Analysis of the innovation process linked with the activation of a natural resource in Baringo, Kenya

Raphael Belmin

Thesis

Submitted to obtain the Honour Master Degree in Innovation and Politics for Sustainable Food

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CIRAD, UMR Innovation
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Executive summary

Joint Learning in Innovation Systems in African Agriculture (JOLISAA) is a European project that aims to increase understanding of agricultural innovation systems and to produce lessons and Agenda for further research, practice, and policies, by cross analyzing experiences of agricultural/rural multi stakeholder innovations in 3 African Countries (Kenya, South Africa, Benin). This internship has occurred in the framework of the Collaborative Case Assessment (CCA) phase of JOLISAA, which consists in the in-depth joint analysis of innovations cases selected out of a large inventory. We took part of a Kenyan CCA team in charged of the assessment of an innovation process linked with the activation of a natural resource in Baringo (Kenya): *Aloe secundiflora* and *Aloe turkanensis*.

Baringo County is dominated by arid and semi arid lands (ASAL), where populations' livelihoods are weakened by hostile marketing systems, environmental degradation, and inappropriate or insufficiently funded past development policies. Kenyan indigenous Aloe species have been described as particularly interesting livelihood diversification options for ASAL communities due to adaptation to dry conditions and commercial value of the sap.

The Baringo Aloe case is a 30 years innovation process characterized by 3 periods of time during which 3 innovations - Wild Aloe exploitation (WAE), Aloe Cultivation (AC), and the Making of Aloe-based Products (MAP) – have been adopted, up-scaled, and institutionalized.

The 3 innovations of WAE, AC and MAP represent 3 successive forms of Aloe resource activation. However, the process of transformation of the Kenyan indigenous Aloe species into a sustainable economical resource for Baringo ASAL has not yet reached a point where it is achieved. Moreover, our study suggests that the process of activation of the Aloe resource in Baringo has reproduced the past dynamics of marginalization and natural resource degradation of ASALs. Nonetheless, the various public interventions implemented so far led to the construction of organisational, institutional, biological, and knowledge resources, which are still immature but usable as a strong basis for further projects.

Key words: Innovation system, natural resource, Aloe, Kenya, Baringo.

Résumé

Joint Learning in Innovation Systems in African Agriculture (JOLISAA) est un projet de recherche européen dont le but est de contribuer à une meilleure compréhension des systèmes d'innovation agricoles et ruraux, et de produire des recommandations destinées à la recherche, aux praticiens, et aux politiques publiques. Pour cela, le projet mène une analyse croisée de plusieurs cas d'innovation multi acteurs dans dans 3 pays Africains (Kenya, Afrique du Sud, Bénin). Ce stage s'est déroulé dans le cadre du Collaborative Case Assessment (CCA), phase du projet qui consiste en l'analyse participative approfondie d'un certain nombre de cas d'innovation sélectionnés dans un inventaire plus large. Nous avons joint une équipe CCA kenyane chargée de l'analyse du processus d'innovation lié à l'activation d'une ressource naturelle à Baringo (Kenya): *Aloe secundiflora* et *Aloe turkanensis*.

Le Comté de Baringo est dominé pas des zones arides et semi arides, où les moyens d'existence des populations sont menacés par des mécanismes de marché défavorables, par la dégradation des ressources naturelles, et par des politiques de développement inappropriées. Certaines espèces indigènes du genre Aloe au Kenya sont perçues comme une alternative prometteuse de diversification économique pour les communautés peuplant ces zones, du fait qu'elles sont bien adaptées aux milieux arides et que leur sève détient une valeur marchande.

Il y a 30 ans, un processus d'innovation a démarré à Baringo, et s'est caractérisé par 3 phases au cours desquelles 3 innovations ont été adoptées, diffusées, et institutionnalisées: l'exploitation de l'Aloe sauvage (EAS), la mise en culture d'Aloe (MCA), et la fabrication de produits à base d'Aloe (FPA).

Les 3 innovations (EAS, MCA, et FPA) représentent 3 formes successives d'activation de la ressource Aloe. Cependant le processus de transformation de l'Aloe en une ressource économique durable pour les zones arides de Baringo n'est pas achevé. De plus, notre étude suggère que le processus d'activation de la ressource Aloe à Baringo a reproduit les dynamiques passées de marginalisation et de dégradation des ressources naturelles des zones arides du Kenya. Cela dit, les interventions publiques passée ont permis la construction de ressources institutionnelles, organisationnelles, biologiques, et de connaissances, qui bien qu'immature, peut être mobilisée dans le cadre d'éventuels futurs projets.

Mots clés: Système d'innovation, ressource naturelle, Aloe, Kenya, Baringo.

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List of acronyms

AC: Aloe Cultivation
AKIS: Agricultural Knowledge and Information Systems
AMU: Aloe management Unit
ARD: Agriculture Research and Development
ASAL: Arid and Semi Arid Land
BABE: Baringo Aloe Bio-Enterprise Development
CBO: Community Based Organization
CCA: Collaborative Case Assessment
CDTF: Community Development Trust Fund
CIRAD: International Research Centre in Agriculture for Development
FGD: Focus Group Discussions
GGD: General Group Discussions
GoK: Government of Kenya
GQ: Generic research Questions
JOLISAA: Joint Learning in Innovation Systems in African Agriculture
KARI: Kenya Agriculture Research Institute
KEBS: Kenya Bureau of Standards
KEFRI: Kenyan Forest Research Institute
KsH: Kenyan Shilling
KOKISA: KOriema-KImalel-SAbor
KWS: Kenya Wildlife Service
ITK: Indigenous Traditional knowledge
IUCN: International Union for Conservation of Nature
IS: Innovation System
IP: Innovation Process
MAP: Making of Aloe-based products
NARS: National Agricultural Research Systems
NGO: Non-Governmental Organization
NMK: National Museum of Kenya
R&D: Research & Development
SHG: Self-Help Group
SSI: Semi Structure Interview
SWOT: Strength, Weakness, Opportunity, Threat.
USD: United States of America Dollars
WAE: Wild Aloe Exploitation
WPs: Work Packages

1. Introduction

In sub-Saharan African agricultural and rural development sectors, there was a shift of the analytical emphasis on technological change from a conventional linear model of knowledge transfers (from researcher to extension agent to farmer) to a more complex, process-based approach called innovation system. Despite the promise represented by the innovation system approach, it has a limited capacity to inform and influence policy formulation, for it lacks formalized methods.

Joint Learning in Innovation Systems in African Agriculture (JOLISAA) is a European project that aims to increase understanding of agricultural innovation systems and to produce and disseminate lessons and develop an agenda for further research, practice, and policy, by cross analyzing lessons learnt about past and ongoing experiences of agricultural/rural multi stakeholder innovations in 3 African Countries (Kenya, South Africa, Benin).

This study took place in the framework of the Collaborative Case Assessment (CCA) phase of JOLISAA. The CCA consists in the in-depth joint analysis of a series of multi stakeholders' innovations cases selected out of a large inventory made by JOLISAA in 2011, according to a common analytical framework and approach. We joined a Kenyan local CCA team coordinated by KARI, and in charged of the assessment of an innovation process linked with the activation of Aloe in Baringo (Kenya): *Aloe secundifora* and *Aloe turkanensis*. After developing a research proposal by adapting the generic JOLISAA analytical framework to the Aloe case, and by developing data collection tools, the CCA team implemented its fieldwork in Baringo, Nakuru and Nairobi from May to September 2012.

Baringo County is located in the Rift Valley Province (Kenya), and is dominated by arid and semi arid lands (ASAL). ASAL have the highest poverty incidence amongst all areas in Kenya, and more than 60% of ASAL inhabitants live under the poverty line. In Baringo ASALs, pastoralists' livelihoods are weakened by inappropriate marketing mechanisms, environmental degradation, and inappropriate or insufficiently funded past development policies. For their part, Kenyan indigenous Aloe species have been described as particularly interesting livelihood diversification options for ASAL communities, since these plants were adapted to dry condition, and their sap had a commercial value.

Our research on the Baringo Aloe case tries to answer the following questions:

- *How the Baringo Aloe Innovation process unfolds?*
- *Has the innovation process contributed to transform Kenyan indigenous Aloe species into a sustainable economical resource for ASAL?*
- *Which generic policy messages and recommendations can be drawn from the Baringo Aloe case?*

To answer them, we begin by explaining the emergence of the innovation system concept and approach, and emphasize the interest and limits of this approach for agriculture and rural development (section 2.1). We then present the JOLISAA project, and highlight its approach towards a better understanding of innovation systems (section 2.2). We continue by presenting some general information on Kenya and Baringo, with a focus on the plight of dry lands (section 2.3), and we show how Aloe species have emerged as a potential resource in this context (section 2.4). After this, we present the research problem and hypotheses (section 3), as well as the methodology we used to address it (section 4). In the following parts we introduce the 3 innovations found in the Baringo Aloe case, and show that they correspond to 3 forms of activation of the Aloe resource (section 5.1). We then develop the innovation process following its temporal development (section 5.2). After this, we enter in analytical part, by successively analyzing triggers and drivers of the Innovation Process (section 5.3),

and the way various stakeholder networks have contributed to the emergence of the various innovations (section 5.4). In the final discussion (section 6), we comment our results in the light of our research problems and assumptions, and we and criticize ou methodology. We finish by proposing way forward for the Baringo Aloe stakehodkers, for research, and we draw policy messages (section 7).

2. Background

2.1. Innovation System: Emergence of the concept and interest for agriculture and rural development

Today, governments, national research, education and development institutions and international donors pay increasing attention to innovation and how it can best be nurtured (Hall et al., 2003; World Bank, 2006, Röling, 2009). A dynamic innovation landscape is indeed considered essential to provide some of the answers required to adapt to a fast-changing world. This need for innovation is particularly obvious for agricultural and rural development sectors - and especially in developing countries where most people still depend on agriculture for their livelihoods - since they are facing a rapidly evolving environment. Climate change, intensification associated with pests, environment degradation, and connection with regional and domestic market: all contribute to re-assessing the values, performance and current practices of farmers. For those reasons, a continuous process of innovation is essential for the people that rely on agriculture for their livelihood (Hall et al., 2005) and stimulating innovation is increasingly recognised as a policy priority.

In this chapter, we introduce the concept of innovation both seen as a product and as a process. We also explore the way science and public policies have evolved in the way they understand and foster innovation processes, from a linear top-down approach to technology transfer to the more holistic Innovation Systems approach. We finally explore the interest and limits of the Innovation System approach to study and promote technical change in the agricultural and rural development sector, with a focus on developing countries and sub-Saharan Africa

2.1.1. Innovation, invention, and innovation processes

Before going further, there is a need for clarifying vocabulary. The term "innovation" should be considered carefully since it can be alternatively seen as a process and as a product (result of the process) (Brodtrick, 1999), and for it is very often confused with the notion of invention. A well accepted definition of innovation is "*any new knowledge introduced into and utilized in an economic or social process*" (OECD, 1999). This definition emphasizes the fact that an innovation is not only something new, but also something that find users, for it was successfully introduced into a process that includes technical, economic, and social components. By contrast, an invention is also something new, but which it is not necessarily utilized. Another existing definition of innovation adds up a positive dimension to the concept, by arguing that a condition for innovation to exist is to bring significant improvement into a system.

Whatever be the best definition, it already appears that innovation, seen as a product, is difficult to separate from the process through which it was developed - in other words the innovation process - even though the conceptual separation is crucial. The aim of this literature review is to consider the processes related to innovation development and diffusion.

2.1.2. Emergence of Innovation System in the industrial thinking

From a linear to a systemic model of innovation processes

Rothwell (2007) has shown that 5 increasingly complex models of innovation processes have been developed, from linear to systemic models.

While early study of innovation can be traced back to Adam Smith, Ricardo, List, and Marx, it is widely agreed that Schumpeter (1934, 1939, 1961), was the real pioneer of the modern comprehension of innovation processes. In his view, innovation is a linear process that results from the endogenously determined behaviour of firm entrepreneurs or financiers caught in the capitalist competition. Over the long run, technological change results from the continuous market entry of entrepreneurial agents and innovation processes that force older firms and production methods into obsolescence (the "creative destruction," or Schumpeter Mark I model). This analytical model was supported by the post-war belief in the power of scientific and technological breakthroughs to solve society's problems (technology push).

But global changes such as in the environment in which industrial firms operate led the Schumpeterian model to show limited power to explain the innovation processes observed. In a context of expanding markets, it was first realized that innovation requires adaptation of technology supply to market demand. This led to the apparition of a new model of technological change, where innovation processes are driven by demand (need pull), as well as a third model considering the matching of markets needs and technological opportunities through interaction between different elements and feedback loops between them. From the 1980s, a fourth model emphasized alliances, linkages and integration within the organization (in this case the firm), downstream with customers and upstream with suppliers.

Finally in the mid 80s, a fifth theorical model of innovation process emerged, recognizing that innovation is generated by a 'system' larger than what one organization can achieve. Thus, the Innovation System (IS) approach emerged as a neo-Schumpeterian perspective in reaction to the limited power of conventional linear model to explain and to promote innovation. An IS can be defined as « *networks of organizations, together with the institutions and policies that affect their innovative behaviour and performance, bring new products and processes into economic and social use* » (Freeman, 1987, Lundvall, 1992). The IS framework introduces the idea that innovation is mainly the interactive process involving an extensive network of stakeholders, that lead up to the generation/mobilization, diffusion, and application of knowledge. In this perspective, institutions, policies, and stakeholder networks play a central role in shaping the innovation process, so that the innovation eventually adopted is not necessarily the same than the one initially proposed by its developers. Here, institution is not defined an tangible entity (e.g. an organization), but rather as a set of common habits, routines, practices and rules or laws that regulate the relationship between individual and groups (Edquist, 1997).

Theorical contribution of evolutionary economics and system theory

From a theorical point of view, the IS concept drew significantly from the literature on evolutionary economics and systems theory. On the one hand, evolutionary economists such as Nelson and Winter (1982), Dosi et al. (1988), Metcalfe (1988), and Andersen (1994) emphasized continuous and nonlinear processes of endogenously determined technological and institutional change. On the second hand, the innovation system approach benefited from the contribution of systems theory, that focuses on the study of the attributes and interactions among diverse elements of a set, how the properties and behaviours of each element influence other elements and the set as a whole, and how interdependence among the elements renders the set indivisible and thus analysis of a single element irrelevant (Caarlson et al., 2002).

2.1.3. Emergence of Innovation System in agriculture and rural development thinking

From linear models to Innovation System perspectives in agriculture

For agriculture and rural development, there were similar changes in the conceptual model of innovation processes, but the innovation system perspective has not directly started influencing the study of agricultural research and technological.

The interest of researchers for innovation in this field has in fact emerged through the theories of agricultural and economic development first developed by Hicks. By introducing relative factor scarcities and prices as the key determinants of innovation, Hicks (1946) married the notion of innovation in agriculture to the larger neoclassical framework (Spielman, 2005). Sustained by the works describing the success of Green Revolution, the Hicksian notion of innovation gave rise to a dense literature on the role of public research systems in generating technological change in agriculture, running from the early 1970s to the late 1990s (Hayami and Ruttan, 1971, Echeverría, 1990; Huffman and Evenson, 1993; Anderson, Pardey, and Roseboom, 1994; Alston, Norton, and Pardey, 1995; and Alston, Pardey, and Smith, 1999, among others). The primary focal point of this literature placed emphasis on the role of the state – represented by National Agricultural Research Systems (NARS) - in promoting technological change through a linear model of research, development, and extension, with the assumption that social and economic institutions in which this process occurs are largely exogenous and unchanging.

A slightly more sophisticated approach was found in the Agricultural Knowledge and Information Systems (AKIS) perspective. Incorporating concepts from the study of information and knowledge economics, the AKIS perspective has highlighted the linkages between research, education, and extension in generating knowledge and fostering technological change (Nagel, 1979; Röling, 1986, 1988), recognizing the knowledge flows between and among agents is less linear than in the NARS approach.

Brought by the combined influence of the industrial thinking of innovation and by broad economic trends, the IS framework has broadened the NARS and AKIS perspectives, and broken with the former linear approaches to research and development. In a context of increasing market competitiveness and changing nature of agriculture, farmers are facing challenges that increasingly transcend the level of individual farms. Thus, by providing an analytical framework that explores complex relationships among heterogeneous agents, social and economic institutions, and endogenously determined technological and institutional opportunities, IS perspectives on agricultural research and technological change appeared as pertinent approach to promote rural innovation and help farmers to adapt to their fast changing environment.

2.1.4. Promises, success and limits of Innovation System approaches for agriculture and rural development in sub-Saharan Africa

Innovation System: a promising approach for agriculture in sub-Saharan Africa

This shift in perspective on technological change in agriculture was also found appropriate for the study of developing-country agriculture, and especially in sub-Saharan Africa (Spielman et al., 2009). In developing countries, where most people still depend on agriculture for their livelihoods, the need to support innovation is particularly obvious for agricultural and rural development sectors. In a similar way than in Northern countries, this sector is facing a rapidly evolving environment. The changes are mainly due to connection with regional and domestic market, the entry of new actors and market forces, social and demographical change, and environmental degradation.

In the specific context of sub-Saharan Africa, smallholders meet difficulties to internalize these environmental changes, partly due to limited success of agricultural education, research and extension (Spielman et al., 2009). On their side, international donors and projects have shown deceiving capacity to reduce poverty and improve resilience among smallholders. This situation conducted to change the linear model of knowledge and technology transfers both applied by most researcher and extension agents in sub-Saharan Africa (Spielman et al., 2009), for a more flexible framework able to promote new rural innovation processes in sub-Saharan Africa.

The increasing success of Innovation System approach

The innovation systems approach experiences an increasing success, both in research and development initiatives. By opening the "black box" of innovation to analyze actors' motives and behaviours as well as the market forces and institutions that shape these motives and behaviours, studies that use an innovation systems framework are recognized for their ability to analyze processes that have been overlooked in the linear approach to Research & Development (R&D) (Spielman, 2005). Yet, studies employing the IS perspective are distinguished from the many other works on agricultural R&D because they embed analyses of innovation within the wider context of institutional change, and could offer some answers to certain research questions that the conventional R&D literature is often unable to address. To give a few small examples of recent works, the innovation systems approach has been applied by the World Bank and International Monetary Fund (Lundvall et al., 2002; World Bank, 2006). In 2012, the World Bank published a major work dedicated to promoting and guiding investment in agricultural innovation systems (World Bank, 2012).

The promises and limits of innovation system approach to influence innovation policies

Despite the promise represented by the innovation system approach, it has not yet matured to a point where it can deeply influence policy making in developing-countries agricultural and rural development sector.

Indeed, this change of research and action perspective is expected to support the move from a model of top-down knowledge transfer to a model of co-innovation that facilitates the emergence of context specific solutions. But this task is made difficult as a result of the complexity of innovation policies, and of their inter sectoral dimensions. To name just a few, innovation policy should consider a diversity of economical sectors such as industry, agriculture, trade, finance and investment, education, science and technology, labor (Spielman, 2005). But the translation of the innovation system analytical framework into a concrete innovation policy framework is also linked with the complexity of a "systems" approach and the weakness of its associated methodologies (Clark, 2002).

This is the case for agriculture innovation systems in developing countries. While in industrialized countries, the innovation systems approach relies on a diversity of rigorous qualitative and quantitative methods (e.g. social network analysis; innovation histories; cross-country comparisons; and game-theory modelling in the tradition of evolutionary economics), the methodological toolkit employed in the study of developing-country agriculture remains limited: Currently, the favoured methodology is the descriptive case study, typically drawn from an action research or stakeholder analysis exercise (Hall et al., in Hall, 2004). These case studies are interesting to the extent that they help illustrate complex relationships and assemble seemingly unrelated bits of knowledge, but they are insufficient tools with which to persuade policymakers and effect policy change.

A lot of initiative but difficulties to learn from them

Lack of formalized methods and complexity of IS approach has no prevented numerous rural development projects to use bottom-up and local knowledge-based approaches of rural development, but learning about such experiences remains fragmented. Springing up all over the developing world, these initiatives are usually implemented with external donor support, and promote participatory development and bottom-up agricultural innovation. But most of this work is, however, not based on an explicit conceptual basis, nor are such experiences systematically documented. Moreover, cross-analyses of cases within a country or across countries are rarely made because of differing underlying analytical frameworks and approaches used in each case study. Thus, these initiatives have limited capacity to inform and influence policy formulation and institutional frameworks (JOLISAA, 2010), and they finally remain at the margin.

Conclusion of part 2.1.

In sub-Saharan African agricultural and rural development sectors, there was a shift of the analytical emphasis on technological change from a conventional linear model of knowledge transfers (from researcher to extension agent to farmer) to a more complex, process-based systems approach called innovation system. Despite the promise represented by the innovation system approach, it is has a limited capacity to inform and influence policy formulation, for it lacks formalized methods.

2.2. JOLISAA: promote a better understanding and approach of Innovation Systems through cross-case analysis

This internship took place in the framework of the JOLISAA (Joint Learning in Innovation Systems in African Agriculture) project, a 3-year European research project which main objective is to contribute to fill the gap that prevents innovation system approach to be translated into efficient public action. This section provides an overview of the JOLISAA project, and clarifies the place and contribution of this thesis to the JOLISAA project.

2.2.1. Overview of JOLISAA project

JOLISAA is a European project (EU KBBE CSA Project No. 245319) that aims to increase understanding of agricultural innovation systems and to produce and disseminate lessons and Agenda for further research, practice, and policies, by cross analyzing lessons learnt about past and ongoing experiences of agricultural/rural multi stakeholder innovations in Eastern, Southern and West Africa (JOLISAA, 2012b). To this end, case studies identified and documented by scientists and practitioners through 2 successive iterations – the inventory and the collaborative case assessment - tackle diverse innovation types and scales. The innovation cases are quite diverse, going from natural resource management to production and agribusiness, and from local initiatives to regional ones (Triomphe et al., 2012). Put together and cross-analysed according to a common analytical framework, those case studies should eventually contribute to better understand how smallholders' innovativeness, knowledge, capacities and other resources can be tapped into, strengthened and linked effectively to those of other stakeholders – public or private, local or global – to contribute to reducing rural poverty and improving food security in Africa (JOLISAA, 2012b).

It is one of the few times such ambitious and rigorous cross-case analysis of agricultural innovation systems has seldom been attempted so far. Thus, the hope is that JOLISAA results may contribute to improve the efficiency of national innovation policies and international donors in their mission to support agriculture and rural development in African sub-Saharan countries.

2.2.2. JOLISAA: a participatory research approach based on partnership and joint learning

JOLISAA relies on a multiple partnerships

For its implementation, the JOLISAA project relies on a consortium of European and African partners coordinated by CIRAD (International Research Centre in Agriculture for Development), and sharing different work packages (WPs) of the project, and mobilizing individuals from diverse disciplines and backgrounds (**Figure 1**) (JOLISAA, 2012b). A table in **Appendix 1** gives more details on the JOLISAA institutional partners, and their role in each Work Package.

