy crop (describe).....
   □ 5. Livestock (describe)..... □ 6 Aquaculture (describe) ……
   □ 7.Trade □ 8.Government Sector
   □ 9. Others (describe).....
8. Agricultural experience .....yrs.
9. Are you: □ 1. Native/born in the village □ 2. Migrant from other villages .....
10. If migrant, where do you come from:
    □ 1. Other village or district of the province
    □ 2. Other province of South Thailand.....
    □ 3. Other province of Thailand.....
    □ 4. Other country.....
11. How long have your family lived in this community? ……. yrs.
12. Please explain what reasons did you think that your father had settled down in this community? or why you decided to settle in this community if you are a migrant

Part 2 Demographic data, evolution of labor use, and labor issues

13. Please state the current family members in your family

Family member	Male (person)	Female (person)	Activity for each (person)	Total (person)
0-14 yrs.				
15 – 24 yrs.				
25 – 35 yrs.				
35 – 59 yrs.				
> 60 yrs.				
Total family member				

14. Please state how many family labour is now available in your family

- Total family labour forces .....persons
- Total farm labour forces ..... persons male .....person, female .....persons
- On farm labour forces .....persons male .....person, female .....persons
- Off farm labour forces .....persons male .....person, female .....persons
- Total non-farm labour forces .....persons male .....person, female .....persons

15. Please state the kind of labour used on your farm (can choose more than 1 answer):

□ 1. Family labour □ 4. Barter labour

□ 2. Permanent labour □ 5. Share tapping labour

□ 3. Temporary labour

16. Do you have adequate family labor for your farming system?

□ No □ Yes, if no, how do you cope with this situation?

17. Please explain family labour working for non-farm sectors if any

Relation with family	Age (yrs.)	Activities	When work for non farm	Where for working	Reason for nonfarm working

18. Had your family member been mobility to/from non-farm sector in last 20 year?

□ No □ Yes, what are reasons?

19. If yes, please state history of labour mobility in your family labour

Relation with family	Age (yrs.)	Activities (before mobility)	When mobility from the village	Activities after mobility	When mobility to the village	Where mobility to	Reason of mobility (describe)

20. Did your family mobility affect on your farming system?

□ No □ Yes, If yes, please explain; what effect did that have on your farming system?

21. Please state history of off-farm activities in your family if any

Relation with family	Age (yrs.)	Farm activities/Task	Period of work (year of start-end)	Work hours per day (hrs.)	Annual work (day)	Income (baht/year)

Remark; Permanent labour (PL), Temporary labour (TL), Barter labour (BL), Sharecropping labour (SL)

22. If some family labour has off-farm activities, what are reasons?

23. Please you state history of off-farm activities with rubber sharetapping labour

Relation with family	Age (yrs.)	Tapping area (rai)	Period of work (year of start-end)	Where to work	Work hours per day (hrs.)	Annual work (day)	Income (baht/yr.)	Relations with owner (describe)

24. Do you think what reasons that made your decision to work off-farm tapper?
25. Had your family member migrated in last 20 year? □ No □ Yes
26. If yes, please state history of migration of family labour

Relation with family	Age (yr.)	Activities (after migrating)	When migrated to/from the village	Where migrated to...	Reason of migration (describe)

27. Did your family migration affect on your farming system? □ No □ Yes
- If yes, please explain; how did migration of family labour affected on your farm?

28. Could you explain what events that have influenced on mobility, migration and off farm of family labour in your community?

Year	Events	Consequences or impacts

29. Please you state labour use on your farm (at the present)
- Family labour

29.1 Working with tapping (tapping in own farm)

Farm activities	Area (rai)	Labour (person)	Type of labour*	Hours of work per day	Day of work per year	Working capacity (rai/day)	product (kg/yr)

29.2 Working permanent on farm

Farm activities/task	Labour (person)	Type of labour	Hours of work per day	Day of work per year	Working capability (rai/day)	Production capability (kg/day)

Remark; male family (MF), female family (FF), children family (CF), old family (OF)

29.3 Working occasion on farm

Farm activities/task	Labour (person)	Type of labour	Hours of work per day	Day of work per year/period of year	Working capability (rai/day)	Production capability (kg/day)

Remark; male family (MF), female family (FF), children family (CF), old family (OF)

- Paid labour

29.4 Permanent labour

Farm activities	Labour (person)	Type of labour	When start to employ	Where labour come from	Hours of work per day	Day of work per year	Working capability (rai/day)	Relations with employer	Cost (baht/month)

Remark; male permanent paid labour (MPL), female permanent labour (FPL)

29.5 Occasional labour (not rubber)

Farm activities	Labour (person)	Type of labour*	When start to employ	Where labour come from	Hours of work per day	Day of work per year	Working capability (rai/day)	Relations with employer	Cost (baht/day)

Remark; male temporary paid labour (FTL), female temporary labour (FTL)

29.6 Barter labour

Farm activities	Labour (person)	Type of labour	When start to employ	Where labour come from	Hours of work per day	Day of work per year	Working capability (rai/day)	Relations with employer	Cost (baht/day)

29.7 Tapping labour (Tapping by paid labor)

Farm activities	Area (rai)	Labour (person)	Type of labour*	Period of work (year of start-end)	Where labour come from **	Hours of work per day	Day of work per year	Working capacity (rai/day)	Type of contracts	Cost (baht/month)

Remark; * type of labour; male share tapper (MST), female sharetapper (FST), children share tapper (CST), old sharetapper (OST), male temporary paid labour (FTL), female paid temporary labour (FTL)