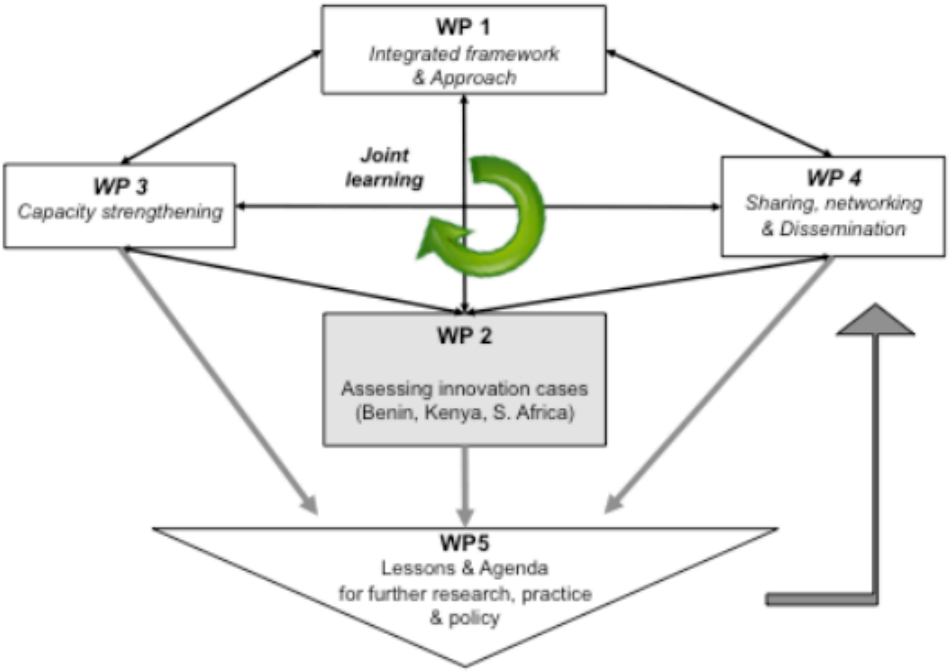

Figure 1: Global interaction among thematic work packages in the JOLISAA project (JOLISAA, 2012a).

JOLISAA: a participatory research programme operating at multiple scales

JOLISAA project has developed a multi-scale arrangement: While an international team is coordinating the overall process, national teams in each African partner countries are in charge of supervising the implementation of the different JOLISAA activities. One of the African partners (Kenya Agriculture Research Institute, JOLISAA coordinator for Kenya) has opted to implement its activities through site teams located in different agro ecological regions of Kenya.

Joint learning at each phase and level of JOLISAA project

The JOLISAA project was designed as an iterative process revolving around joint learning by consortium members and their partners within the three African countries. Joint learning is an iterative process of capacity building among project partners and case-study holders, enabling them to assess and engage more effectively in multi-stakeholder innovation processes and systems (JOLISAA, 2012a). Although there is not explicit joint learning indicators existing yet, joint learning is expected to happen at each phase, in each level, and between each members of the JOLISAA project. Thus, joint learning is embedded in each work package of the project although WP4 specially focuses on knowledge dissemination through sharing, exchange and networking at local, national and international level.

2.2.3. The different phases of JOLISAA

The JOLISAA inventory: first phase of JOLISAA

The first phase of JOLISAA consisted in an inventory of agricultural innovation experiences that was implemented in 2010-2011 in the three selected African countries (Kenya, South Africa and Benin). The main objective of the inventory was to take stock of the diversity of multi-stakeholder agricultural innovation processes involving smallholders, and the role of local knowledge in such processes (Triomphe et al., 2012). The selection of the cases was

based on 4 criteria (Triomphe, 2012): existence of a "genuine" innovation process, involvement of multiple active stakeholders, substantial input (Knowledge, skills, resources) contributed by smallholders, and at least 3 years old existence. The JOLISAA inventory allowed to identify and document 58 recent or on-going experiences, covering a wide diversity of domains, scales and timelines of innovation, with different degrees of success or impact in terms of improving smallholders' livelihoods (Triomphe et al., 2012).

At the conclusion of the inventory phase, 3 national inventory documents were produced (one by each national team), providing a synthetic presentation of the innovation cases that were identified for the inventory. The presentation includes contextual information, innovation(s) description, main phases of innovation processes, effects, and main lessons in light of the JOLISAA goals and questions. The result of the inventory have been used as an input during the following JOLISAA phase, the Collaborative case assessment (CCA) (see below), especially in the formulation of local research questions, and in the development of data collection and processing tools, and a sampling procedure.

The JOLISAA inventory also led to the identification of first trends and lessons characterizing the innovation processes: the common occurrence of "innovation bundles" (a combination over time of technological, social and/or institutional innovations); the typically long time frames of innovation processes; the strategic importance of market linkages in triggering or driving many of the innovations; and an often close relationship between innovation and externally-funded projects (Triomphe et al., 2012).

The Collaborative Case Assessment (CCA) phase: second phase of the JOLISAA project

Started in 2011, the Collaborative case assessment (CCA) is the second major phase of JOLISAA, and it is also the one in which this internship takes place. The general objective of the CCA is to carry out in a participative way the in-depth analysis of a limited number of cases selected out of the JOLISAA inventory for their relevance in accordance to 4 criteria (Triomphe, 2012): the meeting of the original inventory criteria, the content-rich, the existence of significant dynamics during the last few years, the willingness of stakeholders to engage actively in the CCA. After several iterations, 13 cases (out of the 58 inventory cases) have been selected to undergo the subsequent CCA phase. For each one of them, the CCA objective was to assess and understand how the innovation processes unfold with a focus on the multi-stakeholder aspects and the role of local knowledge, and to identify/validate collectively worthwhile lessons and recommendations for research, policy and practice (Triomphe, 2012).

In practice, the CCA is following the same multi-scale arrangement introduced above (Triomphe, 2012): At the local level, site teams gathering researchers, representatives of local stakeholders, and students or young graduates, implement the work. At the national level, a national team supervises and supports the different site teams, while an international team supervises and supports the activities implemented in the different African countries. A CCA team is a 5 to 8 members task force with representatives from those 3 levels, whose mission is to assess collectively one innovation case.

The CCA fieldwork took place from April-May to September-October 2012 in each JOLISAA partner African country. Before CCA formally started, a national workshop (referred as N-xtra) was organized in each one of the African partner countries. The objectives of this workshop were to understand and review innovation inventory results, and to review the main research questions for Collaborative Case Assessment (CCA). Another goal was to test the CCA methodology by going in the field and looking at one or 2 innovation cases (Ng'ang'a & Kamau, 2011). In March 2012, the JOLISAA approach and guidelines to CCA were finalized in the form of a document outlining objectives, research

questions, and methodological choices (sampling, methods and tools available for the data collection and analysis, running of CCA teams, calendar) (Triomphe et al., 2012).

We introduce below the most critical points of these guidelines, because they have shaped the methodology and approach to fieldwork that we have adopted during this study.

2.2.4. The CCA guidelines

The CCA research questions

Within the general objective of assessing and understanding how innovation processes unfold, a set of research questions was developed and presented in the CCA guidelines. The JOLISAA research questions are grouped into 3 types:

- **Generic** research questions: they apply to each and every CCA case and address the main dimensions of the innovation process a given case has witnessed.
- **Thematic** research questions: they apply to a sub-sample of CCA cases and address specific themes or issues of special relevance to JOLISAA,
- **Local** research questions: they apply to individual CCA cases and address issues or concerns of particular relevance to local stakeholders.

Four generic research questions (acronym: GQ) have been formulated as follow:

GQ.1. Stakeholders: Who have been the stakeholders involved in the innovation process, at what moment(s) and with what role? Who among them has been especially active, who has been more passive or maybe even left out and why? What has influenced the participation and actual contribution of the various stakeholders?

GQ.2. Innovations as outcome: What types of innovations (technical, organizational, institutional, etc.) have been developed, at what stages and how have they emerged in the course of the innovation process? What effects have they had for and on the various stakeholders?

GQ.3. Knowledge: What knowledge, skills or other contributions have different stakeholders made during the innovation process, when and with what results?

GQ.4. Enabling environment: What were the key opportunities and barriers, the key triggers and drivers which have influenced the innovation process and outcome, at what scale did they manifest themselves, what consequences did they have?

For their part, the four identified thematic research questions (acronym TQ) are:

TQ.1. Market / Value Chain: What influence has "the market" had on the innovation process / outcome during its various phases (in terms of prices, set of actors, demand, constraints, dynamics, etc.)?

TQ.2. Scale: What factors and conditions have allowed or prevented the innovation process to extend beyond its initial scale or scope (scale up or out)?

TQ.3. Agriculture Research and Development actors: What specific role(s) have donors, formal research and other ARD institutions played in supporting the innovation process, what concrete contributions have they made, what resistance if any have they opposed?

TQ.4. Projects: To what extent has the innovation process been embedded in or determined by the existence and operation of externally supported projects or intervention? To what degree has this influence been positive?

Methodological guidelines

So that each CCA team could address these research questions and come up with rigorous and comparable analyses of its innovation case, the CCA guidelines outline the overall approach to CCA, a list of generic tools for data collection and analysis, as well as advice for implementing it. The overall CCA approach was built around 7 steps (**Figure 2**):

1. At the national level, organization of a planning workshop during which CCA teams should be clearly identified, trained, and should adapt the JOLISAA Generic and Thematic research questions to their own case, select adequate methods and tools, and should agree on roles to be played by each team member.
2. At the site level, implementation of a first phase of fieldwork using the methods and tools developed during the planning workshop;
3. Organization of a multi-stakeholders workshop in order to present initial findings to stakeholders, collect additional data, and identify possible gaps in the findings;
4. Implementation of a second phase of fieldwork to further assess issues identified during the multi-stakeholder workshop;
5. Resources and time allowing, organization of an second multi-stakeholders workshop designed to present overall evidence to stakeholders and to discuss the way forward;
6. Data processing and report writing;
7. At the national level, organization of a national meeting to share results obtained in each of the CCA cases and propose policy recommendations.

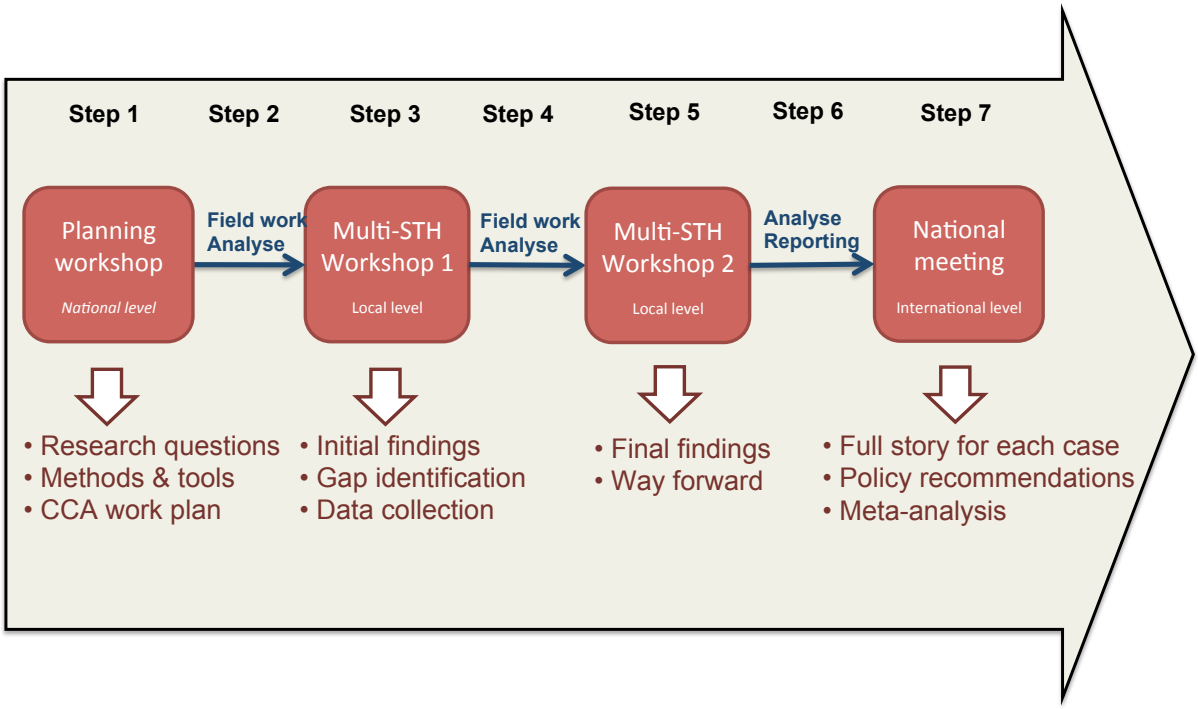

Figure 2: CCA overall approach as proposed by CCA guidelines (adapted from Triomphe, 2012)

The CCA guideline document also provides a list of generic tools for data collection and analysis, as well as advice for implementing it. Tools range from data collection tools such as semi structure interview guide, focus group discussion, direct observation, to other tools that can be both used for data collection and processing according to the context. They include timelines, Venn and flow diagrams, SWOT analysis, ranking, innovation histories, conflict –

partnership matrix, benefit analysis flow chart. In support to the acquisition of those miscellaneous tools by CCA teams, various slideshow as well as an Innovation reader (JOLISAA, 2010) have been provided and/or developed by ICRA to support CCA teams

2.2.5. Demand of JOLISAA to the trainee

As leader of WP2, CIRAD asked me to choose one of the several selected CCA cases and to join the corresponding local CCA team from May to September 2012. As a team member, the student was requested to participate to the joint assessment of the corresponding innovation case (see details of the grant for field research in **Appendix 2**). Out of this analysis, the student was also supposed to contribute actively to the identification and validation of collectively worthwhile lessons and recommendations for research, policy and practice. Moreover, even if this was not included in the student initial specification sheet, i was encouraged to contribute actively to the overall CCA process at the national scale, with the preliminary agreement of the national team.

2.2.6. Choice of addressing the Baringo Aloe case study

Out of the 6 selected CCA cases in Kenya, I selected the Baringo Aloe case. This case is about the history of stakeholders from an arid zone of Kenya who have started to exploit, cultivate, and make value added products from a natural species of the genus Aloe. In the JOLISAA inventory, the innovation process was characterized as a case of « *domestication, organized production, processing and marketing of indigenous Aloe turkanensis and secundiflora species in Baringo district* » (Kamau et al., 2012).

2.3. Kenya, Baringo, and the plight of dry lands

2.3.1. General presentation of Kenya

Geography and economy

Situated in East Africa in the sub-sahelian strip, Kenya had a population of 38 millions in 2009. The country is divided into 47 Counties and 72 districts (**Figure 3**). Its capital city is Nairobi. The Kenyan population comprises about 42 tribes, including the Kikuyu, Luo, Kalenjin, Luhya, Kamba, Kisii, Mijikenda, Somali, and Meru. English is the official language while Kiswahili is the national language (CBS, MOH & ORC Macro, 2004).

The country falls into two regions: lowlands, including coastal and lake basin, and highlands, which extend on both sides of the Great Rift Valley. Agriculture, industry and tourism are major components of the Kenyan economy (CBS, MOH & ORC Macro, 2004). Kenya is a low-income food-deficit country, and in 2004, it was estimated that more than 10 million Kenyans were experiencing chronic hunger (WFP, 2005). This represents approximately one quarter of Kenya's total population.

Figure 3: Map of Kenya, and location in Africa.

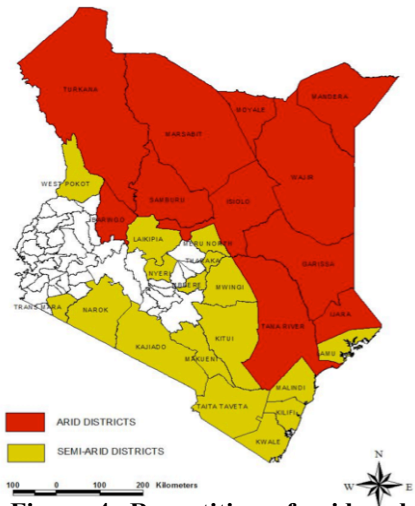

Figure 4: Repartition of arid and semi arid areas in Kenya (source: ALRMP II, 2009)

Kenya: A fast developing economy, but spatial inequalities of serious concern

Kenya is a fast growing economy, but there are huge spatial inequalities of development. After a 30 years period of recession due to external shocks and internal structural problems (CBS, MOH & ORC Macro, 2004; IMF, 2005), the Kenyan economic performance and social conditions have improved steadily since the beginning of the 2000s. The annual growth domestic product growth has increased from 0,6% in 2002 to 6,1% in 2006, and the poverty rate declined from 56,8% to 46% between 2000 and 2006. In this general growing trend, arid and semi arid lands (ASAL) have been left aside. In Kenya, 18% of the land area has high to medium agricultural potential, and supports 80% of the population. The remaining 20% of the population (10 million of inhabitants) lives in 80% of the land, which are classified as ASALs, and characterized by low, unreliable and poorly distributed rainfall **(Figure 4)**. These areas face the highest poverty incidence amongst all areas in Kenya, and more than 60% of ASAL inhabitants live with less than one US dollar per day (GoK, 2004). ASALs are used for pastoral farming (UN & MPND, 2003; FAO, Country Pasture/Forage Resource Profiles). The Kenya National Bureau of Standards record that pastoralists experience the highest incidences

of poverty and have the least access to basic services compared with populations in other areas in the country (KBS, 2007).

2.3.2. General presentation of Baringo

Physical geography

Baringo is an administrative County in the Rift Valley Province of Kenya (**Figure 5**), and its capital town is Kabarnet. The County is divided into 4 Divisions (Koibatek, Baringo, North Baringo, and East Pokot Divisions) themselves divided into 3 to 7 districts. **Figure 6.a** (page 27) shows the administrative Divisions and main roads and town/villages of Baringo. It also shows the unequal level of transport infrastructures, with a road network poorly developed in East Pokot Division, in the Northern part of the County. Baringo County is experimenting a quick population growth rate estimated at 2.65% per year (Kamau *et al.*, 2012). That being said, the population density is unequally spread (from 72 to 29 hab/km^2 from the South to the North). The area experiences one rainy season from April to August and a prolonged dry season, with temperatures comprised between 16 to 30 degrees. **Figure 6.b** shows that a South-North escarpment called Tugens hills divides the County into two parts, with the Njemps flats on the East and the Kerio valley on the West. In the North, the Tugen hills fade slowly, leading Njemps flats and Kerio Valley to merge into a wider geographical area called East Pokot. Resulting from this complex topography, the long-term average annual rainfall ranges from 600 mm in the lowlands (Njemps Flats and East Pokot) to 1000-1500 mm in the Highlands (Tugen Hills). Thus, with the exception of the Tugens Hills, a part of Kerio Valley, Baringo County is largely dominated by ASALs. The diversity of climate and topography conditions, lead to a diversity of livelihood zones, ranging from pastoralism to irrigated farming, and passing through agro pastoralism and mixed farming (**Figure 6.c**).

Figure 5: Location of Baringo in Kenya

Spatial inequalities are also occurring at the Baringo Scale.

In Baringo County, poverty is widely spread and the prevalence of poverty is the highest in the Northern ASAL where pastoralism is the main livelihood strategy. The overall poverty level is estimated to inflict 35% of the total Baringo population (NCAPD, 2005). Nonetheless, spatial inequalities found at the national scale are reflected at the level of Baringo County, and poverty gaps are high due to disparities of climate, topography, and level of infrastructure development.

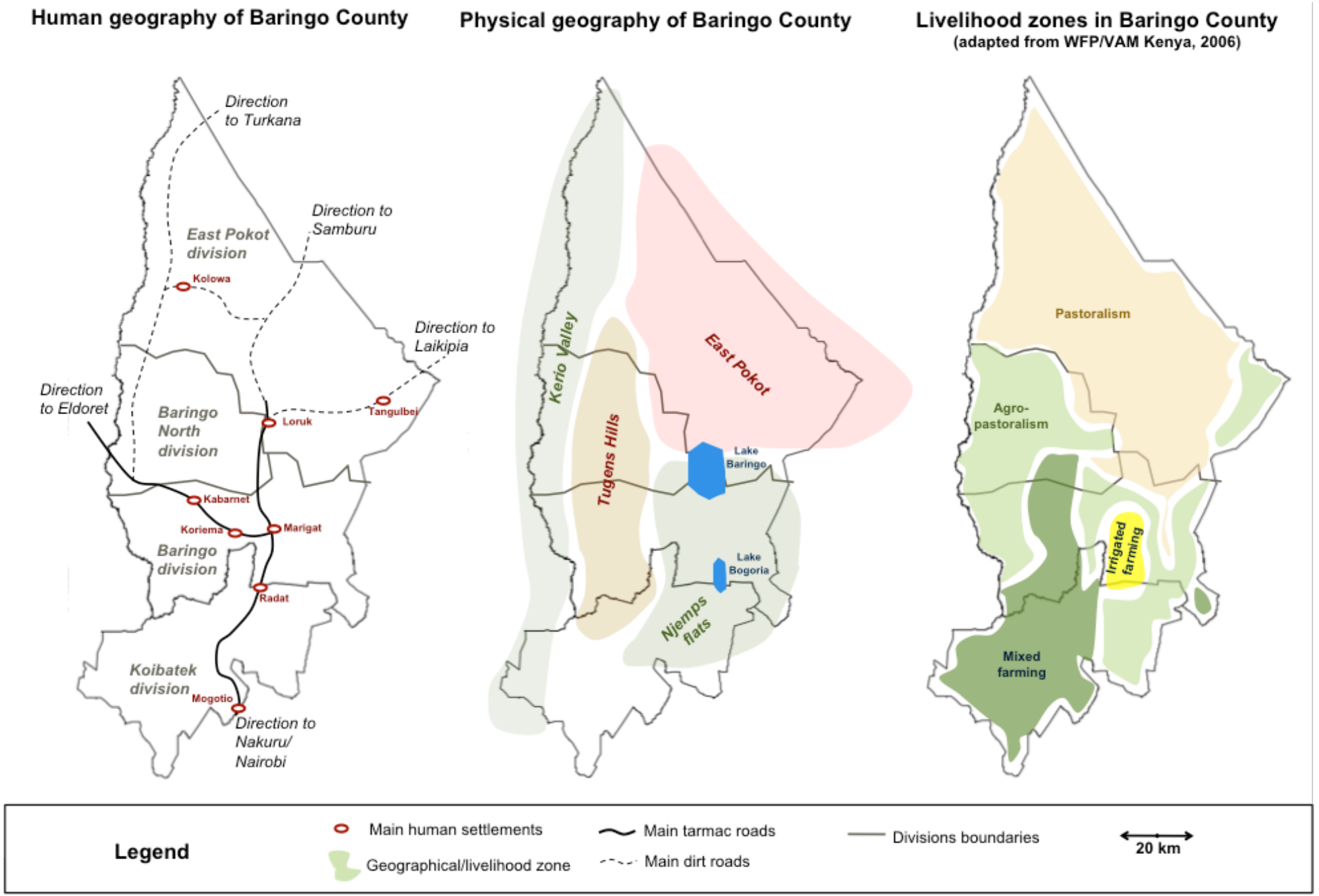

Figure 6: a. Human geography, b. physical geography, and c. livelihood zones in Baringo County

In East Pokot Division (Northern part of the County) the main livelihood source is nomadic or semi nomadic livestock rearing. The area is characterized by high prevalence of poverty, instability linked with frequent cattle rustling, and poor level of infrastructure leading to low market access and high price of staple food. The division is mainly comprised of ASAL communal lands.

Koibatek division (Southern Baringo) as well as Baringo and Baringo North Divisions (Central part of Baringo County, comprising the Njemps flats, the Kerio Valley, and the Tugens hills) are highly dominated by agro pastoralism, while mixed farming also occur in the Tugens hills. The main food crops grown are maize, beans, finger millet and sorghum. In Kobaitek Division, agriculture development has been stimulated by the 1962 land demarcation. In addition to agro-pastoral systems, irrigated farming is found in the Njemps flats, due to the presence of irrigation schemes diverting permanent river waters. Njemps flats also benefit from the presence of Lakes Baringo and Bogoria, that attract wildlife based tourism (tour guiding, boating, selling of curios, boarding and lodging).

Unlike East Pokot Division, the population from the central and southern part of Baringo County benefits from a large range of livelihood sources, as well as a good market access allowing small scale business and leading to relatively low prices of staple food.

2.3.3. Development challenge of Kenya/Baringo arid and semi arid lands

Poverty in ASAL is the result of complex inter related factors

Poverty in the Kenya/Baringo ASAL is a complex issue. Pastoralists' livelihoods are weakened by a wide range of complex and inter-related factors such as collapse of traditional nomadic rearing system, livestock diseases, inter-ethnic conflicts, weak market access leading to price taker position of smallholders, and environmental degradation (soil erosion, periodic floods). The last factor is of major concern as poverty and environmental quality are recognized as being strongly related in Kenya. In a context of growing dependency on environmental resources (more than 70% of the Kenya's population obtain a living directly from the environment), the degradation of natural resources is in turn increasing poverty level (Roba & Mwasi, 2006).

Poverty in ASAL is the result of past inadequate development approaches

But the ASAL problems are also due to inappropriate past development policies, and lack of means and framework for their implementation. Policies to develop ASALs have been implemented in 1972, 1992, 2001, and finally 2005 (GoK, 2005). The 2 first policies were focusing on the settlement of nomadic communities in irrigation schemes, creation of group ranches and other alternative land use systems. Their major weakness was to lack stakeholder participation, resulting in a degree of bias against pastoralism as a viable and sustainable way of life, and their weak capacity to catch the need of the targeted populations. Thus, their main effect was to contribute to increase marginalization and poverty of ASAL people. More recent policies have been more inclusive, but they have lacked means, framework, and monitoring system supporting their implementation (GoK, 2005). This is partly linked with the fact that Government of Kenya (GoK) has always invested most of its resources into high rainfall areas where human population is high and returns to investment are deemed to be better (GoK, 2004).

Sustainable natural resource management in ASALs recognized as a policy priority

After several unsuccessful policies, GoK came up in 2005 with a new policy aiming at addressing the specificity of dry land issues by putting the emphasis on sustainable natural resources management. The policy document (GoK, 2005) begins by recognizing that the Kenyan ASALs have enormous resources that can be harnessed not only to sustain themselves but also to contribute to national economic development. Thus the broad objective of this policy is to ensure livelihood security for all through sustainable natural resources utilisation. Among other, the policy document has identified international interest for ASAL medicinal plants such as *Prunus Africana* and *Aloes* species as an opportunity for Kenya drylands.

Conclusion of part 2.3.

In ASALs, pastoralists' livelihoods are weakened by a wide range of factors such as collapse of traditional nomadic rearing system, hostile marketing systems, and environmental degradation. These trends also occur in Baringo County, as it is largely dominated by ASALs. ASAL problems are also due to inappropriate past development policies whose main effect were to contribute to increase marginalization and poverty of ASAL people. Although more inclusive, more recent ASAL development policies have lacked means and framework for their implementation. An actual policy priority to address the challenges of ASAL is to foster a sustainable use of natural resources, and

2.4. Aloe: From traditional use of Aloe sap to a potential resource

Among other natural products found in ASALs, Kenyan Aloe species have been identified as particularly interesting livelihood diversification options for ASAL communities. In this section, we begin by introducing the genus Aloe, its specificities and its ethno-botanical uses. Then we describe the emergence of an export and domestic market for Aloe products, and finally we explain why Aloe is seen as a potential resource for Kenyan drylands.

2.4.1. Aloe: a multi dimensional object

Aloe: a genus including many species and sub species

Originating from Africa, Madagascar, and Arabia Peninsula, the succulent genus Aloe (family of Asphodelaceae, Liliacee) gathers around 450 taxa (species, subspecies, or varieties) characterized by rosettes of fleshy leaves. Many species are widespread in warm or tropical semi-arid regions, yet the distribution of others is limited to a few living in desert or wet mountainous regions (Reynolds, 2004). It is the case in Kenya: with 57 recorded taxa, the country has the greatest diversity of Aloe in East Africa (Eggli et al., 2001 cited by Oldfield, 2003). Out of it, 25 taxa are recorded in the 1997 International Union for Conservation of Nature (IUCN) Red List of Threatened Plants. In Baringo, the 2 main Aloe species that have been referenced are *Aloe secundiflora* and *Aloe turkanensis*. *Aloe secundiflora* is found extensively in Baringo, and more generally in East Africa. *Aloe turkanensis* has a more restricted extension area, and it mainly occurs in Northern Baringo. The Kenyan Aloe species, and more specifically the Baringo ones, should not be confused with the well-known *Aloe vera* (also called *Aloe barbadensis*). The latter is a cultivar that has originated in North Africa and which is farmed at large scale in both the US and South America. **Figure 7** gives pictures and descriptions of *Aloe secundiflora*, *Aloe turkanensis* and *Aloe vera.*

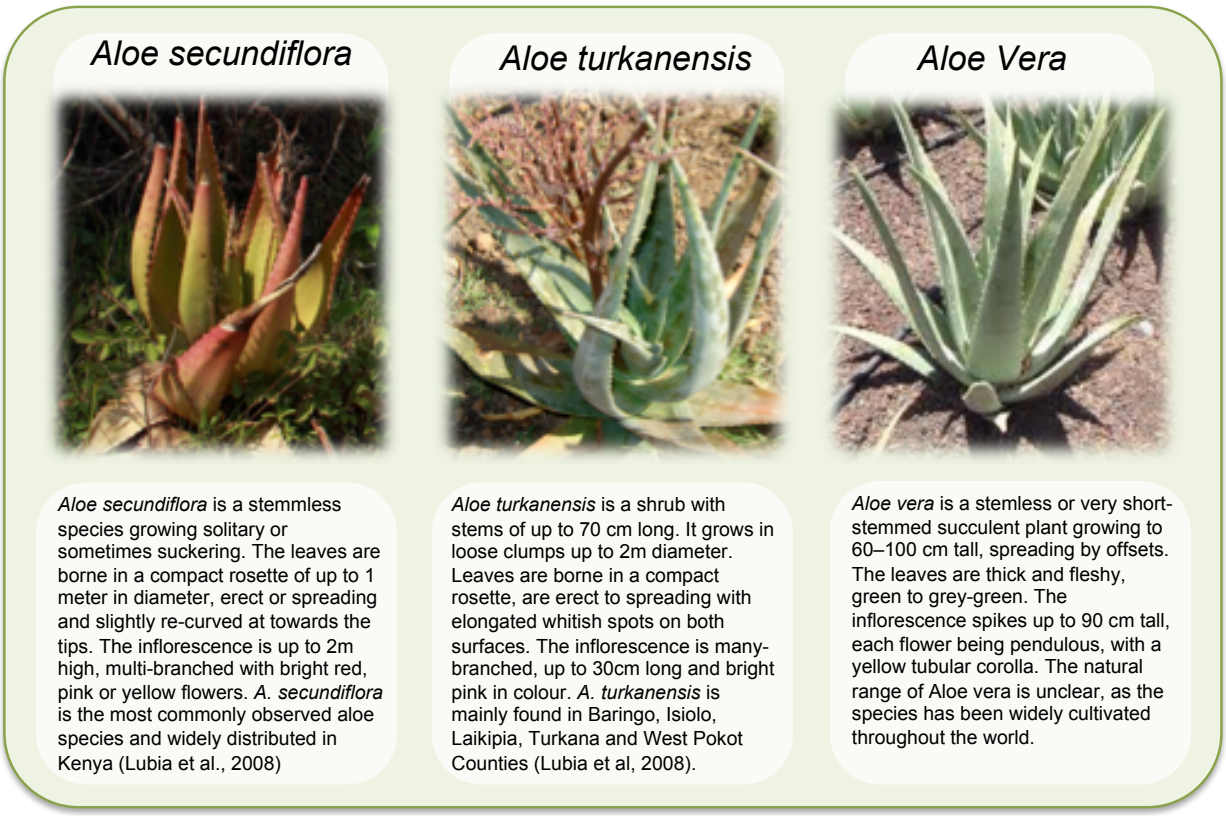

Figure 7: Appearance and description of *Aloe secundiflora*, *Aloe turkanensis* and *Aloe vera.*

Aloe: a genus adapted to arid conditions

From an ecological point of view, Aloes are successful because of several important adaptations to their environments. Firstly, they use a special kind of photosynthesis called CAM (Crassulacean Acid Metabolism) that minimizes water loss that would occur with standard photosynthesis in hot climates. Secondly, to deter herbivory by thirsty desert dwellers, Aloes have developed spines along the margins of their leaves as well as a bitter exudates (Called latex, sap, or simply bitter) produced just under the surface of the leaves. Thanks to this adaptability to dry conditions, Aloe is found in most Kenyan ASAL. **Figure 8** shows the correspondence between ASAL areas and the Kenyan wild Aloe population repartition.

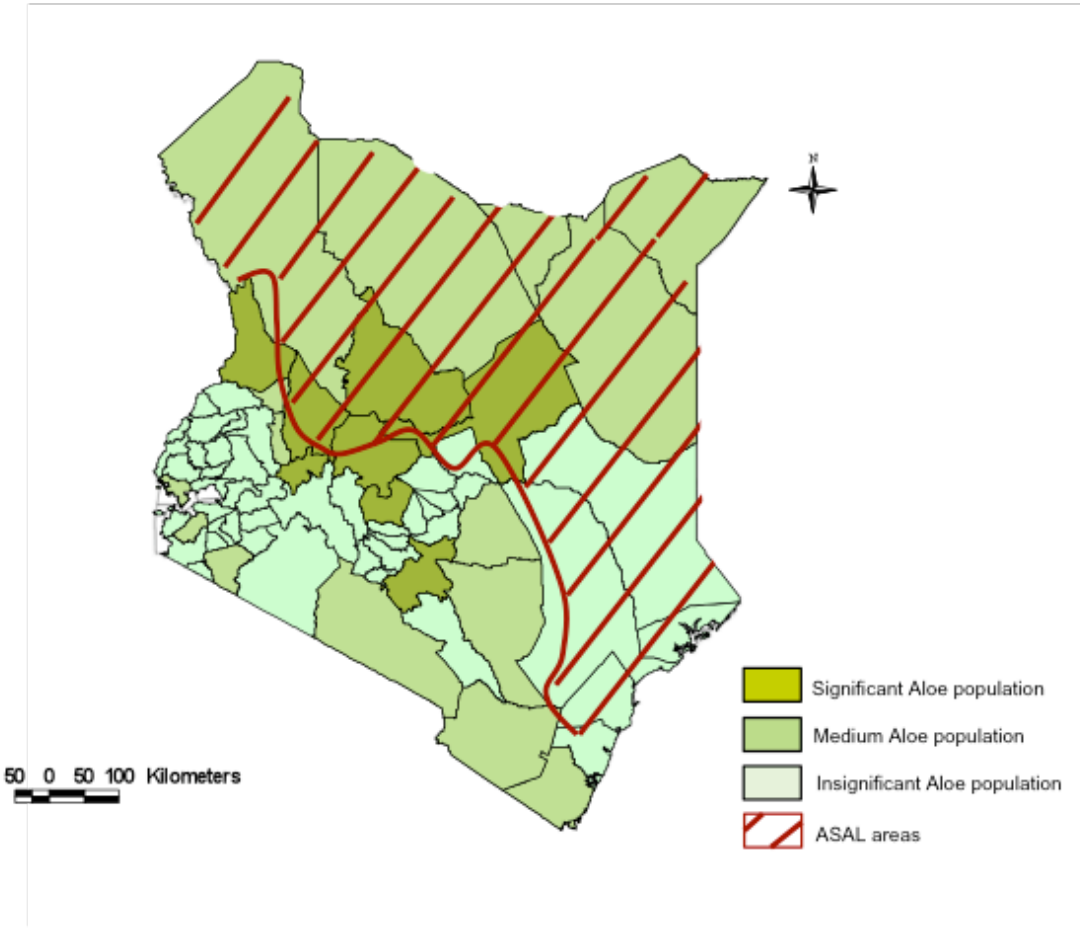

Figure 8: Correspondences between ASAL areas and the Kenyan wild Aloe population repartition (Adapted from GoK, 2004 and Mukonyi et al., 2008b)

Aloe: a genus that assists soil conservation and grass establishment in arid ecosystems

It is well recognized that Aloe species assist soil conservation in arid ecosystems. This facilitative effect has been promoted by conservationists from the 1990s, arguing that in stressful environments such as dry, overgrazed rangelands, augmenting populations of facilitator plants can locally ameliorate degraded abiotic and biotic conditions to accelerate the recovery of healthy ecosystem dynamics (Whisenant et al. 1995; Ludwig & Tongway 1996; Aronson et al. 2002, cited by King & Stanton, 2008).

For its part, *Aloe secundiflora* is known for its ecological restoration potential, as its shrub has a facilitative effect on grass establishment, growth, and reproduction in degradated Kenyan rangeland (King & Stanton, 2008; King, 2008). A previous study in a heavily overgrazed

Kenyan grass-land found that naturally occurring *Aloe secundiflora* shrubs were associated with higher surrounding vegetation cover, plant species diversity, soil seed banks, and soil retention (King, *in litt*. 2003, cited by Oldfield, 2003). To the best of our knowledge, no data are available on *Aloe turkanensis* and *Aloe tugenensis* soil conservation properties.

Aloe: suitability for cultivation

Thanks to their ability to propagate and their rusticity, *Aloe secundiflora* and *Aloe turkanensis* (among other Aloe species) show good potential for cultivation. Both species can be grown from seed and can be propagated through vegetative reproduction. *Aloe turkanensis* is a freely branching species, and small side rosettes can be broken off and planted **(Figure 9)**. For its part, *Aloe secundiflora* usually only has one rosette, but adults tend to start producing suckers if they have been disturbed for example by trampling (King, *in litt*. 2003, cited by Oldfield, 2003).

Figure 9: Stakeholder in Koriema after having broken off an *Aloe turkanensis* rosette.

In addition to this good ability to both sexed and vegetative reproduction, these species require little watering, fertilization. Aloes however would benefit from irrigation during major droughts, and they are prone to various pests and disease: fungal diseases such as rust cause seedling mortality, and insects such as grasshopper nymphs defoliate leaves during dry season. For Aloes that sucker (a plant that suckers produces shoot which grow at the base of the shrub), there is also a need for regular weeding thinning to enhance production of sap (Mukonyi & Oduor, 2008).

As a result of these properties, *Aloe secundiflora* and *Aloe turkanensis* can be propagated from seeds, suckers, cuttings, and they are easy to transplant, and can survive without watering after transplanting in arid and semi-arid regions they have considerable potential as dry land crop. Moreover, Aloe can be intercropped with crops such as maize and beans (Mukonyi & Oduor, 2008).

2.4.2. The wide range of ethno botanical uses of Aloe

The gel and sap of many Aloe species is traditionally used all over the world

Two different substances are coexisting in Aloe leaves - aloe gel and aloe sap (also called latex) - and have been used for medicinal purposes since thousands of years (Egyptian Ebers Papyrus, 1522 BC; Greeks herbal of Dioscorides, 41-68 AC). After harvesting leaves on wild or cultivated Aloe plants, sap can be extracted by draining Aloe leaves, while gel can be extracted by crushing the inside part of Aloe leaves after having removed the skin. The 2 substances vary considerably in their chemical composition: Aloe gel, which is found in the interior of the leaves, has been used as a topical treatment for a variety of skin ailments. The gel works by hydrating and protecting a topical wound until the body can repair itself. For its part, the sap comes from a layer of cells just beneath the outer skin and is used to cure intestinal troubles. It is taken internally and soothes digestive complaints by acting as a purgative or laxative (Davis Botanical Conservatory, 2009). While all Aloe species produce both sap and gel, some species like *Aloe vera* are specialised in the production of gel and others, like *Aloe secundiflora* and *Aloe turkanensis*, are mainly producing sap.

Kenyan Aloe species: a large diversity of traditional uses

According to an ethno botanical survey made in Kenya by Bjøra et al. (in prep, cited by Wabuyele & Kyalo 2008), Aloes are traditionally used as human and livestock medicine, as well as fodder, fencing, hedging, and soil conservation /compaction, traditional brewing and cosmetic therapy. The importance of traditional use of Aloe should not be neglected, since herbal treatment is the only option for treating diseases for up to 80% of the population of East Africa, and up to 50% of the Aloe species are used as medicine, with malaria being the most common human ailment cured by Aloes (Wabuyele & Kyalo, 2008). Each Aloe specie has its own properties, and the traditional use of Aloe is mainly determined by the availability of the different species in the wild. In Kenya, the most popular medicinal Aloe specie is the wide spread *Aloe secundiflora* (Wabuyele & Kyalo, 2008).

2.4.3. Emergence of an international trade of Aloe derivatives

Although science does not formally recognize all the medicinal properties attributed to *Aloe species* (mainly because of lack of research implemented), the market does so. Thus the sap of certain Aloes has been traded internationally for millennia (Oldfield, 2003), an international demand for Aloe extracts has been increasingly important from the 50s. International trade is dominated by the gel of the widely cultivated *Aloe vera,* that represent 123 millions United Stats Dollards (USD) per year (Mukonyi et al., 2008b). It is followed by an other Aloe product called gum, obtained from Aloe sap after boiling. Compared to gel, the international trade for Aloe gum is relatively low. Indeed, Mukonyi et al. (2008b) estimate the total size of the market of bitter gum is 1000t, or 1,5 million USD per year (By multiplying by 1,5 USD, which is the price of 1 kg of *Aloe gum* on the international market according to the same author), which represent 1,2% of the exchanges of Aloe gel. The first Country involved in the production of Aloe gum is South Africa, with 60% of the world gum exported (**Figure 10**). The second is Kenya, with 30% of total quantity of Aloe gum exported in the world. Contrary to South Africa that produces all its gum from *Aloe ferox*, in Kenya, a total of 5 species are wild-harvested for their sap: *Aloe secundiflora*, *Aloe turkanensis*, *A. scabrifolia, A. calidophila,* and *A. rivae* (Lubia et al., 2008).

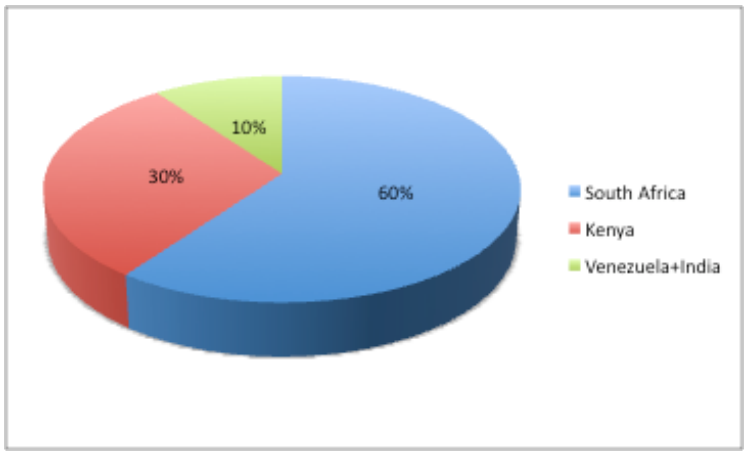

Figure 10: Repartition of Aloe gum world production (adapted from Mukonyi et al., 2007a).

These estimations probably underestimate the part of Kenya and other sub-Saharan countries in the trade of Aloe gum, since the major part of it is occurring illegally. According to Oldfield (2003), it is apparent that significant volumes are traded without being recorded in CITES trade statistics, both between East Africa countries, and toward wider markets. Thus, it is currently impossible to quantify the real quantities of gum traded. According to Oldfield (2003), Kenya remains the main source of Aloe extracts traded internationally from East Africa, and the main source of commercial Kenyan Aloe extracts is Baringo County, where 2 species are wild-harvested for exudates: *Aloe secundiflora* and *Aloe turkanensis.*

2.4.4. International trade of Aloe is regulated

Aloe trade is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is an International treaty that regulates international trade in specimens and derivative of wild fauna and flora. CITES regulates trade by using a system of permits and certificates which must be presented when leaving or entering a country, and which are issued only when certain conditions are met. These conditions vary according to the CITES Appendix in which the specie is classified. Appendix I includes all species threatened with extinction which are or may be affected by trade, and Appendix II includes species which are not threatened with extinction, but which may become so unless trade in specimens of such species is subject to strict regulation. For its part, Appendix III includes species being subject to regulation in any signatory country, and for which a cooperation of other countries is needed to control the trade (CITES, 2012).

In other words, each nation signatory of CITES which wants to export specimens or derivative products from a specie classified under one of the CITES Appendix have has to develop a legal and administrative framework so as to monitor the exploitation and trade of that specie through export permit. CITES makes it obligatory for each country to designate and register at least one authorities, to coordinate, manage, and administer utilization, trade and transactions of all CITES listed species. In Kenya, Kenya Wildlife Service (KWS) is the CITES Management Authority for the Kenya government.

2.4.5. Emergence of a domestic market for Aloe cosmetic and pharmaceutical products

Because of its locally well-known medicinal properties, the sap of few number of Kenyan Aloe species has been traded at a domestic scale for many years in all East Africa regions where Aloes occur (Wabuyele & Kyalo, 2008). Domestic trade is implemented by herbalists that produce their own sap, and urban retailers that buy it to small scale traders, and use it in the fabrication of medicinal products. Although documentation of this domestic trade is scanty and insufficient as a basis for identifying species and quantities exploited, it seems the level of exploitation linked with domestic trade is relatively low compared to the one linked with international trade (Oldfield, 2003).

2.4.6. Aloe: an opportunity for Kenyan dry lands?

The potential for Aloe for dry lands remains largely unexploited

Although enormous, the potential for Aloe utilization remains largely unexploited. Due to their availability in Kenya dry lands and the strong potential domestic and international markets for sap, Kenyan commercial species Aloe have been identified as a particularly interesting livelihood diversification option for ASAL communities. As shown before, Aloe is gathering a lot of properties that make it a latent resource: it is naturally growing in ASAL, easy to cultivate, and drought resistant. M. Dodds (Unknown date) adds that exploitation of Aloe is requiring relatively low skills. But the potential for Aloe utilization remains largely unexploited due absence of information on abundance and distribution, inefficient extraction methods, limited technological know how in processing the products, unclear marketing channels and low returns to primary producers (Mukonyi et al, 2008b).