** Where labour comes from; Kinship (KS), Local village (LV), Other village or district of province (OD), Other province of south Thailand (OS), Other province of Thailand (OP), Other country (OC)

30. Do you think that what would you plan about hire labour?
    - □ Increasing hire labor, what are reasons?
    - □ Decreasing hire labor, what are reasons?
    - □ The same, what are reasons?
31. Do you think that farm labour is easily to find for farm employment? □ No, why not? □ Yes, why?
32. Did you ever have some difficulties to get some labour?
    □ No □ Yes, If yes, when and for what activity?
33. Did you observe any changes in the quantity of labor available to work on the farm?
    □ No □ Yes, If yes, describe the change (increase/decrease, period)
34. What was worker's attitude with farm labour in your experience? and how did worker's attitude affected on your farm?
35. Would you want to employ more other province or other region labour?
    □ No □ Yes, which one? and why?

36. Do you think what factors that have influenced on your decision to hire other province or other region labour in your farm and community?
37. How would you describe the evolution of other province or region tapping labour in your farm and community?
38. When did you employ foreigner labour? What was activity? and how to employ? If any
39. Would you want to employ more foreign labour? □ No □ Yes, why?
40. Do you think what factors that have influenced on your decision to hire foreigner labour in your farm?
41. How would you describe the evolution of foreign labour use in your farm and community?
42. Do you think rubber farmers in your community have increased non-farm activities in last 20 year?
    □ No □ Yes, what are reasons, which of non-farm activities are?
43. Do you think that you favour your children working on non-farm activities?
    □ No □ Yes, why?
44. What are your expectations about the future of your farm?
45. What would you like your children to do in the future? and why?

Part 3 Tapping labors, contracts and their evolution

46. Do you tap by family labour, why do you tap by your family labour?
47. Do you employ tapping labour in your farm? □ No □ Yes
48. Please describe what factor do you think it have influenced on your decision to employ tapping labours
49. Did your tapper more than one plot?
    □ No □ Yes, If yes, how did your management about labour use?
50. How many years did you experience with tapper? ..... years
51. Please explain tapping labour in your plantations (at the present)

Type of tapping labour*	Nb. of labour (person)	Source of tapper **	Type of contracts	Period of work (year)	Reasons (describe why you choice each type of tapper)

Remark; * type of labour; male family (MF), female family (FF), children family (CF), old family (OF), male share tapper (MST), female sharetapper (FST), children sharetapper (CST), old sharetapper (OST), male temporary paid labour (FTL), female temporary paid labour (FTL)

** Source of labour; Family labour (FL), Kinship (KS), Local village (LV), Other village or district of province (OD), Other province of south Thailand (OS), Other province of Thailand (OP), Other country (OC)

52. Please state time schedule of tapping task in working day

Nb. Plot	Labour (person)	Type of labour*	Tapping time (start-end)	Collecting time (start-end)	Sheet making time (start-end)	Selling latex time (start-end)	Selling sheet time (start-end)	Working hours per day (hrs)

Remark; male family (MF), female family (FF), children family (CF), old family (OF), male permanent paid labour (MPL), female permanent labour (FPL), male temporary paid labour (FTL), female temporary labour (FTL), male sharecropper (MS), female sharecropper (FC).

53. Please state average productive labour in working day

Nb. Plot	Tapping area (rai/person)	Nb. of tapping trees (tree/person)	Collecting area (rai/person)	Sheet making (kg/day)	Selling latex (kg/day)	Production per labour, dry (kg/day)	Type of productions

54. Could you explain each tapping contracts in your plantation (plot by plot)

- Type of tapping labour: number of tapping labour, land size plot by plot, and labour relations
- Type of contracts (output-cost sharing)
- Output sharing: type of output, output(kg/rai/yr), how to manage with scrap rubber, frequency of sell production, who sell the production, how to manage output (storage, transportation, and containers), price decision, marketing decision, how to paid tapping labour cost, and how to confirmation about storage quantity and farm price
- Cost sharing: type of cost, cost (unit/rai/yr), frequency of cost sharing, accountability of tapper and owner, decision about method and total cost, how to sharing cost between owner and tapper, and how to implementation into farm management
- Control of labor: method of control, frequency of control, strategies of control, and cost of control
- Risk of contract: type of risk, risk management
- Other advance by owners

55. Did tapping contract agreements change in your plantation?

 No Yes, If yes, please explain when, why and how this change occurred?

56. Did you have some change in your contracts?

 No Yes, why? please explain the change of contracts

57. Since you employ or work as share-tapper, do you think that output-sharing ratio for tapper has?

 Increased Decreased Remain stable

- If changes, please explain when and what are reasons? If increase, what effect did that have on you and your farm?

58. According to the latest contracts, could you explain how your contract has been finalized

59. Do you think that the current contract agreement is reasonable?

 No Yes, If no, why not?, which one would you need to revise?

60. Did you negotiate contract agreements in your contracts?

 No Yes, If yes, which one did you typically negotiate with owner or tapper?

61. Do you consider other contracts in community for finalizing your contracts?,

 No Yes, If yes, which one? and how effect did that have on your contracts?

62. Could you explain what sharetapping contract did you know in your community?

Type of contracts	Type of owners	Type of tappers	Plantation characteristics	Detail of contract agreements	
				Owner	Tapper

63. What kind of changes occurred with contract agreements? and why?
64. What are your strategies to monitor or control your contracts?
65. What are risks of your contracts that would be distorted your level of production in the future? Please explain how to you cope with these risks
66. How to other farms in your community form other contracts? Please explain what contracts are forming? And what effects have on your farm?