The Kenyan Government Commitment to the activation of the Aloe resource

Several evidence show the commitment of GoK in the activation of the Aloe resource, and some of them already provide clear guidance to stakeholders: As already mentioned, the ASAL National Vision and Strategy has identified international interest and market for ASAL medicinal plants such as *Prunus Africana* and Aloes species as an opportunity for Kenya drylands (GoK, 2005). Thus, the policy aims to "build the capacity of local people to move into commercial agro-forestry including medicinal plants". In the framework of Vision 2030, the cultivation of new and emerging crops has been identified as one opportunity among others, and a draft policy has been developed to address the challenges facing the sub-sector. These plants – among which Aloe is present - are defined as under-exploited, and could contribute to food security, nutrition, health, income generation and environmental service and improving both the quantity and quality of useful products (GoK, 2004). Last but not least, a national strategy for conservation and management of commercial Aloe species is guiding Aloe cultivation and wild exploitation, in the purpose of improving economic empowerment and environmental management (Lubia et al., 2008).

Conclusion of part 2.4

To address the double challenge of poverty mitigation and sustainable use of ASAL resources, the promotion of a sustainable exploitation of ASALs' resources has been identified by Government of Kenya (GoK) as a policy priority. Among other natural products found in ASALs, Kenyan indigenous Aloe species are considered as particularly interesting livelihood diversification options, since these plants are adapted to dry condition, and their sap have a commercial value.

3. Research problem and hypotheses

In this section, we begin by formulating a general research problem based on the innovation system analytical framework and the specific JOLISAA approach. In a second step, we draw on the Kenya/Baringo/Aloe background described above as well as on the first description of the Baringo Aloe innovation process found in the JOLISAA inventory in order to come up with Aloe case-specific hypotheses and research problems that guided our investigation.

3.1. General research problem

In the light of the innovation system approach and limits already described, and knowing the specific request formulated by JOLISAA, we developed below our general research problem:

- *How did the Baringo Aloe Innovation process unfold?*
- *What are the key features of the innovation process? Were such features already detected in the JOLISAA inventory?*
- *Which generic lessons and policy messages can be drawn from the Baringo Aloe case?*
- *What are the interest and limits of the case study approach employed in the thesis?*

3.2. Local hypotheses and research problem

3.2.1. What is the JOLISAA inventory telling us?

As already mentioned above, the JOLISAA inventory described the Baringo Aloe innovation process as a case of « *domestication, organized production, processing and marketing of indigenous Aloe turkanensis and secundiflora species in Baringo district* » (Kamau et al., 2012). More precisely, the document describes a story where the increasing demand for Aloe sap on the global market caused the exploitation of the Aloe found in the wild. In the 1980s, over exploitation of wild Aloe led GoK to prohibit its harvest for commercial purpose, and to encourage its domestication through a project in Baringo. In the framework of this project, the capacity of communitieswas built for cultivation, harvest, and processing of Aloe sap, and a community-owned company was entrusted a new Aloe sap-processing factory. But the enterprise lost competitiveness, and decided to explore new markets and to diversify its activity through the making of cosmetic products such as soaps, gel, and herbal products. By domestication, the JOLISAA inventory refers to establishing Aloe fields, including exotic ones in rare cases. We hence decided to refer to this as Aloe cultivation rather than domestication in the reminder of this document, as the domestication concept goes beyond cultivation.

3.2.2. Constructing a set of hypotheses

In the light of this initial description of the Baringo Aloe innovation process, and keeping in mind the contextual information summarized in previous section, we have formulated the following set of hypotheses:

- **Three innovations contributed to the activation of the Aloe resource:** the wild Aloe exploitation, the exploitation of cultivated Aloe, and the small scale making of cosmetic products. We further assume that these 3 innovations happened one after the other.

- **The innovation process contributed to poverty mitigation of marginalized pastoral communities** though income generation and improvement of the local organisational device**.** This hypothesis reflects the fact that the Baringo Aloe story is occurring in a geographical zone dominated by ASAL, marginalized areas characterized by the highest prevalence of poverty. According to the JOLISAA inventory, one of the achievements of the Aloe project was an increase of incomes among Baringo local community, and the creation of Community owned enterprise. .

- **The Aloe innovation process led to sustainable management of the Aloe resource.** Such hypothesis reflects that fact that the Aloe innovation process is about how Baringo communities started cultivating Aloe instead of harvesting it in the wild, reducing in doing so the pressure generated by the commercial exploitation on wild Aloe.

- **The Aloe innovation process contributed to the sustainable management of Baringo drylands.** This hypothesis stems from the fact that Aloe species have a known potential in assisting soil conservation in quickly degraded arid ecosystems.

- **The Aloe innovation process was hindered by external shock.** According to the JOLISAA inventory (Kamau et al., 2012), the community owned enterprise dealing with Aloe sap lost competitiveness in the 2000s due to growing energy costs and decreasing prices for Aloe bitters on the local market.

3.2.3. Specific research problems for the Aloe case

Deriving from the above hypotheses, we formulated the following set of Aloe-specific research questions:

- *Are wild Aloe exploitation, Aloe cultivation, and the making of Aloe-based products actual innovations?*
- *If yes, have they contributed to transform Baringo indigenous Aloe species into a sustainable economical resource for ASAL?*
- *Has the innovation process contributed to reduce poverty and marginalization among Baringo communities?*
- *Has the innovation process contributed to decreasing pressure on wild Aloe resource?*
- *Has the innovation process contributed to improved management of natural resources in Baringo drylands?*
- *What has hindered the Aloe innovation process?*
- *Which way forward could be proposed for the local stakeholders and what are the recommendations in terms of public policies related to the involved in the process of activation of Aloe resource in Baringo?*

4. Methodology

In this chapter, we enter into details about the methodology employed to address the research questions mentioned above. We begin by a rapid overview of the generic conceptual and analytical framework for assessing innovation processes on which our study was based. This includes a presentation of the adapted analytical framework used specifically to assess the Aloe innovation process. We also outline the sampling procedures, the interview guidelines, and other data collection/processing tools used in this study. We finally present the general structure taken by the CCA Aloe, and what has been my specific contribution in this collective process.

4.1. Development of an analytical framework

The first step of our methodological approach was to adapt the JOLISAA analytical framework of Innovation Systems (IP) and Innovation Processes (IP) to our specific innovation case.

Keeping the above JOLISAA research questions as a starting point, we built our own analytical framework. The main objective was to catch the dynamic dimension of the Aloe IP, and to be able to easily translate it into operational tools for data collection/processing. To build this analytical framework, we relied on Gaglio (2011), which presents an overview of the sociology of innovation. Gaglio proposes that an IP can be understood by recognizing 4 main steps: initiation, adoption, up-scaling, and institutionalization. Gaglio also stresses the fact that the nature of the evolving network of stakeholders involved in innovation has a strong influence on the Innovation Process. Success of an innovation thus depends on the intensity and nature of the network that is supporting the innovation. Gaglio also shows to what extent the innovation process is shaped by the nature of the innovation itself. **Table 1** (p. 40) summarizes the four-step analytical framework we used, along with related analytical issues and research questions. **Appendix 3** shows the link between research questions, sub-questions and tools for data collection and processing. The four steps are as follows:

- **Step 1** consists in characterizing the global and local context where the IP is taking place, as well as the nature of the case object, that is to say the object around which innovations occur (here it is Aloe). This step seems crucial as the innovation process may be shaped by number of factors of the Baringo/Kenya context such as policies, public organizations, market, evolution of the local agriculture, as well as the biological and ecological characteristics of Aloe.
- **Step 2** consists in delimitating the IS, that is to say the innovation itself, and the network of stakeholders that generate this innovation. It may lead to understand to what extent the nature of both the innovation and the evolving network of stakeholder that support the innovation influence the innovation process.
- **Step 3** consists in characterizing the innovation process, that is to say the process through which those stakeholders initiated, adopted, scaled up, and institutionalized the innovation. Step 3 includes considerations about the turning points, triggers, and drivers of the IP, as well as of how knowledge has been mobilized and spread. The choice of focusing on knowledge comes from the idea that the success of an innovation depends on the quantity and quality of knowledge mobilised and spread.
- **Step 4** consists in evaluating the economical, environmental, and social consequences of the innovations, in the light of the local research problems we identified above. It

questions in particular the activation of the Aloe resource and its impact on ASAL communities and ecosystems.

This analytical framework overlaps greatly with the JOLISAA set of Generic and Thematic research questions. For example, the third column of **Table 1** (page 40) shows the JOLISAA research questions each analytical issue brings, and proves than all of them have been kept. While the 4 steps of our analytical framework would theoretically allow us to encapsulate the IP in its various dimensions, the various analytical issues of our framework couldn't be treated equally, because of the limited time allotted to the study.

Conclusion of section 4.1

We used the JOLISAA research questions as a starting point for the creation of our own analytical framework of innovation systems to catch the dynamic dimension of innovation process. The latter is organized in 4 steps (characterization of the context, identification of actors, networks, and elementary innovations, analysis of the innovation process, and evaluation of impacts in the light of local research problems.

Table 1: Analytical framework developed to address the Baringo Aloe innovation case study

Analytical issues	Research questions	JOLISAA research question
Understand the general context		
1. National context	- What are the main policies influencing the local Innovation process? - What are the main market drivers influencing the local Innovation process? - What are the main public organizations influencing the innovation process?	*GQ.4. Enabling environment* *TQ.3. ARD Actors*
2. Local context	- What are the main geographical, agro-climatic, human… characteristics of the district? - How evolved the local agriculture over the long term? - What are the main pressing issues for agriculture, natural resources, and rural development in Baringo district? - How did the local context influence the Innovation Process?	*GQ.4. Enabling environment* *TQ.3. ARD Actors* *TQ.1. Market/Value chain*
3. Case object in the context	- What are the main biological and ecological characteristics of the case object? - What are the social, economical, political and technical aspects linked with the case object?	
Delimitate the Innovation System		
4. Nature of the Innovation	- What are the actual elementary innovations involved in the overall "innovation"? - Are wild Aloe exploitation, Aloe cultivation, and the making of Aloe-based products innovations? - What sequence of technical, technological and social, organizational or institutional innovations has emerged during the innovation process? - How did the nature of innovation influence the Innovation Process?	*GQ.2. Innovation as outcome*
5. Stakeholders	- Who are the main stakeholders involved in the innovation Process? - How has their respective role and contribution evolved? - Were any stakeholders left out or isolated of the innovation process, why and with what consequences?	*GQ.1. Stakeholders* *TQ.1. Market/Value chain;* *TQ.3. ARD actors* *TQ.4. Projects*
6. Network	- How did the various stakeholders linked up around the innovation? - How has evolved the network? - How did those evolving linkages influenced the Innovation Process and the nature of the innovation	
Understand the Innovation Process		
7. Initiation & adoption	- How was the Innovation Process initiated? - How was the innovation adopted? - What are the barriers and drivers to the adoption the innovation?	
8. Scaling up and institutionalization	- To what extent the innovation spread beyond its initial developers and users? - How was it scaled up? - How was institutionalised the innovation?	*TQ.2. Scale*
9. Turning points, triggers and drivers	- What were the main turning points of the innovation process? - What triggers and drivers influenced the Innovation Process, from its initiation to its institutionalisation? - What has hindered the competitiveness of the community owned enterprise?	
10. Knowledge	- How were the knowledge and skills being mobilized and spread in the innovation process? - What was the specific contribution of smallholders, brokers, and extension? - What was the specific contribution of ARD actors and projects in the Innovation Process? - Did the latter mobilized local knowledge? - How did the knowledge influence the innovation process?	*GQ.3. Knowledge* *TQ.3. ARD Actors* *TQ.4. Projects*
Understand the consequences of the innovation process and assess the prospect of development		
11. Activation of the Aloe resource	- Have wild Aloe exploitation, Aloe cultivation, and the making of Aloe-based products innovations contributed to transform Kenyan indigenous Aloe species into economical resources for ASAL?	
12. Impact of the IP on ASAL communities	- Has the innovation process contributed to reduce poverty and marginalization among ASAL communities in Baringo? - Have some innovators or innovation networks been empowered during the innovation process?	
13. Impact of the IP on ASAL ecosystems	- Has the innovation process contributed to decrease pressure on wild Aloe resource? - Has the innovation process contributed to improve management of natural resources in Baringo drylands?	*LQ.1. Poverty and Natural Resources*
14. Way forward	- Which way forward could be envisaged for the stakeholders and the Kenyan public policies involved in the process of activation of Aloe resource in Baringo?	*LQ.2. Territorial Resources*

4.2. Development of data collection procedures

4.2.1. Data collection

Fieldwork and areas surveyed

Data were collected from April to September 2012 through published and unpublished secondary data (scientific articles and books governmental reports, Non Governmental Organization (NGO) reports, press article, project reports), and through fieldwork. Fieldwork included individual or grouped interview (26), General Group Discussion (3), Focus Group Discussion (5), multi stakeholder workshop (1) together with direct observation. **Table 2** details their respective specific objective.

Table 2: Field data sources and respective objectives.

Field data source	Objective
Individual interviews	Collect stakeholders-specific data on the Baringo Aloe innovation system.
Grouped interviews	Collect and collectively validate in narrow group stakeholders-specific data on the Baringo Aloe innovation system.
General Group Discussion	Collect and collectively validate in large multi stakeholder group general data on the Baringo Aloe innovation system.
Focus Group Discussion	Collect and collectively validate in narrow group data based on pre identified grey areas in the understanding of the Baringo Aloe innovation system.
Direct observation	Observe stakeholders practices to collect complementary information and validate/invalidate data collected through interviews and group discussions.

The fieldwork was implemented in various zones of Baringo (Koriema, Radat, Mogotio, Kolowa, Loruk, Marigat) as well as in Nakuru and Nairobi. Although not visited, information have also been collected about other areas such as Tangulbei, Mukutani, Bartum, Barpello, Kimalel, and Sabor, through individual interviews and GGD, and reports.

Tools for data collection/processing

The main tool we used for data collection was Semi Structure Interview (SSI) guidelines, although a number of other tools were used in complement. SSI guidelines were designed to transform the research questions and sub-questions identified into direct questions that stakeholders could answer. An example of SSI guidelines is given in **Appendix 4**. It is structured around 5 parts: profile of the household, context, innovation system, innovation process, and consequences and prospect of development. The other tools of data collection were synthetic historical timeline, flow diagrams, supply chain mapping, ranking (to rank the livelihood sources), stakeholders network mapping, tables to be filled (to list knowledge linked with Aloe and link them with knowledge brokers), mapping (evaluation of the distances covered to harvest Aloe), and schematic drawing (harvesting practices). These tools were used in combination with SSI, especially during GGD. **Appendix 3** indicates which method was used for each analytical issue. Some tools such as history timeline and network

mapping were also used for data processing, and in the presentation of the results of this study.

4.2.2. Sampling

Adoption of flexible sampling rules

For the sampling, the initial choice that was adopted was to adopt a flexible sampling rule taking stock of the stakeholders diversity in the IS. Given the openness that characterize the IS approach, and the scarcity of the secondary data available on the Baringo Aloe sub-sector, it was difficult to establish a strict sampling to address the Baringo Aloe IS. Indeed, in this kind of intensive work, research questions often evolve over the fieldwork, calling for an enlargement of the initial sampling to new stakeholders or geographical zones, or on the contrary to a focus on a particular issues. Thus, we adopted a flexible sampling rules rather that locking ourselves in a closed sampling.

The first approach we adopted was to take stock of the diversity of stakeholders in the innovation process. Using the secondary data available in the JOLISAA inventory and on the internet, we identified a first range of direct and institutional stakeholders to be surveyed. For instance, the direct stakeholders surveyed ranged from Aloe wild harvesters and Aloe growers to Aloe sap-processors and traders. Institutional stakeholders surveyed were from KEFRI, KWS, NMK, KARI, AMUs, Land Mawe LTD. **Table 3 (**page**)** provides an overview of the diversity of stakeholders that have been surveyed through GGD, FGD, individual interviews, and multi-stakeholder workshop. But beyond this stakeholder diversity approach, we also used other criteria of sampling that are given in **Appendix 5** together with the underlying assumptions that have led us to adopt them.

As decided together with the rest of the CCA team, the sampling as regards GGD targeted areas where entities involved in the management of Aloe. These entities are called Aloe Management Units or AMUs (see section 5.2.9 page 72) were already established. Thus, the 3 GGD were organized in areas corresponding to Koriema/Kimalel AMU (Koriema GGD), Olduka AMU (Radat GGD), and Kolowa AMUs (Kolowa GGD). **Figure 6a** (p. 27) is a map showing the location of Koriema, Radat and Kolowa. These AMUs were chosen for they were covering a diversity of agro ecological zones, also they were not created in the same conditions and at the same moment (see section 5.2.10 page 73).

4.2.3. Calculations

In section, 5.1.1., the map of wild Aloe exploitation spread has been created by drawing a 30 km circle around each sap processing station (It is the maximal distance stakeholders cover to go and sell Aloe sap), and we removed from this the areas where we found that wild Aloe exploitation did not occur.

In section 5.1.2, all the assessments on surfaces cultivated with Aloe, number and kind of actors cultivating Aloe, and places where Aloe is cultivated come from data collected by a BABE LTD in 2008 (**Appendix 6)**. The various stakeholders were classified according to the AMUs and to the administrative division they were belonging to. They were also classified according to 3 types: Smallholders groups (gathering CBO and self help groups), Institutions (Gathering Project and schools), and individuals. We established this typology in order to simplify the analysis by gathering actors with similar behaviours toward Aloe. **Appendix 7** contains all the tables we used to process raw data, and come up with these estimations.

In section 5.1.3, the calculation of soap production cost were done by estimating unit cost and turnover of each input and labour, taxes, and rent (see Table in **Appendix 8**).

Table 3: Stakeholders surveyed through GGD, FGD, individual interviews and multi-stakeholder workshop

Stakeholders	FGD	GGD	Individual interview/grouped interview	Multi-stakeholder workshop
Direct stakeholders				
BABE official	1	4	2	
KOKISA official			3	
AMU officials	7	1	1	7
Wild Aloe harvesters/Aloe farmers	12	49	6	12
Herbalists	4	3	1	4
Boilers	1	1	1	1
Gum traders	1		1	1
Middlemen		1	1	
Smallholder groups (SHG or CBO)	8	3	3	8
Local leaders	1	6	3	
Land Mawe representative			1	
Barpello high school			1	
Soap making enterprise			1	
Herbalist entrepreneur			3	
Street retailer			1	
Pharmacists			1	
Total (direct stakeholders)	**35**	**68**	**30**	**33**
Institutional stakeholders				
Kenyatta University			1	
KWS			1	1
NMK			1	
KEFRI	1		2	
KFS	1			1
KARI	1		1	
Total (institutional stakeholders)	**3**		**6**	**2**
Total	**38**	**68**	**36**	**35**

4.3. Implementation of the CCA approach

4.3.1. Overview of the CCA phase in Kenya/Baringo

The Kenyan CCA phase was implemented from June to mid September. It was coordinated by G. Kamau and T. Ng'ang'a (the JOLISAA national team) from KARI, and the various case studies were implemented by CCA teams gathering KARI or KEFRI site researchers/extension workers, innovation case stakeholders, students or young graduates, as well as one representative from the JOLISAA National team. The CCA phase was opened through a national planning workshop, after which each CCA team was delineated, and started working on its specific case. In Baringo, 2 overlapping CCA teams were formed in order to tackle two innovation cases: the Aloe case on the one hand, and a case dealing with Prosopis management on the other hand. The Baringo Aloe CCA team was leaded by C. Mulindo (Deputy Director, KARI Perkerra), and was also comprising M. Welimo (Director, KEFRI Perkerra), K. Kimeto (Technician, KARI Perkerra), Joseph Ngetich (Baringo Aloe Bio-Enterprise Development Project stakeholder), Teresiah Ng'ang'a (Representative of the JOLISAA national team), and ourself as a student.

4.3.2. The CCA national planning workshop

The JOLISAA-Kenya CCA phase was opened through a national planning workshop organized by the JOLISAA national team, and held in Thika for 3 days. Two expected CCA members of each selected innovation case attended the workshop. The participants were initially introduced with the objectives and overall approach of the CCA, and the interest of JOLISAA with regard to the long-term strategy of KARI. In a second phase, the different pairs of participants presented their CCA fieldwork plan to the other workshop participants. The JOLISAA national team then submitted for discussion a standard fieldwork plan inspired from the various proposed fieldwork plans, which was validated by the participants after refinement. Then, the participants were introduced to the JOLISAA generic and thematic research questions, and were asked to align them with data collection/processing tools. The role of students was also discussed on that stage. We have participated in the organization of the National planning workshop, by providing technical and logistical support to the JOLISAA national team. **Appendix 9** provides a minute of the JOLISAA planning workshop.

4.3.3. Implementation of the Baringo Aloe CCA

The Baringo Aloe CCA was implemented from June to September 2012 (**Figure 11** page 45). However, for me, the work actually began in April and ended in November. My work started in Montpellier in April, with secondary data collection on the Kenyan/Baringo context and on the Aloe sub-sector through Internet. This led to the initial formulation of research questions and sub-questions as well as tools of data collection/processing to document them. This preliminary work gave rise to a pre-proposal that was submitted in May to the JOLISAA coordinating team (CIRAD), Kenyan national team, and to the Baringo site team. Shortly after my arrival in Kenya, the national planning workshop was held, and I joined the Baringo Aloe CCA team located in Marigat, Baringo County. The upcoming activities were subsequently planned together with the CCA team.