67. Could you explain what events did you think that they made to change tapping contracts in your community

Year	Events	Consequences

68. Do you have adequate tapping labour for your plantation? □ No, why not? □ Yes, why?
69. Have you ever employed other source of tapping labour
    □ No, If no, why? □ Yes, If yes, what kind and why did you change
70. Since you started your farm, did you change tapper?
    □ No □ Yes, how many years as average of tapper?
71. Who did decide to stop the contracts (owner/tapper/others)? and what are reasons?
72. Could you explain how the change of tapper occurred in your farm?
73. Which methods do you find a supply of tapping labour?
74. Do you think that tapping labour is difficult to recruit? □ No □ Yes
    - If no, why not? what did farm strategies for available tapper?
    - If yes, which type of tapping labour would you employ? What are reasons?
75. Could you explain how you find a supply of tapper in the last 20 years?
76. Did you think that tapping labour is difficult to recruit in the last 20 years? □ No □ Yes, why?
77. Could you indicate history of tapping labour in your plantation

Nb. Plot	Land size (rai)	Type of tapping labour	Nb. of tapper (person, M/F)	Type of contracts	Period of work (year of start-end)	Production (kg/rai/yr)

78. Have you experienced with stop tapping your plantations? (exclude seasonal leaf fallen)
    □ No □ Yes, If yes, please explain what factors or problems caused to stop tapping your rubber plantation? When? And how has you respond with these problems or constrains?
79. Did you consider that you have good relation between owner and tapping labour?
    □ No, why not? □ Yes
80. Do you think that the use of sharetapper has impact on:
    □ the level of production: describe impact.....
    □ the quality of tapping: describe impact.....
81. Do you think that the conditions of the sharetapping agreement has an impact on:
    □ the level of production: describe impact.....
    □ the quality of tapping: describe impact.....
82. How has your contracts increased labour incentive for increasing tapping quality?
83. Do you think that share-tapper would be sustained occupation for your family?
    □ No □ Yes, what are reasons?
84. Do you consider that you would be changed share contract in the future?
    □ No □ Yes, what are reasons?
85. What tapping contract do you think that it would be appropriated for the future situation of rubber economy? What are reasons?
86. Do you consider yourself as skilled tapper? □ No □ Yes
    - If yes, what features that characterize tapping skill?, and how has you become skilled tapper?
    - If no, how do you define a skill tapper? and how would you do in order to skill tapper?

87. What was your training in order to skill tapper? and how has skilled tapping affected on your production?
88. Please state tapping and farm management calendar in the last year

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.

89. Could you indicate the current tapping systems and tapping day in the last year

Nb. Plot	Dry season (period, tapping day/month, tapping system)	Rainy season (period, tapping day/month, tapping system)	Leaf fall (period, tapping day/month, tapping system)	Total tapping day (day/year)

90. Do you know tapping system by ORRAF recommendations?
    □ No □ Yes, If yes, please explain what is recommendation?
91. Did you use tapping system as ORRAF recommendation?
    □ No □ Yes, If no, what are reasons?
92. What are factors affecting your selection with tapping technology? and what are reasons?
93. Before the present, did you change tapping system in your production?
    □ No □ Yes, what are reasons?
94. Please explain history of tapping system in your plantation

Nb. Plot	Land size (rai)	Tapping system	Year of start	Year of end

95. What were factors affecting your decision to select each tapping system?
96. Did you change production form? □ No □ Yes
97. If yes, please state history of rubber product form in your plantation

Plot	Type of product form	Year of change	Reasons

98. How has the change of production form affected on your farm?
99. What events in community did you think that made to evolve product form? How these change affected on your farm?

Year	Events	Impacts/consequences

Part 4 Evolution of land use and land issues

100. How do you acquire your farmland?

□ Rent □ Inherited □ Bought □ Government allocation □ Others....

101. Please state, the current landholding of your family

Nb. Plot	Land size (rai)	Farm activities	Type of landholding*	Landownership by whom mother/father	Date of receive or acquiring	Type of property right	Price of land (baht)
Total area							

Remark: * Land transfer (LT), Buy new land (NL), Sharecropping land (SL), Rent land (RL), Barter land (BL), Free land (FL), Other (OL)

102. Do you consider yourself to be a small, medium, or large farm size?

103. How has landholding of farm changed since you acquired the farm?

□ Increase □ Decrease □The same

104. If you think that farm size decline, increase or the same, what factors do you consider are the cause?

- Decreasing landholding .....
- Increasing landholding .....
- The same landholding.....

105. Could you indicate the change of landownership in your family

Time	The change of landownership			Landholding at that time (rai)	Method of landholding change	What is reason?
	increase	decrease	maintain			
Last 20 year						
Last 10 year						
Next 10 year						

106. Now, do you have adequate land for your present family needs?

□ No □ Yes, If no, please state; how do you cope with this situation?

107. Could you indicate history of land cultivation plot by plot in your farm

Nb. Plot	Current (activities, size & period)	Third cultivation (activities, size & period)	Second cultivation (activities, size & period)	First cultivation (activities, size & period)

108. Did your father and mother have been pre-empted for access to land in this community?

□ No □ Yes

- If yes, please explain; what is reason? and when?
- If no, how did your father and mother have been access to land in this community? and when?

109. Do you think what reason that made your family to decide access to land in this community

110. What kind of landownership developed in your community? and how they developed?

111. Please explain what events or relevance stories in community did you think that affected on access to land and landownership in communities, and how did those of impacts affected on landownership in communities?