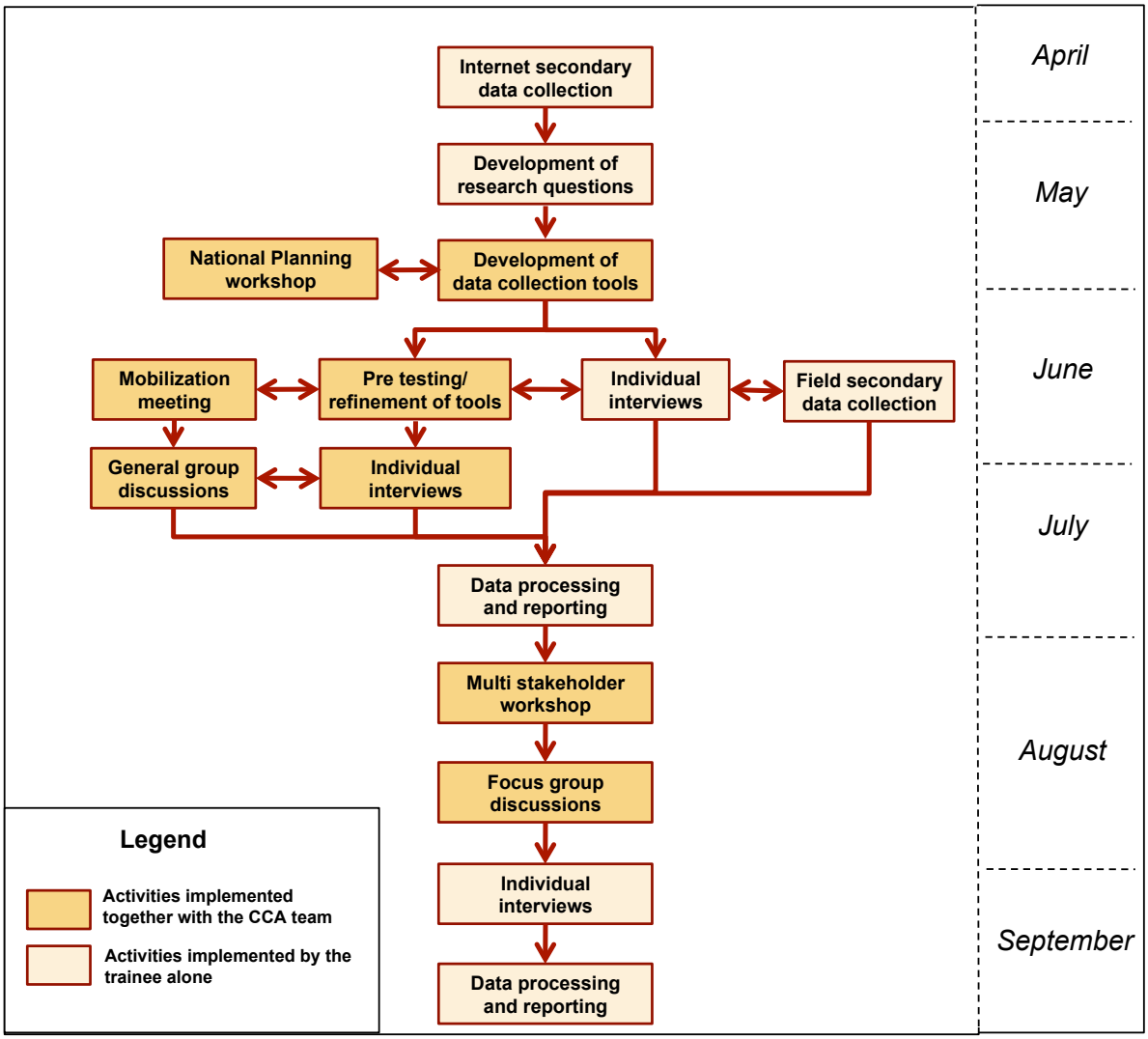

Figure 11: Implementation of the Baringo Aloe CCA.

In June, after a stage of refinement of the proposal's data collection tools, the CCA team organized 3 mobilization meetings with local leaders of sampled zones where local leaders were asked to help identify stakeholders to be invited to the upcoming General Group Discussions (GGD), and to mobilize them. These meetings also constituted an occasion for the CCA team to test and refine data collection tools by interviewing local leaders as well as available stakeholders. Three GGD were eventually held in July in Koriema (Baringo Division), Radat (Koibatek Division), and Kolowa (East Pokot Division) respectively. They lasted between 2-4 hours each, and involved 20 to 30 stakeholders. They were facilitated using alternatively English and Kiswahili, and followed some pre-defined semi-structured interview guidelines. The facilitator was asking questions to the assembly and writing answers on a flipchart while other CCA team members were taking complementary notes. **Appendix 10** presents each GGD, the way they were implemented, and the results that came out from them. Before and after each GGD, several individual interviews were also conducted with available stakeholders (e.g. Aloe harvesters, middlemen, local leaders). In June-July, during the period pending the GGD, I made several individual interviews on the side, and collected secondary data from them when possible.

The GGD were followed by a period of data processing and report writing pending the organization of a multi stakeholder workshop. The latter was organized in early August and

coincided with a field of B. Triomphe (CIRAD), who subsequently supported the organization of the multi stakeholder workshop. During this event, the CCA team presented its initial results to 30 Baringo Aloe stakeholders who were asked to validate/comment them, and gave their expectations and way forward for Aloe production and marketing in Baringo. This workshop also allowed to fill some information gaps in the Aloe innovation story through the organisation of Focus Group Discussions, as well as to identify further grey areas. **Appendix 11** presents details about the workshop implementation and results.

The workshop was followed by another stage of individual interviews and secondary data collection carried out by myself, and designed to address the grey areas identified. It lasted till mid September, after which I focused on the CCA report and thesis writing.

4.3.4. Place of the trainee in the CCA team

By being the only CCA team member mandated to allow 100% of working time to JOLISAA project, I played a key role in the CCA team. As already mentioned above, the CCA phase of JOLISAA is a collective process where students are only one piece. It should thus be clarified the repartition of tasks within the CCA team (**Table 4**).

Table 4 Repartition of tasks within the CCA team.

CCA team member	Role in the CCA
C. Mulindo	Coordination of the CCA team, planning of the CCA phase, revision of data collection tools, fieldwork, redaction
M. Welimo	Planning of the CCA phase, fieldwork, oral presentation during feed back workshop
K. Kimeto	Fieldwork
J. Ngetich	Fieldwork
T. Ng'ang'a	Planning of the CCA phase, organisation of the feed back workshop.
R. Belmin	Planning of the CCA phase, conception of the analytical framework and data collection tools, fieldwork, major role in the redaction, oral presentation during feed back workshop

5. Results

In this chapter, we introduce the results of the CCA phase. In section 5.1, we begin by introducing the 3 forms of utilisation of *Aloe secundiflora* and *Aloe turkanensis* resource have successively emerged within the last 30 years, and show that they actually are innovations. We continue by detailing the process through which these innovations appeared, after which we identify key phases in this history (section 5.2). We then enter in 2 analytical parts. In section 5.3, we highlight the triggers, drivers, and enabling/disabling factors that have been conditioning the adoption of innovations. In section 5.4, we look back on the history of the innovation process in the light of stakeholders network analysis so as to emphasize their interactions and specific roles in knowledge spread and innovation adoption.

5.1. The 3 forms of activation of the Aloe resource

In Baringo, 3 forms of utilisation of *Aloe secundiflora* and *Aloe turkanensis* resource have successively emerged within the last 30 years, and today co-exist. They are represented by Wild Aloe Exploitation (WAE) to supply international market of Aloe gum, Aloe Cultivation (AC) for various purposes, and the Making of Aloe-based Products (MAP). The goal of this section is to give a detailed picture of their nature, technical content, diversity, and place within the socio-economical environment.

5.1.1. The wild Aloe exploitation

Overview of wild Aloe exploitation

In Baringo, WAE consists in the harvest of the leaves of wild indigenous Aloe species - *Aloe secundiflora* and *Aloe turkanensis* – in order to collect and sell the collected sap to sap-processors. WAE has been implemented at a large scale in connection with the international market of Aloe bitter gum since 1984. The Natural Resources Management & Development Agency (Kihara et al., 2003) has estimated that Kenya has exported about 470 tons of Aloe gum between 1994 and 2000.

Harvest of wild Aloe also occurs at a smaller scale in the framework of domestic use of Aloe sap, and in relation to the domestic market of Aloe-based cosmetic and pharmaceutical products. With a view to simplification, what we call WAE will only make reference to the commercial harvest of Aloe. While Aloe harvest for domestic use is a widespread practice throughout Baringo, WAE is only concentrated in the pastoral areas of Northern Baringo (East Pokot Division), and to a lesser extent in a single spot in Radat (Koibatek Division) **(Figure 12** page 48**).** WAE occurs in the area surrounding sap-processing stations, generally no more than 30 km from each one of them. Sap-processing stations are units where sap is bought to Aloe harvesters and transformed into gum (see below for more details).

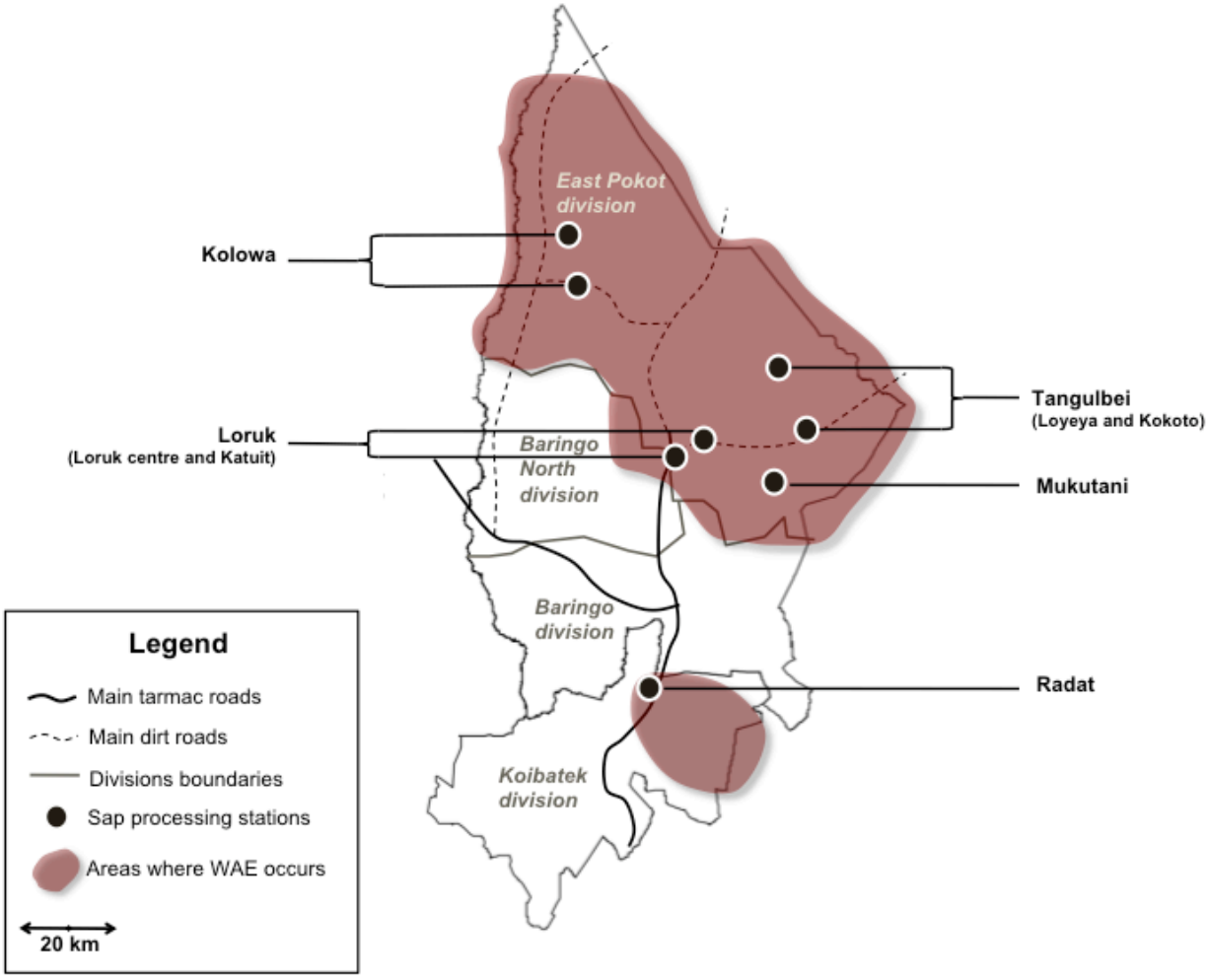

Figure 12: Baringo County's areas where WAE was occurring in 2008 (Source: GGD & interview traders).

Practices linked with Aloe exploitation

Such practices include a diversity of techniques, such as leaf harvesting, viscosity-based purity test, sieving, Aloe sap processing into gum, and gum cooling (**Figure 13** page 49).

Commercial WAE is mainly implemented by women and children from pastoralists households, who harvest Aloe on a daily basis. WAE mainly happens during the short rains and the dry season (from July to December). Harvest stops during the long rainy season (from March to June), during droughts, as well as for a few weeks after any heavy rains (because the sap becomes diluted).

GGD and SSI in Kolowa revealed that harvesters leave home around 8 AM with 5-8 basins and water for the day, and walk up to 2 hours to reach a place usually located anywhere between 9 and 12 km from their house. When they reach the point, harvesting can start. They start cutting Aloe leaves around, and drop them in one basin so that their sap content to be drained (**Figure 13**, photo **1**). Some harvesters cut all the leaves of one Aloe shrub, others leave uncut the 2-6 top leaves so that the plant regenerates faster. When one basin is full, they go further and realize the same with another basin. At the end of the afternoon, around 4 PM, they come back on their steps, collect the basins, pour all the sap in one basin, and come back home. Between 2 and 5 L of sap are usually collected in a day. They repeat this operation daily going each day in another direction from home. Harvest of Aloe is a full-time activity, as it is not coupled with any other activities.

After 4-7 days of harvest, women or children go and to sell their sap to Aloe sap-processors (also called boilers: see below) for 20-28 KsH/L. They are paid cash or in kind (mainly

through food), according to the capital possessed by sap-processors. Household located far from places where processors are established only supply them on market days. Before buying sap, boilers check its quality through a viscosity-based test that consist in pouring one drop of sap on soft soil, or the border of a basin, and see weather it retains its shape or it stinks down (**Figure 13** photo **2 and 3**). Then they process the Aloe sap into bitter gum through boiling in 100L tanks using firewood. Once boiling is over, they cool the resulting gum mass in semi-buried bags and store it (**Figure 13**, photos **4, 5 and 6**).

Figure 13: Practices linked with wild Aloe exploitation.

Wild Aloe exploitation is linked with the sap demand of a non-official supply chain

In Kenya, WAE is implemented in the perspective of selling sap to agents of a non-official supply chain that links Aloe harvesters from the most remote pastoral areas to the global market. According to Kihara et al. (2003), there are at least 7 main actors in the Aloe supply chain. **Table 5** presents the actors and their respective function, which sometimes overlap.

Table 5: Actors of the non-official Aloe supply chain and their functions

Aloe supply chain actors	Functions realised
Farmers/harvesters	Aloe production and harvesting, sap selling to middlemen or boilers
Middlemen	Sap purchasing to farmers/harvesters, transport, and sap selling to boilers
Boilers	Sap purchasing to farmers/harvesters or middlemen, sap processing into gum, bulk transportation of gum
Traders	Bulk transportation of gum, packaging, selling to exporters
Exporters	Buying to traders, packaging and shipping, selling to end-users
End-users	Buying to exporters, secondary processing to make aloe-based consumers products

Specifically, Kihara et al. (2003) show that wild Aloes are harvested by pastoralists women who extract sap by draining leaves, and go and sell it to sap processors. In some cases, middlemen are responsible for transport from the household to the sap processing stations.

Often located near human settlements, sap processors are in charge of purchasing Aloe sap, processing it into gum using firewood, and storing the gum before traders come and take it. Traders advance significant amounts of money (enough to produce 10 tones of bitter gum) to boilers, and make arrangement with local authorities so that gum can be stored and transported safely and without administrative hassles. Traders transport the Aloe gum in bulk to Nairobi or Mombasa on the coast (700 km away from Baringo), where they sell it to exporters. Pre-export packaging (using tins, packs, or carboard boxes) are handled by traders or exporters themselves. Kihara et al. (2003) identified 4 Kenyan registered exporters involved in Aloe business. Over the 1995-1999 period, the main export destinations were Thailand and Singapour, and to a lesser degree European countries including France. Overseas buyers of the aloe gum use it as a raw material for the making of cosmetic products.

Our study shows that in Baringo, the Aloe supply chain organisation is similar than the one described by Kihara et al. (2003): Wild harvesters supplying boilers hired by traders who bulk Aloe gum before sending it to exporters. In Baringo, sap-processing stations are concentrated in Northern pastoral areas (East Pokot Division), at the exception of one which is located in an agro-pastoral area from Southern Baringo (Radat, Koibatek Division). **Figure 12** (page 48) shows the location of the 8 sap-processing stations we identified through our surveys and interviews with traders: Tangulbei (Loyeya and Kokoto), Mukutani, Kolowa, Loruk (Loruk centre and Katuit), and Radat. There are at least 3 traders in Baringo. They are located in Marigat and each of them supervises a network of 2 to 4 boilers spread in rural areas. Sap-processing stations are often located 20-30 km apart so that their catchment areas do not overlap. The gum produced by each one of them (around 2 tones) is transported to Marigat at the conclusion of a 3 months period. One trader interviewed revealed he was selling gum to a Chinese exporter.

Importance of wild Aloe exploitation in pastoral livelihood strategy

In the places where it occurs, WAE often represents an economical diversification alternative for pastoral communities. As already mentioned before, the pastoral communities of Northern Baringo (dominated by East Pokot tribe) experience the highest prevalence of poverty in the County since their livelihoods are threatened by several factors such as droughts, livestock diseases, and low market access leading to high prices of staple food and low business opportunities.

In this context, WAE represents an economical diversification option and a drought aversion strategy that fits well with the social organization of pastoral households. A study from 2002 showed that in 5 Kenyan districts (including Baringo), 56% of smallholders were relying on Aloe for their livelihood (Kihara et al., 2003). Our own results, while more qualitative, go in the same direction.

In pastoral communities such as the East Pokot tribe that dominates Northern Baringo, women are often unemployed, staying at home while men are herding livestock. By providing full-time activity to women at certain times of the year, and by allowing them to get cash independently from their husbands, WAE is bringing a significant - although scarce - livelihood source in pastoral households. During the dry season (that also correspond to the pick of Aloe harvest), when men spend several months with their herds in the framework of nomadic rearing strategy, Aloe contributes to securing household livelihoods. By contrast to goat selling that cover exceptional expenditures (school fees, buying of medicine), the sale of Aloe sap covers daily expenses such as maize flower and sugar. The livelihood source represented by Aloe should not be underestimated. In Kolowa, general group discussion revealed that the sale of Aloe represented the second source of income of the households, just after goat sale. Section 5.2.2 gives an estimation of the income earned by Aloe harvesters.

5.1.2. The Aloe cultivation

Overview of Aloe cultivation

In Baringo, Aloe cultivation (AC) consists in the cultivation of indigenous Aloe species - *Aloe secundiflora* and *Aloe turkanensis* – (and in rare cases the cultivation of introduced Aloe species such as *Aloe vera*). Aloe has been cultivated from 2004 with the goal of harvesting and selling sap in connection with the market represented by a community owned enterprise called nowadays *Baringo Aloe Bio Enterprise LTD (BABE LTD)*. To a lesser extent, Aloe is also grown to stabilize farming terraces, especially in the sloppy areas of Koriema, Kimalel and Sabor, as well as for ornamental purpose. Based on data collected by BABE in 2008, we estimated that in 2008, a total of 128 acres (52 hectares) were cultivated in Baringo by 72 stakeholders.

Practices linked with Aloe cultivation

AC involves several technical practices including propagation, nursery management, transplanting of seedlings, and maintenance of Aloe crops, and sometimes inter-cropping with self-subsistence crops and terracing using Aloe (**Figure 14** page 52). While there is a marked heterogeneity in the AC practices of farmers, we will deal with them as if it were a standardized technical itinerary, because of lack of sufficient information to properly deal with the diversity of practices.

AC begins with propagation from seeds or suckers. In the first case, seed collection is done through identification and harvest of mature pods, pounding of dry pods to extract the seeds, seed planting in furrows and covering with a thin film of soil, and transplanting germinated seedlings into polyethylene tubes. In the second case, suckers are detached from mother plant (**Figure 14, part 1**), pricking out suckers into a polyethylene tube, or directly transplanting them in the field. In Baringo, such propagation techniques have only been implemented in 3 nurseries trained by KEFRI. In most cases, stakeholders only transplant suckers directly in the field. The management of Aloe nurseries consists in the preparation of nursery beds with polyethylene sheets, fencing of the nursery, and potting (**Figure 14, part 2)**. After a minimum of 6 months in the nursery, the seedlings with good growth are transplanted in home gardens, farms, and terraces, preferably on tilled lands. Before transplanting, the root system is pruned, and the spacing is determined and holes are dug, generally with a 100x100 cm spacing. Then, Aloe seedlings are transplanted and the holes filled with humus. Once transplanted, Aloe requires little maintenance. Some farmers weed their Aloes crops, and also thin the Aloe is of the suckering type (e.g. *A. turkanensis*) (**Figure 14, part 3).**

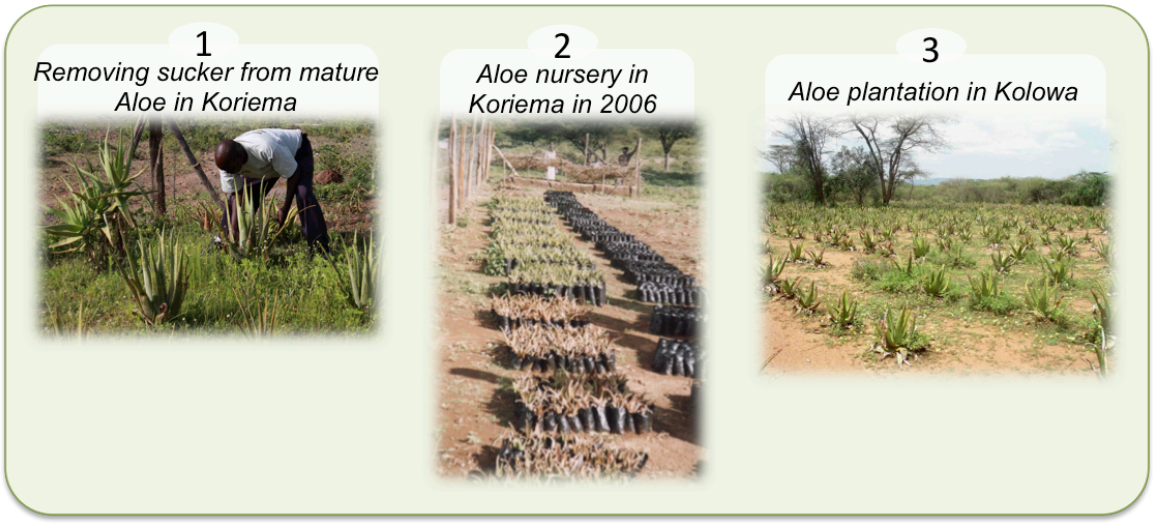

Figure 14: Different practices related to Aloe cultivation

A diversity of stakeholders cultivate Aloe in Baringo

AC is implemented by a diversity of stakeholders, including institutions (Schools, projects), smallholder groups (Self help groups, community based organization), and individual farmers. Institutions only represent 19% of the total number of Aloe growers, yet they detain the largest quantity of cultivated Aloe, with 50% of the total surface. The average size of their Aloe field is 4,6 acre. Most of institutions that cultivate Aloe are schools that have planted Aloe in the schoolyard. Smallholders groups cultivating Aloe make almost the same proportion than the institutions (15%), but only detain 13% of the cultivated surfaces. This is because they cultivate lower areas than schools (1,5 acre per group on average). Individual farmers for their part represent 65% of the Aloe growers. But with an average of 1 acre of Aloe per farmer, they own less surfaces than the institutions (37%).

Cross-analysis of stakeholder diversity and spatial disparity

Figure 15 (page 53) and **Table 6** (page 53) show that in addition to the stakeholder diversity, there is an important spatial disparity within Baringo in term of surfaces cultivated with Aloe, number of Aloe growers, and size of Aloe plots. Baringo and Baringo North Divisions are the places where the lowest scores of surfaces cultivated are found (respectively 17% and 13%). In the case of Baringo Division, it is surprising since it is the place where BABE project has been actively promoting AC from 2004. In fact, the number of stakeholders cultivating Aloe – mainly indivduals and institutions - is quite high (38% of the total Baringo Aloe growers) but they have small plots: less than 1 acre on average.