112. How people in community had access to land in the last 20 years?

113. Have you been land transfer from father and mother's property? □ No □ Yes

114. If yes, please state land that transfers from your father or mother to your family

Nb. Plot	From mother/father of husband (rais)	From mother/father of wife (rais)	Original land activities (describe)	Date of receive/acquiring	Where (location, topography)	Time of land transfer (before/after marriage)	Type of property right
Total							

115. Please explain land transfer from grandfather/mother to family member of husband (by father/mother of husband) if any

Nb. family member	Land size (rai)	Original farm activities	Date of receive/acquiring	Type of Property right	Original landownership by whom his mother/father
Total					

116. How did grandfather/mother transferred land to family member of husband?

117. Please explain land transfer from grandfather/mother to family member of wife (by father/mother of wife), if any

Nb. family member	Land size (rai)	Original farm activities (describe)	Date of receive/acquiring	Type of Property right	Original landownership by whom M/F
Total					

118. How did grandfather/mother transferred land to family member of wife?

119. Do you think what reasons that your father and mother transferred this land for your landholding?

120. Had your land transfer been adequate level of production to fulfil family need?

□ No □ Yes If no, please state how many land size do you need to have? How did you cope with this situation?

121. Do you plan to transfer land to your children

□ No, why not? □ Yes

122. Please state what land size would you transfer to your children?

Nb. children	Land size (rai)	Original farm activities (describe)	Date of receive/acquiring	Reasons
Total				

123. Did you ever transfer some land to your children

□ No □ Yes, If yes, how many areas to how many children?, and when?

124. Do you have divide landholding to small plot? □ No □ Yes, what is reason?

125. Please explain what factors or institutions do you think that have influence on your decision land transfer? Why?

126. Did you sell some land in your farm? □ No □ Yes, what are reasons?

127. Please state history of sold land in your family if any

Nb. Plot	Land size (rai)	Type of landowner ship*	Type of property	Farm activities	Date of sold	Location (where ,topography)	To Whom	Price (baht/rai)
Total								

Remark; land transfer from father family (LTF), land transfer from mother family (LTM), new access to land (LA), Bought land by your family (LB)

128. In which land sold, could you explain what reasons or why you have been decision to sold out

Nb. Plot	Reasons

129. How did you determine land price? And what factors determine land price?

130. Who decides what land to be sold in your family? And how did the land to be sold was chosen?

131. How did the reduction of landholding size affected on your family? (describe impact in term of level of production, income and livelihood)

132. How did you expense the most of income from the sold of land? For what?

133. Would you plan to sell land in the future? □ No □ Yes, If yes, please you expect why?, when?, how many land size?, how much?, and for what?

134. Do you observe that farmers in your communities have sold farmland?

□ No □ Yes, what are reasons? and when?

135. What factors did you think that have influenced on farmer's decision to sell farmland?

136. Did you even buy land? □ No □ Yes

137. Could you indicate history of acquiring farmland through buy method in your family if any

Nb. Plot	Land size (rai)	Type of landownership from solder	Farm activities	Date of acquiring	Location (where ,topography)	From Who	Price (baht)
Total							

138. How do you determine land price?

139. According to acquired land, what reasons or why did you buy this farmland and for what?

Nb. Plot	Reasons/objectives

140. Please you state what financial sources did you expended for land accumulation?

Nb. Plot	Land size (rai)	Price (baht/rai)	Source of finance	
			Non-farm (%)	Farm (%)

141. Did you receive any financial support from family member for acquiring farmland?

□ No □ Yes, please explain what was the activity of family member, and how much, the relationship and if it is a loan or a grant?

142. Did you receive any loan to buy the land?
 No Yes; if yes, from where, how much, which conditions?
143. Have you acquired land through any income or saving of rubber production?
 No Yes, how much?
144. How did land accumulation affected on your farm? (describe impact in term of level of production, income and livelihood)
145. Did your communities have newcomer or outside person to buy farmland in communities?
 No Yes, please state what are reasons?, who? and when?
146. What effect did that have on your community?
147. Would you plan to buy land in the future?
 No Yes, please state how many land size, how much, and for what?
148. What is the trend of landownership in community?
 Concentration of landownership, what are reasons?, describe this impact:…….
 Smallholding landownership, what are reasons?, describe this impact:……..….
 Landless, what are reasons?, describe this impact:…….…….
149. Do you think that there is a risk for you to become landless? No Yes
- If yes please explain do you think what the period time that you will become to landless on the short term (1 year), medium term (5 years), and long term (more than 5 years), and why do you think so on?

150. What factors do you think that made you to be landless?
151. Would you plan migration to non-farm activities? No, why not? Yes, why?
152. Please state history of you rented your land to somebody if any

Nb. Plot	Land size (rai)	Year of rented	Farm activities	Period of rented	Location (where ,topography)	To Whom	Cost (baht/rai/year)
Total							

153. Could you indicate what reasons/why you rented your land to somebody and for what?

Nb. Plot	Reasons

154. Have you rented somebody's land? No Yes, what are reasons?
155. If yes, please state history of you rented somebody's land

Nb. Plot	Land size (rai)	Year of rented	Farm activities	Date of rented	Location (where , topography)	From Who	Cost (baht/rai/year)
Total							

156. Could you indicate what reasons or why you rented land and for what?

Nb. Plot	Reasons

157. Do you have loss any land by any reasons? No Yes, what are reasons?
158. How would you describe the current situation of the landholding, land accumulation, and land use in your community?
159. What events did you have experienced that have influenced the evolution of land use in your community regarding landownership, land use, and land institutions? When? And how did affected by them?
160. How do you expect your landownership and land use to develop over the next 10 year?
161. How did you respond with government policies according to ORRAF program, RRIT technology, marketing policies, and land policies?
162. What government policies would you demand for the future of rubber-based economy regarding to landownership, land use, labour use, and contracts?

Annex E

Semi-structured questionnaire guides for the field survey in 2011

1) Semi-structured questionnaire guides for interviews rubber farmers, share-tappers, expert farmers, local leaders

Part 1 History of community and agricultural development

1. Please explain about history of communities and what happened about social and economic development, infrastructure, cultural and circumstances in your community
   - What happened about social and economic change in your community?, how this change occurred in your community?, what effect did that have on your community? and how did individuals or collective action overcome these changes?
   - What do you think about agrarian society in your community?, what happened about agrarian change? and when?
   - What events or factors do you think that have influenced on social and economic development in the village?, and how did affected by them?
2. Please describe history of agricultural development from backward economy to rubber-based economy
   - Could you describe access to land, landownership, land use, labor use, contracts, farming systems, market, and trade during backward economy? and how did you feel about livelihoods at that time?
   - What happened about the village economy during the period of early transition to rubber-based economy?
   - Could you explain what events or factors that made farmer decision to plant rubber in the village and how did farmers respond to the first rubber plantation in the village?
3. Please describe habits of thought, behavior, and actions of the farmer and collective actions during backward economy and at the period of transition stage to rubber-based economy
   - What institutions do you think that played an important role in the farm and collective actions regarding to access to land (new land), landownership, land use, labor use, labor contracts, production systems, market and constitution order during backward economy?
   - Which institutions do you think that persisted until the present?, and what did affected by them on people?

Part 2 History and the evolution of rubber based economy

1. What was the evolution of rubber based economy in the village? when? and how has your community changed into rubber based economy?
2. Please describe how social and economic development from the stage of backward economy to jungle rubber plantation regarding to farm objectives, access to land, land use, labor use, technological use, labor contracts, production systems, exchange or marketing, economic performance, livelihoods, and government interventions, etc.
   - What happened about your community during the jungle rubber period? why farmer has decided to have new plantings in the village?, when?, who was the first planter?,

how did farmer planted rubber?, and what was farm strategy or objective of rubber plantation at that time?

- Do you think what events/factors that have influenced on farmer's decision to plant rubber? and how did those of events affected on the farms and the village?
- How have you handled rubber plantations and productions according to land use, technological use, labor use, production system, contracts, and market?
- Could you explain what happened about estate plantation or large farms?, how a large farm developed?, and how did affected by them to the farms?
- What was policies and the government interventions during jungle rubber time?, what effect did that have on the farms and the village?, and how did farmers respond to policies and the government interventions?
- Could you describe what happened about rubber market and industry at that time? and how did rubber market and rubber industry affected on the farms and the village?
- Do you think how rubber affected on socioeconomic change at that time?
- What institutions do you think that farmers changed corresponding to new plantings?, how these changes occurred?, and what effect did that have on the farms and the villages?

3. Please describe the development of rubber based economy from the period of transition from jungle rubber to modern plantation according to farm objectives, access to land, landownership, land use, labor use, technological use, labor contracts, production system, market, economic performance, livelihoods, the replanting scheme and government interventions, etc.

- What happened about socioeconomic change in the village during the period of transition into modern plantation?
- What happened about the farms and people when the re-plantation scheme developed?, how did you and people respond to the re-plantation scheme?, who were the re-planters?, and why the farm decided to participate with the replanting?
- What are reason did you think that affected on farmer decision to re-plant with the replanting scheme or modern plantation?, when?, how the farmer has altered to modern plantation?, and what effect did that have on the farm and the village?
- What was farm strategy or objective regarding to the replanting /modern plantation in that time?
- In that time, Could you describe you experience with the re-planting scheme regarding technology, land use, labor use, farm management, and production at that time?, and how did affected by them to the farm?
- What was the difficulty to adopt RRIT technology in your farm?, and how did you overcome these difficulties?
- What were policies and the government interventions during the period of transition to modern rubber plantation?, how did policies and the government interventions affected on your farm and the village in term of access to new land, land use, labor use, technological use, production system and market?, and what effect did that have on the farm and livelihood?
- What do you think about the play roles and implementations by ORRAF, RRIT, RES, and DOAE?, and how did affected by them?
- How did rubber market and industry evolve?, what events and what effect did that have on farmers and the village?
- What habits of thought, behaviors and actions of the farms and collective actions do you think that have changed by the replanting scheme/modern rubber plantation?, how these changes occurred?, and what effect did that have on the farm and the village?

4. Please explain the current situation of rubber based economy in your community: what happened about farm objectives, land use, labor use, technological use, production system, market, economic performance, livelihoods, and the government intervention

- What happened in your community when it had changed into rubber based economy?, what are the most important evolution of rubber based economy in your community?, and how has the evolution occurred?
- What events or factors did you think that played an important role in the development of rubber-based economy?
- What was the evolution of rubber marketing and industry?, and how has these changes affected on your farm and community?
- What do you think about government intervention in rubber-based economy?, how did government intervention affected on the farm and community?, and what policies do you demand for the future of rubber based economy?
- What were events/policies that made the farm to continue development of rubber production in?, and how did those of changes affected on the farm and community?