By contrast, the biggest Aloe surfaces cultivated are in Koibatek Divisions and East Pokot Divisions (respectively 38% and 31% of the total Aloe surface cultivated), although public intervention promoting AC only occurred promptly in 2007. In Koibatek Division, AC is only implemented by a very few number of institutions who present huge acreages: 10% of total Baringo Aloe growers with an average of 7 acres per stakeholder. In fact, it is the existence of 2 single huge farms that inflates the figures for Koibatek. The biggest of them was already there before *BABE Project* starts, and Aloe were recently removed from it. Otherwise, it is visible that smallholders globally do not cultivate Aloe in this area. It is the opposite situation than the one found in East Pokot Division, which has the highest score of stakeholders involved in AC: 42% of the total Aloe growers cultivating around 2 acres. In this area, AC is mainly implemented by individuals, and at a fewer extent by institutions. A deeper analyse of spatial/stakeholder disparities (See table in **Appendix 7**) shows that in East Pokot, the hot spot of smallholders AC is a place called Lake Baringo or Loruk, while few institutions are cultivating Aloe in Kolowa.

The qualitative data collected during the CCA phase have confirms the trends observed above, and suggest that new dynamics of AC have appeared since 2008. GGD and SSI have also shown that AC was timidly adopted in the BABE project intervention areas (Koriema, Kimalel, and Sabor in Baringo Division), and that a good part of the Aloe growers there was in fact constituted of institutions and smallholder groups. They have also confirmed that the places where AC was the most represented were the one where public intervention was limited to few trainings in 2007, while Aloe Management Units were created. It is especially true for a place called Loruk, which is located in East Pokot Division. Surveys in Kolowa have shown that a new dynamic of smallholder AC had occurred after 2008 (the year for which the data above was available). In Baringo Division, further dynamic of AC have also occurred after 2008.

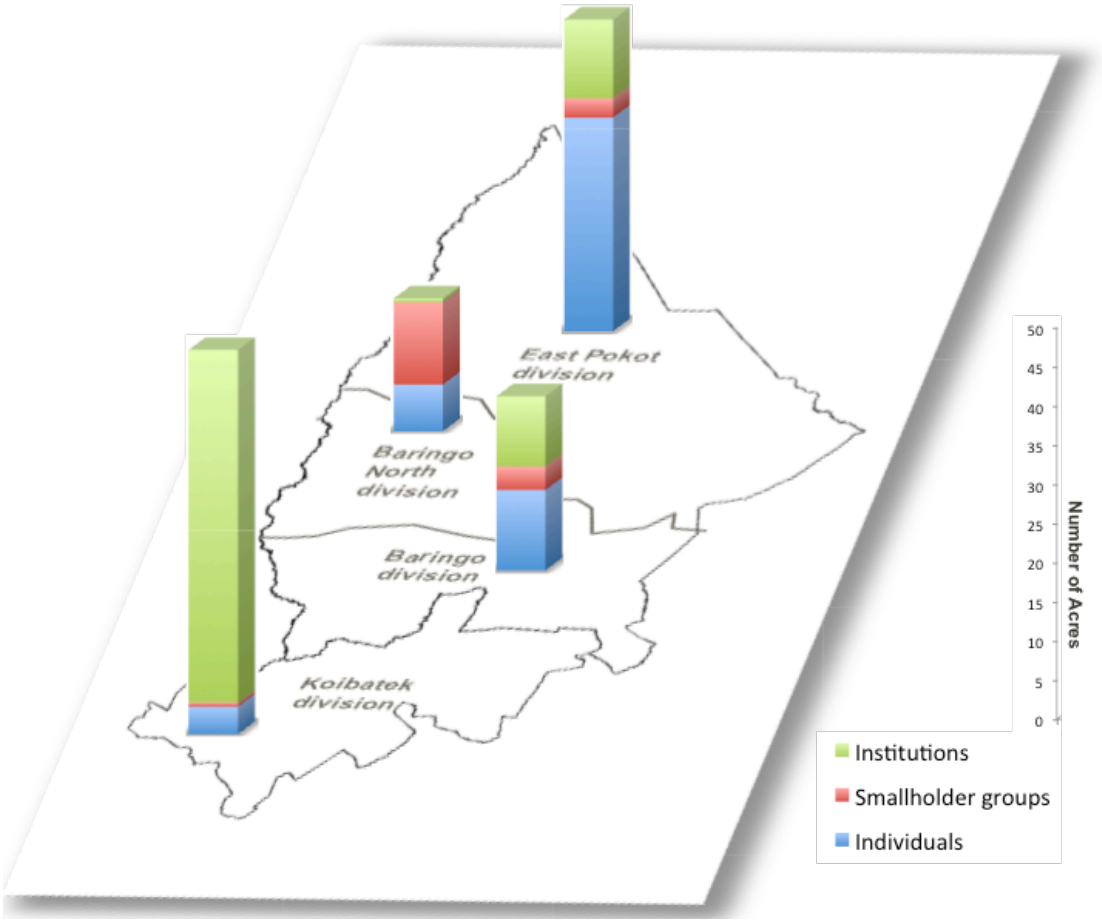

Figure 15: AC statistics per geographical zone and stakeholder type (Source: BABE, 2008)

Table 6: Number of stakeholders and surfaces they cultivate depending on stakeholder types and administrative Division

	Individuals		Smallholders groups		Institutions		TOTAL		Percentage	
Location	Number	Surface	Number	Surface	Number	Surface	Number	Surface	Number	Surface
Baringo Division	13	10,3	6	3	8	9	27	22,3	38%	17%
Baringo North Division	4	5,95	3	10,5	1	0,5	8	16,95	11%	13%
East Pokot Division	26	27,25	1	2,5	3	10	30	39,75	42%	31%
Koibatek Division	4	3,5	1	0,5	2	45	7	49	10%	38%
Total	47	47	11	16,5	14	64,5	72	128	100%	100%
Percentage	65%	37%	15%	13%	19%	50%	100%	100%		

In Baringo Aloe is mainly grown in the perspective of selling sap to BABE LTD, a community-owned enterprise based in Koriema (Baringo County) whose objective is to address the issue of sustainable utilization of commercial Aloes in the Kerio Valley Landscape, encompassing the Counties of Baringo, West Pokot, Laikipia, Turkana, and Samburu. BABE LTD is owned by community members represented by KOKISA

Cooperative, although its overall activity relies on a partnership with a private enterprise (Land Mawe LTD), and GoK agencies (represented by KEFRI and KWS). The Bio-enterprise has been created in 2010 as a result of a series of public interventions between 2004 and 2010, the first and most important of which being a EU-funded project called *BABE Development Project*. It has first been encouraging smallholders to plant Aloe from 2005, and it has been buying Aloe sap to smallholders from 2009 through local entities called Aloe Management Units according to a certification scheme (See section 5.2.9 page 71 for more details)

Importance of Aloe cultivation in livelihood systems

Although AC does not yet lead to income generation in most places (as Aloe has not been harvested), it nonetheless represents a potential value while at the same time providing services to the other components of agro pastoral and pastoral systems. In Baringo, Baringo North, and Koibatek Division, AC has stopped generating income in 2011 due to a standstill of BABE LTD (that was representing the only commercial outlet for Aloe sap). In some areas of East Pokot such as Loruk, AC has continued to generate income until recently, due to the presence of boilers (but they left this area in 2011). In Kolowa, the cultivated Aloe have not yet been harvested as the crops are still young (Aloe can usually only be harvested 3 to 5 years after plantation), and for the time being, smallholders prefer to keep their cultivated Aloe untouched and continue exploit the wild one.

Despite this situation, most smallholders keep their already established Aloe plantations for they hope that BABE LTD will be revived one day. They also keep it for the plant prevents soil erosion, retains water into soil, and facilitate grass establishment. This makes AC compatible with extensive livestock rearing systems, and with terrace farming. In addition, when intercropped with self-subsistence crops such as maize and beans, millet, and sorghum, Aloe roots act as a repellent for ants and termites that use to eat stems and roots of maize. Lastly, Aloe constitutes good bee forage in a place where beekeeping and roadside sale are one of the main livelihood sources.

5.1.3. The making of Aloe-based products

Overview of the making of Aloe based-products

In Baringo, the making of Aloe based-products (MAP) consists in the making and selling of diverse cosmetic products, ranging from soap to lotion and hair food, using the sap of *Aloe secundiflora* and *Aloe turkanensis* so as to enrich the formulation and brand the product as "Aloe product" or "Aloe vera" product (**Figure 16,** page 55**, parts 1 and 2**). The MAP only occurs in the area of Koriema, Kimalel, and Sabor, in Baringo Division. This activity has started in the late 2000s-early 2010, and is today implemented by BABE LTD, as well as 2 smallholders groups and few individual herbalists (**Figure 16, part 3**) in the perspective of supplying the domestic market for cosmetic products. One of the so-called smallholders groups is a 15-member woman Self-Help Group (SHG) called Kamasaiwa, and the other one is a 60-member Community Based Organization (CBO) called Sabkor. For the smallholder group members and individuals, MAP only represents a complementary source of income, since this activity remains at a small scale.

Figure 16: Practices and products linked with the MAP

Practices linked with the making of Aloe-based Products

MAP occurs in a diversity of ways in Baringo. In the case of BABE LTD, MAP is limited to the making of soap. Agents involved in this activity begin by buying, producing in farm, or collecting in the wild small quantities of Aloe sap, and fabricate various Aloe based products from it. The quantity of sap incorporated in these products is very low, so that the Aloe sap only represents 0,2% of the total production cost (see **Table 7,** and **Appendix 8** for details of calculation). In the case of smallholders groups, 5-10 group members are used to gather every 3 weeks to every 3 months, and produce Aloe-based products according to customers' orders. The main agents making orders are general retailers and wholesalers. They are used to produce more than the quantity required to satisfy one order (generally less than 100 pieces of cosmetic products per order), so that they can sell the rest directly to consumers when there is no order. Kamasaiwa SHG produces soap and body lotion while Sabkor CBO produces body lotion, and hair food. In the case of individual herbalists, the MAP is limited to soap produced at the kitchen scale. The Aloe-based products are fabricated in bulk in basins where are mixed all the ingredients as well as 50 mL of *Aloe secundiflora* or *Aloe turkanensis* sap. The most time-consuming activity is the labelling that is gradually the few days after the production. For its part, BABE LTD outsourced the fabrication of 5000 soaps to an external firm. BABE LTD did it only one time, since the soaps have not been yet sold today. The recipe was given by KEFRI to BABE LTD.

Table 7: Sources of spending, and percentage of total production costs (soap).

Source of expense	Percentage of total production cost
Palm oil	54
Packaging	24
Lye	7,2
Salary	6,2
Transport	6,0
Aloe sap	0,2
Other	2,4
Total	100

MAP is linked with the domestic market of herbal products

MAP in Baringo is linked with a vibrant domestic market of "herbal" products, whose lead products are Aloe-based products. On this market, the Baringo Aloe products are in competition with imported Aloe products, as well as with Aloe-based cosmetic products coming from other parts of Kenya (**Table 8,** page 57). The latter are fabricated by "soap making enterprises" found in Nakuru, Nairobi, Naivasha, Nyahuru and other Kenyan towns. Other Aloe-based products produced in Kenya are homeopathic remedies prepared by "herbalists entrepreneurs" also located in towns. These products are not in competition with

Baringo Aloe cosmetic products. Both herbalists entrepreneurs and soap making enterprises buy Aloe sap to middlemen in rural areas or traders in Nairobi (these traders are probably involved in the export supply chain of gum, and sell Aloe sap as a secondary activity), and fabricate Aloe based products from it.

Confusion between the various Aloe species on the market

On the domestic market, there is a general confusion between the various Aloe species, leading actors to brand their product in an inappropriate way (**Table 8,** page 57). Indeed, most part of the herbal products sold on the market are branded as containing *Aloe vera* although most of the Aloe-based products produced by Kenyan soap making enterprises or by herbalists entrepreneurs are in fact containing the sap coming from indigenous Aloe species such as *Aloe secundiflora* and *Aloe turkanensis*. The confusion occurs at 2 levels. On the one hand, most consumers and actors involved in the Aloe supply chain are not aware of the diversity of species included in the genus Aloe. For them, all what look like Aloe is thus *Aloe vera*. On the other hand, some actors, especially herbalists, can recognize various species of Aloe, and sometime know their latin names. But most of them continue branding the products as *Aloe vera*, for they think the second part of the latin name is coming after Aloe vera (e.g. *Aloe vera secundiflora*). This confusion is maintained by the non-existence of Kenya Bureau of Standards (KEBS) definition of Aloe sap, Aloe gum, and homeopathic remedies.

Place of the Aloe-based product making in the livelihood

In Baringo, MAP is implemented at the handcraft scale, and it only represents a complementary source of income for the involved stakeholders. The Aloe-based products are mostly sold to individuals within the community and anywhere else since group members bring with them their products when going outside for any purpose (meeting, market). Such opportunistic selling strategy is explained by the fact that the selling of Aloe-based products is far from being the only income source for the group members. BABE LTD soaps are also sold at the occasion of events such as agricultural shows, since KEFRI allow the bio-enterprise to use a part of its booth. Sabkor CBO and Kamasaiwa SHG products are also sold in a grocery in Koriema.

Conclusion of section 5.1

WAE, AC and MAP represent 3 successive and increasingly elaborated forms of economical activation of the Aloe resource involving each a certain number of specific practices, and that have respectively appeared in Baringo County in 1984, 2004, and 2008. However, the transformation of the Kenyan indigenous Aloe species into an economical resource is not completed. Indeed, WAE linked with the demand of non-official Aloe traders is widely spread in East Pokot Division, where it support livelihoods of number of pastoral household. But AC occurs in all Baringo County, but it is not a common practice. Moreover, stakeholders involved in AC do not get income from it, since BABE LTD (The lonely buyer for Aloe sap) stepped down in 2011. They nevertheless get indirect benefit from AC, since Aloes interact positively with other components of agro pastoral/pastoral systems. For its part, MAP is only implemented at the handcraft scale by 2 smallholder groups, few individual herbalists, and by BABE LTD (who has outsourced the production) in relation to the domestic market. MAP nevertheless constitutes a complementary livelihood source for smallholders. WAE, AC and MAP can thus be seen as 3 innovations, in that they are new practices that were adopted by Baringo stakeholders.

Table 8: Baringo Aloe products and other products found in the Kenyan domestic market of herbal products.

	Baringo Aloe products			**Kenyan Aloe products**		**Imported Aloe products**
Kind of producers	Kamasaiwa SHG	Sabkor CBO	BABE LTD	Soap making enterprises	Herbalists enterpreneurs	International firms
Example of products	Soap 	Body lotion, hair food 	Soap 	Soap, body lotion, body cream 	Polyvalent drug 	Soap 
Price (KsH)	75	50 (body lotion)	50	50 (soap)	100	50
Announced Aloe Content	*Aloe vera*	*Aloe*	*Aloe secundiflora* and *Aloe turkanensis*	*Aloe socotina*	*Aloe vera*	*Aloe vera*
Effective Aloe Content	*Aloe secundiflora*	*Aloe secundiflora*	*Aloe secundiflora* and *Aloe turkanensis*	Kenyan indigenous Aloe sap	Kenyan indigenous Aloe sap	Imported *Aloe vera* gel
Distribution channel	Groceries, informal channel	Groceries, informal channel, retailers of herbal products	Informal, agricultural shows	Groceries, retailers of herbal products	Retailers of herbal products	Supermarkets, groceries, Retailers of herbal products

5.2. History of the innovation process

In the precedent section, we made a photographic analysis of the present situation that conducted us to show that 3 main innovations had contributed to activate the Aloe resource, and to analyse to what extent and in which form stakeholders had adopted them. In this section we use an historical perspective to draw the process that has conducted to this present situation: the innovation process.

5.2.1. 1984: Beginning of wild Aloe exploitation in Baringo

The wild Aloe exploitation spread in Baringo followed the presence of buyers

Although it had begun in the 1950s in other parts of Kenya (Wabuyele & Kyalo, 2008), WAE only appeared in Baringo County in 1984, when traders established in the North of East Pokot Division (Tangulbei, Mukutani). From that moment, WAE spread in Baringo County, under the influence of Aloe sap traders. Traders trained Baringo smallholders on the various techniques linked with WAE, established sap processing stations, and started buying Aloe gum to supply the growing international market of Aloe-based cosmetic and pharmaceutic products. WAE then spread in Baringo, as traders were establishing new sap-processing stations. In 1985, WAE appeared in the south of East Pokot Division (Loruk), and finally reached Kolowa (East Pokot Division) and Radat (Koibatek Division) in the 2000s (**Figure 17**).

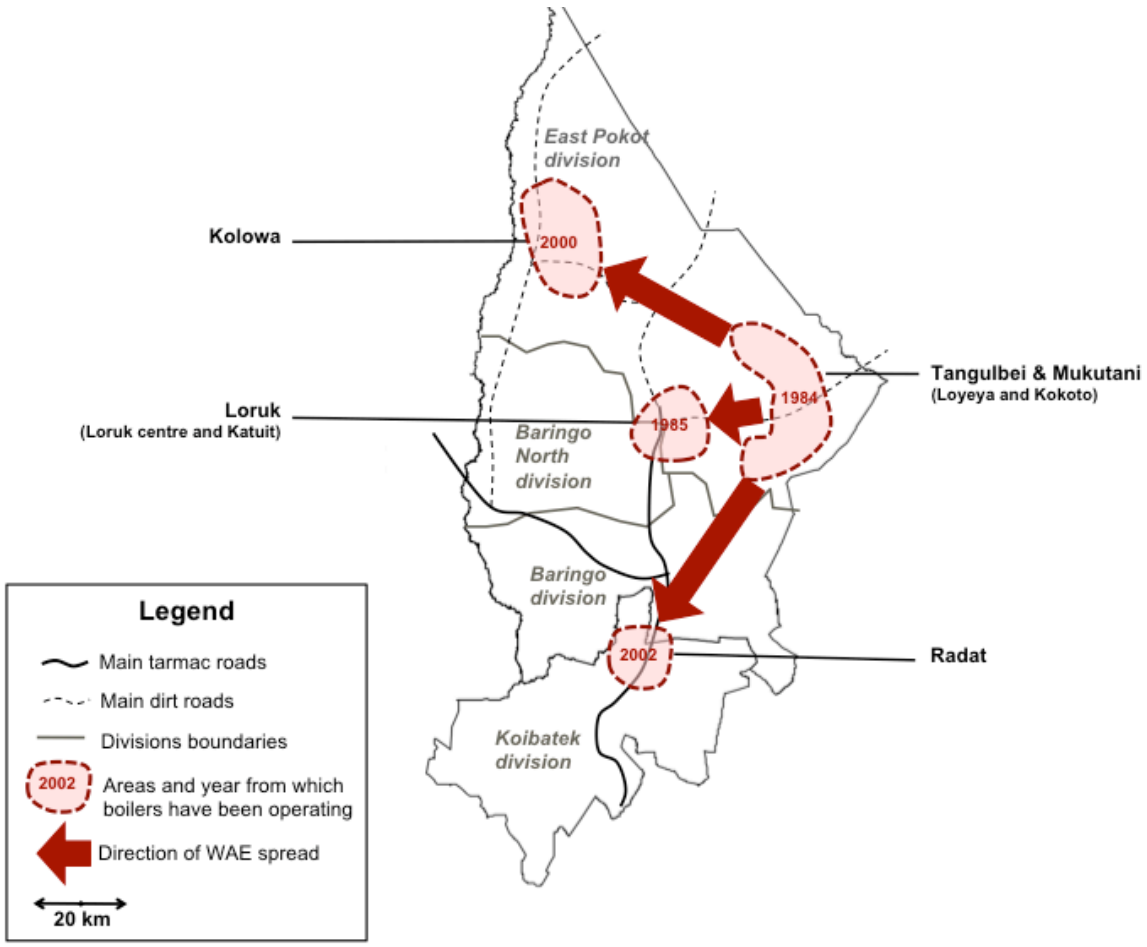

Figure 17: Spread of WAE in Baringo over time.

Irregularity of wild Aloe exploitation and nomadic nature of non-official supply chain

GGD in Radat and interviews in Loruk suggested that, WAE has been irregular in Baringo and in some places stopped altogether due to the unstable presence of buyers. In Radat and Loruk, WAE adoption was always determined by the presence of sap processing stations which however appear to be unstable components of the local landscape. In Radat, boilers established stations in the early 2000s, and left the place between 2004 and 2006, came back episodically before finally left for good in 2009. The same situation appeared in Loruk, where boilers' activity was marked by several years of absence, and stopped again 2011. Thus, in these 2 places, WAE has stopped and started again several times depending on whether sap buyers were present or not.

Interviews with traders and boilers suggested that the nomadic behaviour of non-official trade agents is probably driven by downstream market opportunities, availability of wild Aloe, and quality of sap. Firstly, the transactional nature of the commercial relationships between traders and exporters leads each gum order to be negotiated in advance, and not necessarily renewed. As a result, if the gum accumulated by one trader's boilers network is sufficient to fulfil the order while no other order has been given so far, boilers have to stop operating. Secondly, sap-processing activities have to stop sometime due to supplying challenge linked with overharvest of wild Aloe population. This is what has happened in Loruk. Also, spatial disparities of sap quality (problems related to rates of dilution, which themselves depend on the rainfall and the Aloe species) can lead traders to abandon areas with the lowest sap quality in case market demand drops. This is what has happened in Radat, where a trader who was operating since the early 2000s decided to abandon his activities in 2009.

5.2.2. Wild Aloe exploitation raised social and environmental questions

Wild Aloe exploitation raised environmental questions

Soon after its apparition in Kenyan dry lands, WAE had caused environmental concern among whom? by generating overharvest of firewood and wild Aloe. These concern are still the same today, and hence we can rely both on the CCA results and on the existing literature to analyze to what extent WAE is posing an environmental problem.

Firstly, the boiling process requires massive use of firewood: at the rhythm of 2 to 4 drums of 200 L boiled per day, during 6 to 8 hours for each, the consumption of firewood is indeed high. This has a negative impact on sensitive dry lands for which firewood is in short supply (Kihara, 2003). A boiler we interviewed confirmed this, by stating that the main limiting factor to the expansion of his activity was availability of firewood.

Although it has not been clearly demonstrated, it is widely agreed that uncontrolled commercial harvest through non-official supply chain tends to destroy wild Aloe population. However, the available secondary data cannot demonstrate clearly the link between commercial harvest and wild Aloe population health. A CITES consultancy recognized that the impact of the trade on the conservation status of Aloe species was unclear (Oldfield, 2003). According to Wabuyele & Kyalo (2008), the Aloe trade chain in Kenya tries to remain invisible as it operates on the fringe of the legal system, and very little information is available to estimate the volumes involved in this non-official trade.