Part 3 Labor use, contracts, and their evolution

1. Please explain history of labor force, labor use, labor mobility, migration of family labor, labor contracts and farm change in your family and the village

- What would you describe labor use in your community since jungle rubber to the present?, how these change occurred?, and what effect did that have on the community?
- What was events/factors that made to evolve labor use in the community?, what events or factors do you think that have influence on labor use, labor mobility, migration of family labor, and labor change?, when?, and how has affected by them on the farm and community?
- What was farm labor supply in the community?, which labor sources did you employ?, why, and what are reasons?
- Why have and when your workers moved to non-farm sector?, how did those of impact affected on your farm and the village?, and how did your strategies overcome with mobility and migration of family labor?
- Have you experienced with stop tapping plantation due to shortage tapper?, when?, and how did you cope with this situation?
- What were labor institutions on labor contracts?, how have these changes occurred?, and how did labor institutions affected on the farm and community?
- What do you think are demand for government policies about labor use and contracts in rubber plantation?

2. Please describe about available labors for tapping labor, farm labor market and the relations between farm and non-farm labor market

- What happened about farm labor market since the period of jungle rubber to the present?, how has farm labor market evolved?, how did you respond with this change?, and what effect did that have on your farm and the village?
- What factors do you think that have influenced on the change in farm labor market?, and why?
- What were labor market institutions that embedded on individual and collective actions in farm labor market?, how have these institutions changed?, and how did labor market institutions affected in the farm and community?

3. Please describe history of share-tapping contracts in community and southern region: type of tapping labor, contractual arrangement, output sharing, cost sharing, negotiations, condition of agreement, risks, wage payment, and control of contracts.

- What happened about share-tapping during the period of jungle rubber?, and how did share-tapping contractual arrangement evolved?
- What do you think about why share-tapping contracts persisted in rubber production?, what events did you think that have influenced on evolution of share-tapping and contractual arrangements in rubber economy?, and how those of events affected on contracts?
- What were share-tapping arrangements in the farm and the village?, how did share-tapping contracts conduct?, and how did affected by them on the farm and the village?
- What factors do you consider for labor choices and contractual arrangements in your farm? and how has share- tapping contract finalized?
- What were relationships between the rubber owner and hired labors?, and how did this relation affected on contractual arrangement and production?
- Could you explain share-tapping contracts in your experiences? and how has affected by them on your farm?
- Have you ever heard about wage contracts in the areas? If yes, please explain what, where and how has wage contracts applied?
- Do you think that wage contracts will be increased profited for the rubber owners?, what are reasons?, and what effect did that have on the farms?
- What do you think are the challenge of tapping contracts in the future of rubber economy?
- What do you think about labor quality for tapping task?, and how do you train in order to be skilled labor?
- What were institutions of share-tapping contracts?, how has these institutions evolved?, and how did these institutions affected on the farm and labor contracts?

Part 4 Landholding, land use, access to land and their evolution

1. Please describe history of access of land and land use in your community including land right, landownership, land transfer and land accumulation since the period of backward economy to the present.

- Could you explain history of your family in this community?, what was your experiences about access to land, landholding, land right, and land use during jungle rubber?, and how has it evolved?
- Could you explain how land evolved in your community including land transfer, landholding, reduction of landholding, land accumulation, and landless?, how has farmer access to land for new planting?, how these changes occurred in the village?, and how has affected by them?
- What events or factors do you think that have influenced on access to land, land right, landholding, land transfer, land use, and their evolution during the period of transition to rubber based economy to the present?, what farmers in community were doing with these events, and how has affected by them?
- What do you think about trend of landholding in the village: increase, decrease and stable in landholding?, why?, and Could you explain process of land changes?
- Why farmers in community have been declined landholding?, what events or factors do you think that have influenced on the reduction of farm size?, who were the farmers concerned by a decline in landholding?, when did it started?, and what effect did by them?

- What do you think about land accumulation in the village?, what was it that made to land accumulation?, who were the farmers concerned by an increase in landholding?, when did they start? and how did land accumulation affected on the farm and people in the village?
- What happened about land use after farmers collaborated with re-plantation schemes?, and how did these changes affected your farm and community?
- What was the evolution of land use in your community?, why farmer has converted any crops into rubber plantation?, when?, and how these change occurred?

2. Please describe your experience with access to land, land transfers, land accumulation, land use and their changes in your family
   - What events or factors do you think that have influenced on access to land, landholding and land use in the village?, and how did those of impacts affected on your farm?
   - Could you explain why you acquired land into your family?, and how did acquiring land affected on your farm and the village?
   - If you had reduced landholding, what reasons that made you to sell landholding?, and what effect did that have on your farm?
   - What do you think about land accumulation or the reduction of landholding in your family?, how did the change of landholding affected on the farm and livelihood?, and how did you cope with this situation?
   - What was it that made you decision to change landholding and land use?, and how has affected by them?
   - What happened about land use and landholding in your family after the re-plantation scheme implemented?, and how did you respond with them?
   - What institutions do you think that embedded on land transfer, landholding, and land use in your family?, how these institutions evolved? and how has affected by them?
3. Please describe available land and land market in the village
   - What happened with land market in the village since the period of jungle rubber to the present?, how has farm land market evolved?, how did you respond to this change?, and what effect did that have on your farm and the village?
   - How did land market affected on your decision regarding to landholding, labor use, production system and farm strategies?, and how farmers in the village respond to these changes?
   - Do you think what land market institutions that embedded on individual and collective actions?, how have these institutions changed?, and how did these institutions affected in your farm and the village?
4. Please describe your experience with production systems, farm management, technological use, market and their changes along with your family and parent (if you could be reminded).
   - What has been your experience with rubber plantation, production system, farm management, technological use, and marketing during the period of jungle rubber to the present?
   - What happened about your rubber plantation after the re-plantation scheme implemented?, what was the re-plantation scheme impacted on your farm and the village regarding to grants, technologies, production system, farm management, land use, labor use, and market?, and how did affected that have on the farm and livelihood?
   - Could you explain the evolution of rubber plantation, production system, farm management, technological use, and market?, and how these change occurred?
   - What events or factors do you think that have influenced on your decision to participate with the replanting scheme?
   - What do you think about technologies for rubber plantation?, how these technologies evolved?, why?, and how did these technologies affected on your farm?

- What happened about farmer when technology of modern plantation introduced?
- What was it that made farmers decide to change technology?, how did farmer change technology?, what do you think about adapted technology in rubber farm?, why? and what are reasons?

5. Please describe what/how policies and the government intervention played an important role in development of rubber based economy
   - What policies and the government interventions do you think are the most and least support for development of rubber economy?, why?, and what measures did you think that was achieved by policies and the government interventions?
   - What farmers thought about polices and the government interventions?, how farmers reacted to those of government interventions?, and how did these government interventions affected on your farm and the village?

2) Semi-structure questionnaire guides for interviews; government organizations, rubber organization, associations, and related organizations

1. Could you explain what the role or function of your organization involved rubber based economy and what/how impacts could your organization contribute to rubber development and the farms regarding to land use, landholding, labor use, labor contracts, technology, productions, farm management, market and farm's livelihood?
2. What were government policies and interventions that guided rubber development since jungle rubber to the present?, when?, why?, what change did you think it affected by them?, and how did government policies and interventions affected the development of rubber based economy?
3. Which of government interventions did you consider to be key elements in order to be the growth of rubber economy?, why did your organization established these interventions?, and how did rubber farmers react to these interventions?
4. What measure did you think your organization achieved to enhance the growth of rubber based economy?, and how did your organization reach outcomes?
5. How has government policies evolved?, and what are reasons?
6. How government policies have any concern regarding access to land, landholding, land us, labor use, technological use, labor contract, and marketing?, and how important are your organization's functionality for rubber development?
7. What are the limitations/challenges of your organization in carrying out your organization's functions or implementations?
8. What was the role of your organization affecting on the evolution of rubber-based economy?, and how your organization has implemented these interventions?
9. What do you think about available labor, labor use, labor quality, contracts and their evolutions in rubber based economy?, what was it that made their evolution?, how has your organization played role with them?, and how has rubber farmers respond with your intervention?
10. What institutions of labor use and labor market did you think affected by your organization's interventions?, how did these institutions change?, and what effect did that have on rubber farm?
11. What do you think about farm changes according to landholding, labors and livelihood?, what was it that made their evolution?, how has your organization played role with them?, and how has rubber farmers respond to your intervention?
12. What institutions of land use and land market did you think affected by your organization's interventions?, how did these institutions change?, and what effect did that have on rubber farm?

13. Regarding to technological use in rubber plantation, what was technological use in rubber plantation?, how has technology evolved?, and how your organization involved with technological development, adopted technology and technological use in rubber farm?
14. What do you think about agrarian change in rubber based economy?, how important are your organization's interventions that led to agrarian change?, when?, and why your organization implemented these interventions?
15. What do you think are the main challenge of the rubber economy is facing?, and what are strategies use to overcome these challenges?

3) Semi-structure questionnaire guides for interviews: middlemen, marketing organization, cooperative, factory, and company

1. Could you describe about history of your business?, and what was it that made you decision to establish rubber business?
2. What is your business or business function?, and how has your business been involved rubber farmers in term of price, trade, and market?
3. Could you explain how your business made marketing function dealing with rubber farmers, farmer groups, and cooperative?, and what are your business strategies?
4. What would your plan for the future of your business?, what is the challenge of rubber based economy in the future?, and how would you cope with them?
5. What was the evolution of rubber market and industry regarding to market system, marketing agents, price, trade, and industry since the period of jungle rubber to the present?, and how has rubber marketing and industry evolved?
6. What events did you think that have influenced on the evolution of rubber marketing and industry?, and how did affected by them that have on your business?
7. How has rubber market and industry been affected on the evolution of rubber-based economy?, what market and industrial events do you think that affected on the growth of rubber based economy?, when?, and why?
8. What government policies do you think that affected on the evolution of rubber marketing and industry?, and how did these policies affected on your business
9. What happened about rubber market and industry after the re-plantation scheme implemented?
10. What do you think about the role of farmer and cooperative had impacted on market and industries?
11. What do you think about agrarian change?, how has agrarian change occurred?, and how did your business respond to agrarian change?
12. What were you point of views about the evolution of land use, labor use, and contracts in rubber based economy?, how these evolution occurred?, and what/how market and industry had impacted on these evolutions?
13. How did the evolution of land, labor, and contracts in rubber-based economy had impacted on your business?
14. What institutions do you think that played an important role in rubber market and industry?, what factor was it that made institutional change?, and how did these institutions affected your business?