Nevertheless, several punctual observations and indications all converge towards the same conclusion: uncontrolled commercial harvest is likely to destroy wild Aloe populations. For once, Wabuyele & Kyalo (2008) stated that the upsurge in demand for aloe sap in the advent of commercial production has meant that increasingly younger plants were harvested to obtain as much sap as possible. They concluded that unregulated exploitation was a major threat for

species harvested for aloe bitter gum production, and further added species that have a restricted distribution and narrow ecological range (e.g. *Aloe turkanensis*) are the most threatened. Our own, interviews in Loruk and Kolowa indirectly indicated a link between uncontrolled commercial harvest and destruction of wild Aloe population: in Loruk and Kolowa, two places where smallholders were highly dependent on Aloe sap selling for their livelihood, the fear of seeing wild Aloe disappear led smallholders to start cultivating Aloe in the 2000s, a fear probably triggered by observations of wild Aloe depletion. Bjøra et al., (in prep., cited by Wabuyele & Kyalo, 2008) made a similar observation. According to them, people had to walk increasingly longer distances to harvest aloes (and other plants) for routine use. This has prompted the establishment of herbal gardens closer to homesteads to ensure steady and easy access to these resources.

By pooling data about wild Aloe population given by Mukonyi et al. (2008b) with our own estimation of Aloe trade volume in Baringo (see **Appendix 12** for the source of data used for this estimation), we estimated that the number of wild Aloe plants harvested each year was of the same order of magnitude than the total number of Aloe available in the wild. Each Aloe sap processor produces annually 9000-15000 kg of gum, this translates back in approximately 27000 – 45500 L of sap harvested (Conversion coefficient of 0,4 kg/L). Taken together, the 8 sap processing stations from Baringo would be processing 216 000 – 364 000 L of sap annually. Assuming that all the corresponding sap was harvested from the wild, and that a single mature Aloe plant produces 80-100 mL of sap (Kihara et al., 2003), this would mean that between 2 160 000 and 4 550 000 Aloe plants are harvested every year in Baringo, a figure higher than the total Aloe population estimated by Mukonyi et al. (2008b) (1 860 000 Aloe plants in the whole Baringo County), but of the same order of magnitude. The difference (between number of plants available and number of plants harvested) could be due to the fact that Mukonyi et al. (2008b) did not survey East Pokot Division, where *Aloe turkanensis* is widely spread.

Wild Aloe exploitation raised social questions

In addition to environmental issues, most interviews and GGD revealed that WAE was perceived to be unfair to smallholders, due to defavorable market structure. As in the precedent paragraph, we rely on the result of the CCA and existing literature to analyze to what extent WAE is posing a social problem.

Firstly, the oligopoly position of traders leads them to fix prices unfavourable to smallholders, who always remain price-takers. To better take stock of the alleged unfairness of WAE, we estimated the annual income generated by wild Aloe exploitation (see Appendix 13 for the source of data used for this calculation). With a buying price of 28 KsH/L, and a working day allowing the harvest of 2-5L of Aloe sap, the resulting sap sale brings 56 to 140 KsH/day to a household. Over one year, and assuming that one person per household harvests Aloe during 120 to 150 days, this activity would thus bring anywhere between 6720 and 21000 KsH. The actual income from Aloe sap sale is probably somewhere between these 2 extremes. By comparison, a Kenyan unskilled employee working all year long will earns 51096 KsH, which is more than 2 times the maximum annual income that a woman can hope to get from WAE. But in the context of poverty, scarcity of livelihood sources, and low market access that characterizes pastoral areas of Northern Baringo, the opportunity cost of exploiting wild Aloe is low, and thus justifies the time investment into such an activity.

Secondly, the common occurrence (perhaps present in half of the sap transactions) of barter trade (exchanging sap against food), rather than of cash payments prevents many women from meeting the diversified needs of their household. Boilers who engage in barter trade do so because they don't have enough working capital to buy sap during 1 buying cycle (3 months).

Instead, they make arrangements with local food retailers so that Aloe suppliers may go to their shops and take "for free" a certain amount of staple food (flower, sugar). At the conclusion of a buying cycle, when gum has actually been sold to traders, boilers refund the retailers (with an additional interest rate). This coordination between retailers and traders allows boilers to increase the volume of their sap business despite limited capital. But barter trade is criticized by most smallholders surveyed, for the food given to them instead of money does not always suit their needs. For example, very common spent in pastoral areas are drugs for livestock.

Last but not least, the nomadic behaviour of the boilers is an serious issue. When boilers reach an area, they not only buy sap to women. They also set a dependency system that strongly influences women' livelihood strategies within the household, and thus the whole pastoral household organization. Kihara et al. (2003) found that in the 5 districts (Baringo included), 46% of households relied on Aloe for their livelihood. Being suppressed by the unpredictable departure of boilers, the alternative livelihood source represented by Aloe turns to a direct threat to pastoral households. This is especially true when women and children are left behind while men drive away livestock for pasture and water during dry season.

5.2.3. Wild Aloe exploitation led to an increasing attention of Aloe

Wild Aloe exploitation in Baringo lead to a presidential ban

In 1986, the social and environmental issues raised by WAE prompted a presidential decree banning harvesting of Aloes from the wild, and instead encouraging its cultivation (Wabuyele & Kyalo, 2008). In November 1986, although no objective data was available to make a formal conservation assessment, reports of indiscriminate harvesting of the commercial species of Aloe led President Moi to declare Aloes to be protected species and to decree that Aloes could be harvested only from plantations (Nyamora, 1986). Presumably, the decision of president Moi to ban commercial harvest of wild Aloe was envisaged as a temporary solution so as to avoid Kenya to breach international law (Kenya became co-signatory of CITES in 1973). A KWS informant interviewed also advanced that there is a link between president Moi's decision to ban commercial harvest of wild Aloe, and the starting of commercial harvest in Baringo in the early 80s (Baringo is the place of origin of president Moi). In any case, the presidential decree was not however translated into legal instrument and was largely ignored (Newton, 2004; Wabuyele & Kyalo, 2008).

Presidential ban and international focus on dry lands raise scientific attention on Aloe

Although the presidential ban had no significant effect on the grassroots, it contributed to raise the attention of the Kenyan scientific community on Aloe issues. The presidential ban, that was issued without any consultation, was perceived as being out of step with the issues at stakes in Aloe trade (Owuor, 2006). Firstly, although it was recognized that uncontrolled commercial harvest could destroy wild Aloe population with impact on overall environment quality, several experts emphasized that Aloe commercial harvest was a significant cash source for the poorest in Kenyan ASAL, and that the implementation of such interdiction of Aloe exploitation would threaten their livelihood. Secondly, from a more macro economical point of view, the ban on trade of Aloe products was seen as a missed opportunity for the national economy since commercial Aloe species are widely spread in Kenyan ASAL, and the world demand for such product is increasing. Finally, the ban that had not been translated into law didn't contribute to slow down the progress of commercial harvest of wild Aloe and related environmental threat (Newton, 1991, 2004).

In the early 2000s, Aloe research was boosted as a consequence of the 1992 Rio summit

This increasing attention on Aloe was also fed by a broader concern on ASAL populations and ecosystems. In 1992, the plight of drylands came into the forefront of the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. In Kenya, it led to a regional conference in 1993, and to the emergence of the Regional Programme on Sustainable Use of Dryland Biodiversity (RPSUD). Funded by the Swedish International Development Cooperation Agency and the Swedish Agency for Research Cooperation with Developing Countries (SIDA/SAREC), RPSUD was a program of bioprospecting including Aloe species, and dedicated to promote sustainable management of dryland biodiversity for development (Malo, Unknown date). By enabling a number of East African scientists to conduct research on sustainable management of natural resources in dry lands, the RPSUD had a string influence on further research and public interventions in the field of Aloe (see next paragraph).

Kenyan institutions develop research program on indigenous Aloe in the 1990s

Encouraged by an inappropriate legal framework and by the international focus on dry lands (see next paragraph), a number of Kenyan research institutions developed specific and non-specific research programs on Kenyan Aloe, leading to a significant production of knowledge about Kenyan Aloe commercial species.

The first bundle of publications on Kenyan Aloe came from the Department of Plant & Microbial Sciences of Kenyatta University. It highlighted the suitability of Aloe for cultivation (Newton, 1987) and the problematic link between human exploitation and conservation of Aloe in Kenya (Newton, 1994). Newton also openly criticized the presidential decree, qualifying it as a "harmful conservation law" (Newton, 1991). According to Newton, the presidential ban has had a perverse effect on the environment, since in at least one area where the ban was observed, it led to more harm than if the law had been ignored: rather than defoliating plants in natural populations and allowing their recovery, farmers actually dug up plants of *Aloe secundiflora* and unsuccessfully re-planted them in "plantations".

From the mid-1993 to 2000, the genus Aloe was part of a National Museum of Kenya (NMK) conservation program financed by Oversee Development Assistance. The main objective of this program was to generate information about Aloe distribution, conservation status, and to participate in Aloe conservation ex situ through a succulent plant garden (largely dominated by Aloe species). The program led to several publications on ecology and conservation of dry land species (among which Aloe species were), such as a NMK book on trees, shrubs, and lianas (Beentje, 1994), and a IUCN publication on status and conservation of succulent species (Newton, 1998).

In 1997, a KEFRI research program on non-wood products was undertaken, and led KEFRI together with NMK to conduct research on AC and WAE. One of the subsequent reports was an appraisal of the Aloe resources, utilization, and development status in Kenya (Mukonyi et al., 2001). This report was used as a basis to design and conduct another research on Aloe in the framework of the RPSUD. At the occasion of this appraisal, researchers found several cases of AC in Baringo County (*Aloe turkanensis* in Loruk, *Aloe secundiflora* in Mogotio and Loboi). This contributed to draw attention of Aloe specialists on Baringo.

From 2002 to 2004, a research team including KEFRI and NMK researchers benefited from a RPSUD research grants, and step up research efforts and awareness on Aloe. The program also led to an Aloe bio prospecting study (Mukonyi, 2003) as well as on Indigenous Traditional knowledge (ITK). The Aloe bio prospecting study demonstrated the importance of

Aloes in drylands and described the structure of the fast-growing trade in aloes and aloe-derived gums in Kenya (Malo, Unknown date). The bio-prospecting study was used as an input for a 2003 CITES consultancy (see last part of this section), that stimulated the formation of the Kenya Aloe working Group (KAWG) (see 5.2.4) (Malo, Unknown date). The study was also used as a basis for the design of further Aloe resource mapping and inventory (see 5.2.9) (Mukonyi et al., 2008a; 2008b). According to a KWS representative interviewed, the study on ITK showed that Baringo had the highest level of ITK in the country. Those RPSUD assessments, coupled with the previous works on non-wood products, created a strong interest by researchers on the specific plight of Baringo as far as Aloe was concerned. In addition to being a place where *Aloe secundiflora* and *Aloe turkanensis* were well spread and illegally exploited, Baringo was also a place where stakeholders innovativeness based on strong ITK had started responding to the challenge posed by commercial overharvest. This determined the choice of Baringo in 2004, for the implementation of an Aloe-based project (see 5.2.5 page 64).

In 2002, Laikipia Widlife Forum paid for a consultancy to the Natural Resources Management and Development Agency that produced an exhaustive description of the non-official Aloe supply chain (Kihara, 2003). The fieldwork was implemented in Laikipia, Samburu, and Baringo districts Turkana, and led to precise description of the chain of actors involved in Aloe supply chain, and their respective function.

A CITES consultancy encourages Kenyan government to regulate Aloe trade

From the 90s, CITES implemented research aimed at monitoring the Kenyan situation in term of conservation of endangered species, and at supporting the efforts of Kenyan government in the conservation of commercial and non-commercial species. In 2003, a CITES consultant was sent in Kenya to assess the situation of Aloe. The subsequent report formulated recommendations to GoK (Oldfield, 2003): (i) Legislative provisions and administrative procedures should be developed in Kenya as a matter of urgency to regulate the export of Aloe extracts; (ii) Based on status assessments for *Aloe scabrifolia*, *Aloe secundiflora* and *Aloe turkanensis* quotas should be determined for sustainable levels of harvesting where appropriate and as a basis for future monitoring; (iii) Periodic field monitoring should be undertaken to ensure that other Aloe spp. in the harvesting regions are not impacted by collecting for trade.

5.2.4. 2004: A pivotal time for the Kenyan Aloe sector

The challenges of Aloe sub-sector formulated through a national seminar

In 2004, the challenges of the Aloe sub-sector were for the first time clearly formulated and brought to light at the occasion of a National seminar (Mathenge, 2004). As a consequence of the raising attention of Aloe issues in Kenya and of the worsening of Aloe overexploitation, Netherland Development Organization (SNV) and Laikipia Wildlife Forum (LWF) organized in January 2004 a seminar with a variety of stakeholders to discuss the issue of Aloe exploitation and trade. The event occurred in Nanyuki (Laikipia County), thanks to SNV funding. Participants included representatives of CITES, NGOs (SNV), conservation organization (LWF), public R&D actors (KEFRI, KWS, NMK), as well as communities involved in WAE or AC, traders, and exporters. During this seminar, the ideas that had progressively emerged during the past 20 years were for the first time clearly formulated and brought to light: Aloe sub-sector is an opportunity for the Kenyan economy, and in particular

for the ASAL, but absence of legislation relating to Aloe exploitation and trade is hindering the capacity of Kenya to seize this opportunity, and is an opened door to illegal trade.

GoK embarked on a process to fill the legal gap

The seminar had serious repercussions since it was followed by the creation of a task force called Kenya Aloe Working Group (KAWG), designed to sustain the consultative process in the perspective of protecting Aloe in the wild, promoting AC, and establishing of a legal framework. Most of KAWG activities were funded by SNV. In the framework of the KAWG, KWS was mandated by GoK to lead the consultative process with objective to steer development of a policy and long-term strategy to guide conservation and management of Aloes (Lubia et al., 2008). KWS was in fact the GoK body already in charge of handling CITES regulations for other endangered species. The seminar had also mediatic repercussions since it was covered by the National press (Mathenge, 2004).

The GoK initiative triggered Aloe-based projects

Made public, the GoK initiative to fill the legal gap on Aloe was perceived as an open door to any initiatives relating to Aloe. Thus, in the same year (2004) 2 Aloe-based projects appeared in the landscape. The most ambitious of them was implemented in Baringo (the other one was implemented by LWF in Laikipia district), at the very spot where WAE emergence had triggered the presidential ban on Aloe exploitation, and where researchers had identified innovative actors cultivating Aloe.

5.2.5. Emergence of the BABE Development project

The CDTF-BCP line of funding compatible with an Aloe-based project

In 2004, a KEFRI researcher called Kavaka Mukonyi that had been involved in past Aloe bio prospecting study decided to seize the opportunity of a CDTF-BCP call for proposal to apply for an grant to implement an Aloe-based project. The Community Development Trust Fund (CDTF) is a social development fund that was established in 1996 as a joint initiative of the European Union and the Kenya Government. The Biodiversity Conservation Program (BCP) of CDTF (2000-2006) was a flexible and demand-driven funding mechanism that provided financial and technical assistance to local initiatives to enhance sustainable biodiversity conservation. So the broad objective of the BCP line of funding was compatible with an Aloe cultivation project, since it could contribute to reduce pressure on wild Aloe.

Choice of Baringo for an Aloe-based project

Based on the results of previous assessments (Assessment on wild Aloe Resource and Assessment on ITK), Baringo was identified as a good place for such project to be implemented, for a range of reasons. Firstly, the 2003 CITES consultancy had emphasized the fact that Baringo populations of *Aloe secundiflora* and *Aloe turkanensis* were among the most important in the country, and they were already exploited (and so potentially endangered) through non-official channels. The second factor that has determined the choice of Baringo for a public intervention was the presence of isolated cases of Aloe cultivation in Loruk, Loboi, and Mogotio (see 6.1.3). Last but not least, the geographical situation of Baringo - at the gate of Northern Kenyan dry lands - appeared as particularly pertinent with respect to the expected scale of the project (all Northern-western Kenyan dry lands).

KEFRI mobilised a community in Baringo

Thus, KEFRI started looking for a Baringo community that could become project backer in Baringo, and that would be easily accessible to the Baringo KEFRI station (located in Marigat). After some research, a proactive chief ready to mobilize his community was identified in an agro pastoral areas of Southern Baringo called Koriema (Baringo Division). Also influenced by the good infrastructure level of the place (Access to tarmac road, electricity, water), the proximity to the KEFRI station, and the natural presence of Aloe in the wild, Koriema was finally chosen. Following KEFRI specifications, the Koriema chief mobilized successfully the communities of 3 locations (Koriema, Kimalel, and Sabor), who decided to form a project-backer Community Based organization (CBO) that was registered as KOKISA (KOriema, KImalel, SAbor) on the 3 June 2005 by the Department of Social Services, Ministry of Gender, Sport, Culture, and Social Services. Little time after its creation, KOKISA CBO came up with a draft proposal, that was used as a basis by KEFRI for the writing of a final proposal to CDTF-BCP.

Northern Baringo ASALs were left aside

For a number of reasons mentioned above, the place chosen to implement an Aloe-based project in Baringo was not located in the ASAL of Northern Baringo (where WAE was occurring), but in Koriema, Kimalel and Sabor locations, an agro pastoral area of Southern Baringo (**Figure 18**). As already mentioned, WAE was (and is still) concentrated in East Pokot (Northern part of Baringo County), where pastoral households were exploiting wild Aloe in a survival strategy while threatening ASAL ecosystems. But it was decided that the project would be implemented in an agro pastoral area of Southern Baringo where WAE was not occurring, and where livelihood sources were relatively diversified compared with the situation in East Pokot. As a consequence of this initial choice, from 2004, most efforts and inputs to promote AC and regulate WAE were concentrated in the restricted area of Koriema, Kimalel and Sabor (see 6.4 page 100) instead of in the places where the social and environmental issues linked with Aloe had been identified.

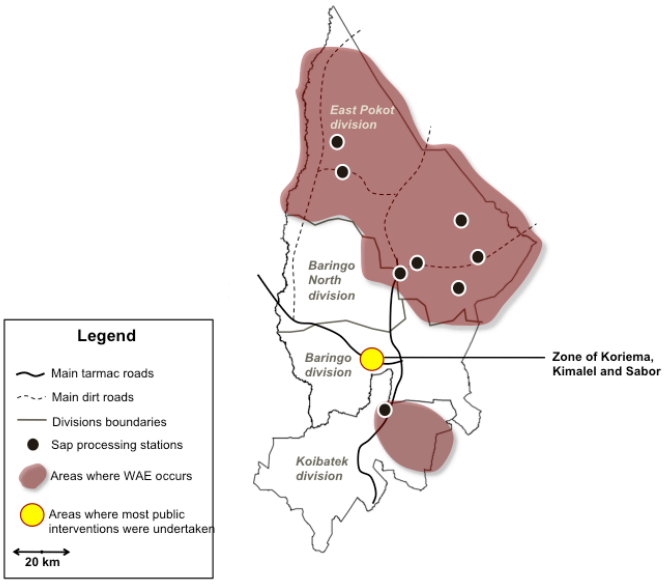

Figure 18: Baringo area of BABE Project and areas where wild Aloe exploitation occurs.

KEFRI mobilised a private investor

In parallel of community mobilization, KEFRI also started looking for a private investor that could generate a fair commercial outlet for Aloe derivates produced in the framework of a future project. Out of 8 enterprises that had contacted KEFRI to get information about the project, Land Mawe LTD - an enterprise specialized in the sale and delivery of maize grinder and motor vehicles - was the only one to accept the challenge. Interview of a Land Mawe LTD representative revealed that the manager of this enterprise was aware of the economical value of Aloe sap for he had been contacted by a Chinese entrepreneur in 2003, who was asking for huge quantities of Aloe gum. Thus, although Land Mawe LTD had never been

involved in such business, its manager contacted KEFRI that was on that time, by coincidence, looking for an entrepreneur to submit an offer to the CDTF-BCP bid. Given the amount of money (around 470 000 KsH) requested by KEFRI and the risk represented by a community owned enterprise, most potential investors had stepped down. According to the manager of Land Mawe LTD, by being regularly in contact with poor pastoralists communities in West Pokot in the framework of his business, he had been sensitized to their plight, and had unsuccessfully tried to provide assistance a couple of time. He finally decided to invest and assume the underlying risks for his main purpose was not profit but to provide a sustainable livelihood source for ASAL poor people through the selling of Aloe gum. By doing so, the manager of Land Mawe LTD contributed to the writing of the CTDF-BCP proposal.

Broad objective of the BABE Project

The *Baringo Aloe Bio Enterprise Development project* (or *BABE Project*) emerged on the paper with the broad objective of building up an Aloe-based bio-enterprise. More precisely, the goal of the project was to promote AC in the area of Koriema, Kimalel, and Sabor, and to set up the bases of a certified Aloe supply chain, which node would be a bio-enterprise owned by a multi-partnership (KOKISA, Land Mawe LTD, GoK), and able to process the sap bought not only in Baringo, but also in all Kerio Valley landscape. The latter includes Baringo, West Pokot, Laikipia, Samburu, and Turkana Counties, so hardly all North-western Kenyan dry lands. In the vision of the KEFRI civil servant that was from the beginning pushing the project, a successful Aloe-based project could operate as a flagship project opening the way to the sustainable exploitation of ASAL natural resource such as *Prunus Africana* or Amarula.

The shape that the *BABE Project* took was the contingent result of the meeting between the visions of a KEFRI civil servant, a social entrepreneur, and a pro-active community. The final proposal given to CDTF-BCP was the result of the combined contribution of KOKISA CBO (that had come up with the idea of building a factory), KEFRI (that had brought the scientific justifications to an Aloe based project), and Land Mawe LTD (that had worked on the technical and market feasibility of the project).

A project backed by a multi-partnership for a sustainable activity

The *BABE Project* was backed by an original institutional arrangement getting together a CBO (KOKISA), a private actor (Land Mawe LTD), and a public research-extension organizations (KEFRI and KWS), which expected interest was to ensure the sustainability of Aloe-based activities, by imitating past success stories such as the Honey case Africa and the Ikhala Company. Indeed, the underlying idea was to take advantage of the entrepreneurship and marketing skills of a private actor, of the expertise in Aloe management of research-extension actors, and the knowledge on the reality on the ground of a community based organization. It was also expected that the co-ownership would lead to a bio-enterprise piloted in a pro-poor and environmental friendly perspective. The hope was to imitate the *Honey Care Africa*'s tripartite model, that had successfully promoted commercial beekeeping activities in Kenya. The latter became well known since the project won an award from the small and medium enterprise department of World bank (World Bank, 2003). According to the KWS representative we interviewed during CCA, the *BABE project* also took its inspiration from the Ikhala Company in South Africa (Eastern Cape Business News, 2004), that deals with Aloe Ferox, and had developed a certified Aloe gum export mechanism as well as a range of Aloe-based products (Aloe and green leaves, Aloe honey, Aloe gum branded, processed products).

5.2.6. Implementation of the BABE project

The BABE Project was funded

The resulting CDTF application was successful, and the *BABE Project* was finally funded. The 11,7 millions KsH project was finally granted for a total duration of 13 months project (November 2004-December 2005), and co-funded by CDTF-BCP (78%), KEFRI (12%), KWS (5%), Land Mawe LTD (4%), and KOKISA CBO (1%) (DFA KEFRI-CDTF, 2004). With its objective of promoting AC and building up a bio-enterprise exporting Aloe derivates, the project soon crystallised the opportunity for Kenya to activate the underexploited Aloe resource, and to reduce poverty among marginalized populations living in the North-Western Kenyan ASAL. During the project implementation, SNV provided complementary funds (1,6 millions KsH) to train KOKISA Project Implementation Committee on internal management.