Annex F

Semi-structure questionnaire guides for the field survey in 2012

Part 1 farm trajectory and evolutionary process

1. Please describe history of your family and explain your experiences on farm changes regarded to land, labor, contracts and livelihood along your family?
   - Could you explain your experience of farm changes?, when?, and why?
   - What happened when it had changed (before and after trajectory occurred)?,
   - What factors or events that have influenced on farm changes?, and how did affected by them?
   - What was your witness to any farm trajectory and their determinants in the village?,
   - What happened on farm trajectories?, and how farm trajectory occurred?
   - What factors that have influenced on farm trajectories, and how has affected by them?
   - What was the different experiences among farm trajectories in the village?, what was it made different farm trajectories?, and how did the difference trajectories occurred?
   - What do you think about future trajectories in the village?
2. Please explain your experience about land and labor change?
   - What happened about land and labor changes in your family? , and what was it that made land and labor change in your family?
   - What events or factors do you think that have influenced on the change of land and labor? when?, and how did affected by them?
   - How farms acquired landholding (purchase, inheritance, marriage)?, and what/how land accumulations or reductions occurred?
   - What was process of land acquisition?, and how did it impact on the farms?
   - What was process of land reduction?, and how did it impact on the farms?
   - How/why some farms have lost their land?
   - How/why some farms developed into tenant farms?
   - How/why some farms had stable landholding and maintain their activity?
   - What do you think about we observed that there are 1) a concentration of land into less number of large and medium farms, 2) a large numbers of family farms moving downward either very small farm or tenant farms, and 3) a rapid reduction of land in some farms
   - What factors or events that have influenced on that of farm change?, what kind of farmers was affected?, how did affected by them?, and how farmers response that of change?

Part 2 the evolution of share-tapping contracts, contractual arrangement, and wage contracts

1. Please describe your experience with share- tapping contracts including your witness about share-tapping arrangement and labor issues in the village?
   - Could you explain why the rubber farmers choose share tapping contract?
   - What happened on share-tapping arrangements in the period of jungle rubber and thereafter?
   - How did share-tapping contract evolve?, and what effect did that have on farms?

- Could you explain why share-tapping contracts persisted in rubber-based economy?, what reasons do you think that have influenced on the persistence of share-tapping contracts?, and what effect did that have on farms?
- Please describe share-tapping arrangements and labor use in your plantations?
  - Type of contracts; why share-tapping selected?, how did you choose share-tapping contracts?, what factors influenced you decision to choice types of share-tapping?, and how did contract make?
  - Tapper; who?, how did you choose tapper?, what/how labor attributions did you consider/evaluate?, and what was relationship between you and hired labors?
  - Output sharing; what was output sharing?, why scrap was share or not?, and what/how output sharing did you mnage?
  - Input sharing; what was type of input sharing?, and what/how did input sharing manage?
  - Monitoring and supervision: what/how did you managed monitoring and supervision? and how much cost of them did you paid annually?
  - Marketing; what/how did you choose market place or middlemen?, why?, and how did you mange sell of products or middlemen?
  - Allowance; what was allowance in share-tapping?, why?, and what/how allowance did affected on share-tapping arrangement?
  - Finalization: how did you finalize share-tapping?
  - Social institutions; what were social institutions and labor institutions involve share-tapping arrangement?, and how social institutions and labor institutions did affected share-tapping arrangement and the farms?
- How have these share-tapping contracts change?, what was effect by them?, and what was it that made to change share-tapping contracts?
- What events or factors do you think that have influence on the change /no change of share-tapping contracts?

2. Please describe wage contract in your experience or your witness in the village?
   - What/how did wage contract evolve?, what happened on wage contracts in village?, and what events or factor do you think that caused to use wage contracts?
   - What factors did you consider to choice and arrange wage contracts?, what was wage contractual arrangement?, how did you finalize wage contracts?, how has affected by them on contractual arrangements, labor use, production and farm strategies?, and how has affected by wage contract to share-tapping contracts and the farms?
   - What/how did the farmers react to wage contract?, and Could you explain and assess the differences between the farmers who used wage contract and those using share-tapping contracts?
   - What do you think about arrangements of wage contracts to compare with share-tapping?, what do you think about how wage contract expanded/less?, what factors or events did wage contract expand?, and what/how has affected by them to the future of rubber development?

3. Please describe your experience or your witness on tapping contract regarding to the different types of farms (large farms, medium farm and patron farms)?
   - What was the different contract arrangement among farm types?, and what was it that made farms have different contractual arrangements?
   - Could you explain the relationships between share-tapping contract and characteristics of the farms? and what factors do think that affected on that of relationships?
   - What measure did you achieve efficiency of tapping contracts? and What do you think about appropriate contracts in the future?

Path 3 Path dependency and rubber development

1. Please describe your perspective to evolution of rubber economy in Thailand?
   - What happened with path development of rubber economy regarding before and after the re-plantation scheme?
   - What events or factors do you think that have influenced on path development of rubber economy?, what consequents or impacts did that have on rubber development? and how has affected by them to the current situation and the future of rubber economy?

2. Could you explain what your point of views to rubber policy, government interventions, and the play roles of government including markets affecting evolution of rubber economy?, how has affected by them? and what measures do you think that was achievement or failure?
   - What were policies and government interventions related rubber development from the period of introduction of rubber to the present?, how did polices and the government interventions evolve? and what events or factors do you think that have influenced on evolution of policies and the government interventions?
   - What/how did affected by them to the farm and path of rubber development?
   - Regarding to the government agencies, why did your organization implement these interventions?, and what/how measured your organization achieve in policy implementations?
   - What/how did rubber farmers react to policies and the government interventions?

3. According to government organizations, what measure did you think your organization achieve to enhance the growth of rubber based economy?
   - What were your organization's function and implementation?, and why policies and the interventions has your organization implemented?
   - How did your organization implement policies and the government interventions? and how has your organization play role with them?
   - How did your organization reach outcomes? and what measure your organization achieve?
   - What are the limitations/challenges of your organization in carrying out your organization's functions/implementation?
   - How has rubber farmers respond to policies and the government interventions?
   - What do you think about agrarian change in rubber-based economy? how important are your organization's functions that led to agrarian change? and why?
   - What do you think are the main challenge for the rubber economy is facing? and what are strategies use to overcome these challenges?