The BABE Project was implemented

The *BABE Project* was implemented from November 2004 to December 2005 in the area of Koriema, Kimalel and Sabor (Baringo Division). The intervention strategy consisted in encouraging AC in this area by providing adequate knowledge and input, as well as market incentives through the construction of an Aloe processing factory and the creation of an Aloe bio-enterprise. Thus, during one year, communities of Koriema, Kimalel, and Sabor were trained by KEFRI on the various practices linked with AC (Propagation techniques, Aloe nursery management, transplantation of seedlings, maintenance of Aloe crops, inter-cropping and terracing using Aloe, and harvest of Aloe). KEFRI also encouraged Aloe cultivation by providing access to cheap Aloe seedlings, by establishing demonstration plots in several schools (this explain why there is a lot of institutions involved in AC in Baringo Division, see 5.1.2), and by empowering 2 self help groups charged of managing Aloe nurseries. Beside that, KEFRI also trained communities on MAP.

Beyond this classical top-down technology transfer strategy, what has brought the *BABE Development project* is the promise of a future market for Aloe sap by constructing of an Aloe sap-processing factory to be managed by KOKISA CBO and Land Mawe LTD. Thus, a factory was built in Koriema (**Figure 19**), with main purpose of processing Aloe sap into gum so as to supply the global market. The factory initial plan was also including an exhibition room, a laboratory, and enough space to accommodate a processing line in case further funds could be mobilized.

Figure 19: Photo of the *BABE Project* factory.

A partnership relying on complementarity among its members

KOKISA, Land Mawe LTD, KEFRI and KWS, had complementary roles in the project implementation (DFA KEFRI-CDTF, 2004). While the KEFRI/KWS mandate was to provide technical expertise and monitoring to the communities and to sustain research on Aloe propagation techniques and value addition, the role of Land Mawe LTD was to set up the processing plant as a first step, and then to commercialise Aloe gum while ensuring equitable remuneration for all involved

stakeholders in the Aloe supply chain. For its part, KOKISA CBO role was to actively promote AC within the Koriema, Kimalel and Sabor communities and to ensure wild Aloe remained untouched.

There was initially an agreement between the project players, about the ownership of the future bio-enterprise. Although no written contract testified it, all parties accepted at the beginning that both KOKISA CBO and Land Mawe LTD would own the future enterprise, with respective shares of 60% and 40% (Draft MoU, 2007). This ration thus gave the biggest part of the enterprise to the community, in spite of the fact that Land Mawe LTD initial investment was higher than the one of KOKISA CBO. It was also agreed that Land Mawe LTD would gradually withdraw by selling its shares to KOKISA CBO after its initial investment would be recovered. As requested by CDTF-BCP, a Project Implementation Committee (PIC) comprising representative of all parties was coordinating the various project activities.

5.2.7. Delays, lack of funds, and conflicts hindered the BABE Development project

The *BABE Project* was affected by delays and unforeseen spent

The *BABE Project* implementation was delayed and unforeseen expenses were incurred due to administrative barriers. Although BABE project was funded and supported at the highest level by GoK organizations, the interest of an Aloe-based project in Koriema was not shared by all, and for unclear reasons, some elected officials of the Baringo County Council began by refusing that a factory be built in Koriema. Thus, what should have remained an administrative formality became a long and expensive struggle. Finally the pressure exerted by KEFRI and Land Mawe LTD led the Baringo County Council to allow the construction of the factory provided that a preliminary environmental Impact Assessment and a sensitization workshop (Keitany, 2005). This administrative battle and related expenses contributed to delay the project implementation, especially the construction of the factory, that was only finished and commissioned in 2006 (Owuor, 2006), around one year after the expected end of the project.

Lack of funds hindered the BABE Project

At the end of the *BABE project* in 2006, it appeared that more funds were needed to foster AC, complete the construction of the Aloe processing factory, and to start buying Aloe sap to farmers. The factory had been commissioned, but it was missing facilities such as electricity and water, and KOKISA understood that the dynamic of AC initiated by the project had to be supported for a longer period. In 2007, KEFRI urged the community organization to start looking for funds by itself. Between 2007 and 2009, KOKISA CBO has asked in vain for external support at least 7 times (**Table 9** page 69).

Conflicts appeared between project partners

All stakeholders involved in the BABE Project agree during CCA on the fact that from 2006 on, conflicts among and between the project partners emerged. A first conflict between KOKISA CBO and Land Mawe LTD started soon after the end of the *BABE Project*. The conflict was triggered by a controversy about the contribution of Land Mawe LTD to the construction of the factory, and was probably fed by an accusation made by some KOKISA CBO members that the enterprise artificially inflated its contribution, and left the factory under equipped (no water, no electricity).

Table 9: KOKISA CBO unsuccessful grant applications.

Date	To whom	How much	Purpose
15 February 2007	GoK	191365 KsH	Rehabilitation of Aloe nurseries
24 September 2007	Arid Land Resource Management Programme	4 578 800	Purchase 250 tones of sap
26 September 2007	Land Mawe LTD	Not precised	Start factory operations
1rst November 2007	KEFRI	Support	Gap analysis proposal
5 June 2008	Constituency Development Fund	5 565 000 KsH	BABE GAP analysis proposal to Constituency Development Fund
21 July 2008	Constituency Development Fund	1 645 000 KsH	Purchase sap, processing and export
8 September 2009	KEFRI	200 000 KsH	KEBS certification of the BABE Aloe-based products, training of BABE staff

Since the contribution made by Land Mawe LTD was not recorded, the conflict remained unsolved, and led to an increasing tension between the partners. This tension prevented them to agree on a Memorandum of Understanding, yet this was an essential step to formalize their future commercial relationship and their respective shares in the future bio enterprise. During the same period, another conflict occurred within KOKISA members. The conflict was generated by a controversy about the use of KOKISA assets (mainly about the use of a tractor that had been bought through the CDTF-BCP grant). This second controversy was also fed by the recent splitting of KOKISA into 2 entities in early 2006 - KOKISA CBO and KOKISA Cooperative, which had started looking for the future bio-enterprise ownership. – the split was made for the Koriema, Kimalel, and Sabor communities to get the administrative status allowing them to develop an income generating activity.

These conflicts led community members to loose confidence in the KOKISA CBO, forcing its PIC to step down and to be replaced in 2007. Another consequence was the unilateral decision of KOKISA CBO to review the preliminary agreement on the shares of the bio enterprise: In 2008, KOKISA CBO started claiming 100% ownership of the enterprise instead of the 60% initially agreed. Interview of a KWS representative suggested that insufficient and inappropriate monitoring from institutional project partners contributed to worsen the conflict situation.

5.2.8. Direct and indirect impact of BABE Development Project on Aloe cultivation

Disparities in Aloe cultivation adoptions

AC was timidly adopted in the intervention zone and paradoxally met success in East Pokot. As a result of the various *BABE Project* incentives, a first – but deceiving - wave of AC occurred in Koriema, Kimalel, and Sabor. In this area, institutions, smallholder groups, as well as few individuals started cultivating Aloe species in 2005 so as to sell it to the bio enterprise once the factory ready to run. But in this area adoption of AC was deceiving with regard to the 11,7 million KsH invested (see section 5.1.2 page 51 as well as BDPP, 2005). Koriema, Kimalel, and Sabor communities did not show much interest to AC and the KOKISA nurseries were quickly abandoned for nobody was coming to buy Aloe seedlings. Contrary to what happened in the *BABE Project* intervention zone, AC had more success among East Pokot's smallholders. From 2006 in Loruk, AC started spreading when smallholders heard a factory was under construction in Koriema. From 2007, AC continued

spreading to Baringo North Division in the framework of the establishment of Aloe management Units (see section 5.2.9 page 71), and it finally reached Kolowa in 2008 (the drivers and enabling/disabling factors explaining why AC did/did not take off in the various places are detailed in section 5.3.3 page 81). **Figure 20** is a map representing the spread of AC in Baringo County.

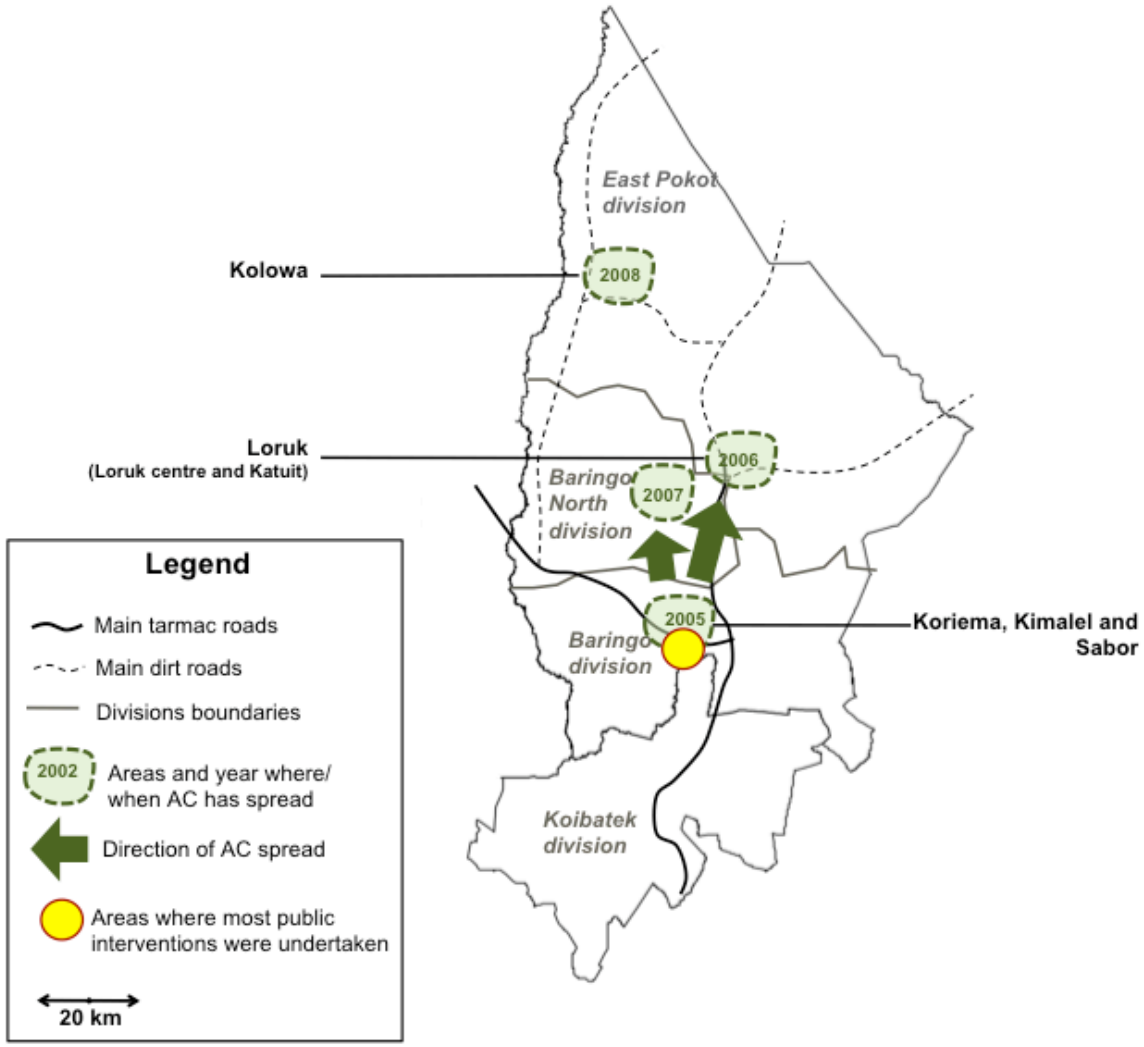

Figure 20: Map representing the spread of Aloe cultivation in Baringo County.

The BABE Development project indirectly encouraged Aloe cultivation outside Baringo

Contrasting with conflicts and challenges regarding AC promotion in Baringo, the *BABE Project* indirectly encouraged AC outside Baringo. In fact, the project rapidly became well knows in Kenya. This happened because the factory was used by KEFRI as national training place, within its mandate of promoting AC all over the country. The project also became well know because between 2005 and 2012, several national press articles have covered its evolutions (Unknown author, 2006, 2008, 2009; Cheploen, 2007; Odunga, 2012; Kumar, Unknown date; Owuor, 2006). Thus, *BABE Project* contributed to sensitize many Kenyan stakeholders about the fact that Aloe was a promising cash crop. A KWS researcher interviewed asserted that the project had encouraged a significant number of smallholder groups to start AC or MAP in the whole country. At the international scale, the project inspired the Ugandan government to develop a Policy aiming at increasing Aloe production,

processing, and exports (Unknown author, 2007). This happened one year after 8 Ugandan Members of Parliament visited the BABE factory.

5.2.9. Creation and enforcement of a regulatory device for Aloe

A law and implementation strategy were created to regulate Aloe exploitation and trade

As a response to the issues raised by the non-official Aloe trade, a process intending to establish a legal framework had been embarked by GoK in 2004 (see section 5.2.4 page 63), and led to the creation of a national legal and administrative framework in 2007-2008 enabling Kenya to export Aloe derivates in accordance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). GoK gazetted in 2007 the Wildlife (Conservation and management)(Aloes species) Regulations (GoK, 2007), and thus translated the CITES specifications at the national level. The law objective was to streamline the Aloe sub sector through promoting AC of the aloe species and certification of harvesting operations dependent on the wild aloe resource base (Lubia et al., 2008). One year after the legislation had been gazetted, the *Strategy for Conservation and Management of Commercial Aloe Species in Kenya* (or *National Strategy*) was created to provide a framework for its enforcement. The *National Strategy* prescribes systems, procedures and institutional arrangements, to guide and monitor sustainable management of Aloes for local and international trade in accordance with the national and international obligations. The strategy also prescribes research and public awareness to guide adaptive management of Aloes and to promote value addition initiatives (Lubia et al., 2008). The implementation of the National *Strategy for Conservation and Management of Commercial Aloe Species* relies on a broad institutional arrangement coordinated by KWS, and composed of several organizations having complementary and well-defined role. **Appendix 13** details the various organizations involved in the Aloe regulatory device and their role. Concretely, the strategy proposes the establishment a certification scheme based on Aloe Management Units (AMUs). AMUs are introduced as delineated areas selected on the base of wild aloe population availability, and where Aloe exploitation is regulated. For an AMU to exist, a smallholders association must produce a register of association members, as well as simple standards and internal control procedures able to gradually reduce unsustainable practices, and improve quality management. Although not very clear in the strategy document, what appears between the lines is that AMUs can both rely on WAE and AC.

The Kenyan Aloe regulatory device was shaped by CITES specifications

It should be pointed that the Kenyan Aloe regulatory device is no more than the translation of the CITES specifications at the national scale. 21 Aloe species are listed under Appendix I, and all the other Aloe species (except *Aloe vera*) are listed under Appendix II of the CITES (see section 2.4.4 for more details about CITES functioning). This is the case for *Aloe secundiflora* and *Aloe turkanensis* (as well as all Kenyan commercial Aloe species), the commercial Aloe species found in Baringo. Kenya being signatory of CITES since 1978, export of live plants or extracts of the Kenyan Aloe species requires prior grant of a CITES export permit. For such permit to be granted, the proof must be provided to CITES that export will not be detrimental to the survival of that species in the wild, and that the specimen was not obtained in contravention of the laws of that country for the protection of the species. Thus, the GoK initiative of creating a regulatory device dealing with Aloe was intending to allow Kenyan stakeholders to start exporting Aloe derivates in accordance with the international law. And the shape the regulatory device took (AMU certification scheme) was

influenced by the various CITES specifications and by the fact that the Kenyan commercial Aloe species were included in the CITES Appendix II.

From the National inventory of Aloe resources to the Aloe Management Units creation

In the purpose of guiding the upcoming *National Strategy*, a participatory Aloe resources mapping and inventory was undertaken in 2005 at the national scale (so also in Baringo), and was used as a basis to set up the AMU certification scheme (Mukonyi et al., 2008a; 2008b). The broad objective of this inventory exercise was to establish conservation, management and utilization status of Kenyan Aloes, so as to formulate recommendations enabling GoK to design an appropriate approach for conservation and utilization of each Kenyan commercial Aloe specie (Mukonyi et al., 2008b). More specifically, the objective of the resource mapping was to identify areas of critical masses of Aloe (or Aloe clusters), that could be used by KWS as a basis for the delineation of potential AMUs.

The National inventory of Aloe resources was implemented all-over the Country using participative approach. The areas to be surveyed were selected on the basis of an RPSUD Aloe bio-prospecting study that had been undertaken in the early 2000s. In each surveyed area, provincial leaders, community elders and extension agents were trained by a national resource mapping team on identification of the Aloe species and counting methods, and went for field inventory. In Baringo, this participatory exercise was funded by CDTF-BCP in the framework of *BABE Project*. However, the Northern part of Baringo was not surveyed (All East Pokot Division) because of an insecurity climate due to inter-tribal conflicts. The report that has come out from the resource mapping exercise recommended to GoK to rely on the established national distribution and abundance of Aloe species to delineate areas where Aloe exploitation and trade would be authorized, but regulated and controlled: The AMUs.

From Aloe cultivation as the sole response to regulated wild Aloe exploitation

Interview of KWS researcher revealed that the resource mapping exercise contributed to a perception change on the best way Aloe exploitation should be regulated. Although in the precedent Aloe-based initiatives (*BABE Project*, KAWG, LWF project in Laikipia) the dominant trend was to put the emphasis on AC, the results of the resource mapping exercise suggested that WAE could also be a sustainable way of taking advantage of the Aloe resource. In fact, the resource mapping showed that some Aloe species such as *Aloe secundiflora* were not endangered, and were widely spread across Kenya. In a context where first initiatives of AC promotion in Baringo had shown limited success, the idea of regulating WAE became increasingly accepted among Kenyan Aloe specialists and policy makers. This had a consequence on the shape taken by the *National Strategy*, and the subsequent Aloe Management Units certification scheme. Thus, and contrary to a common belief among stakeholders, the Kenyan legislation and *National Strategy* both promote AC and harvesting operations dependent on the wild Aloe (GoK, 2007; Lubia et al., 2008).

A national strategy well-designed but unfunded

Although well conceived onto the paper, the National *Strategy* has lacked financial means for its implementation. To the top of our knowledge, there was no specific budget allocated to the implementation of the national strategy. Accordingly, despite the existence of this legal and administrative framework that theoretically enable Kenyan stakeholders to establish AMUs and start Aloe exploitation and trade, the constitution of operational AMUs remains a challenge in most part of Kenyan dry lands. However, in Baringo, the AMU certification

scheme could be enforced through CDTF-BCP funds in the framework of the BABE Project, and through the KEFRI 2007 budgets to the project.

5.2.10. Establishment and internalization of Aloe management units in the framework of BABE Development Project

Establishment of AMUs in the framework of BABE Development Project

In Baringo, the AMU certification scheme was implemented in the framework and though the funds of the *BABE Project* in the perspective of starting certified Aloe exploitation and trade. From 2006, even though law and national strategy were not established yet, KWS stressed the *BABE Project* stakeholders that the challenge for them was to set up and make operational a certain number of AMUs. Thus, seven AMUs were established in Baringo County between 2006 and 2007 (**Figure 21**). The places to set them up were chosen by KWS on the basis of the Baringo Aloe clusters, and thus exceeded the bounds of the intervention area of BABE project.

In 2006, a first wave of AMUs were set up – The Koriema and Kimalel AMUs - by KEFRI and KOKISA CBO in the intervention zone of the *BABE Project* thanks to last tranches of the CDTF-BCP funds. In 2007, once the European funds were exhausted, KWS urged projects partners to set up other AMUs and to strengthen the prior-existing ones, so that they could obtain the license. KEFRI, that had attributed a budget line to sustain the Aloe activities in Baringo, could fund the establishment of 3 new AMUs (Kolowa, Oge and Koromoi). Other AMUs, like Olduka and Lake Baringo, have also been established, although we didn't find in which condition and through which funds. According to Mukonyi & Kyalo (2007), a total of 1547 AMU members were registered in Koriema, Kimalel Kolowa, Oge and Koromoi AMUs.

Creation of Aloe management standards in the various Baringo AMUs

Once the different AMUs created, KOKISA CBO worked together with KEFRI and AMU leaders on the development of Aloe management standards to be review by KWS for approval. The final standards approved by KWS were comprising Species to be harvested, harvesting period (between June and October and then January to March), number of leaves to be left uncut, recording procedures to be followed by AMU chairmen, as well as quality specifications (harvest practices, separation of the sap from *Aloe secundiflora* and *Aloe turkanensis*) (Mukonyi & Kyalo, 2007).

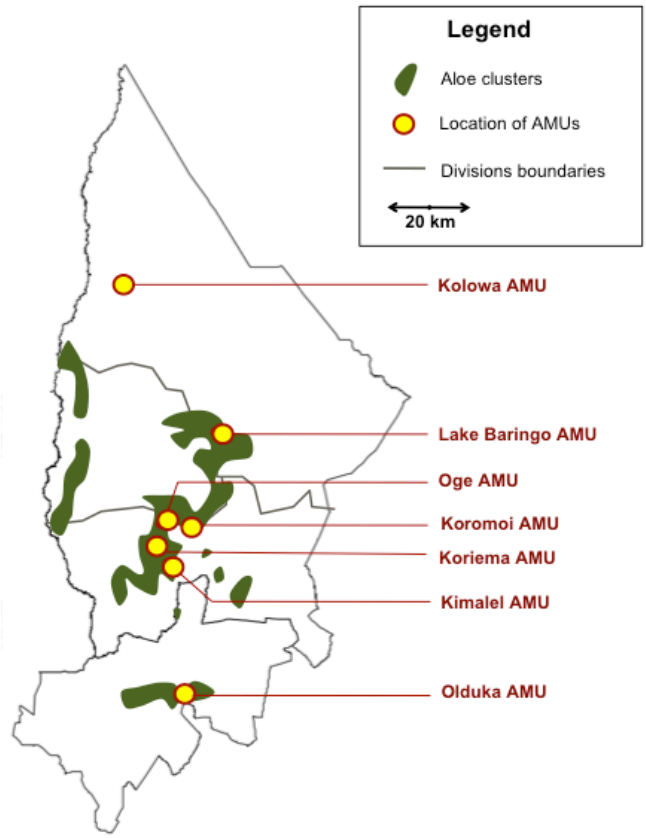

Figure 21: Location of AMUs and Aloe clusters in Baringo County (Adapted from Mukonyi et al, 2008).

Baringo AMUs were established in rush and remained empty shells

Due to inappropriate funding, the Baringo AMUs remained empty shells for they

were established in rush, non followed-up, and unclearly documented. Interviews of KWS stakeholder revealed that such situation happened because the various funds allotted to AMUs creation and monitoring were not sufficient. KOKISA CBO former members also revealed that Olduka and Lake Baringo AMUs were established without presence of representative from these areas. The observations made during the Baringo Aloe CCA confirmed the fact that AMUs were in fact not operational: At the exception of the KOKISA/BABE LTD active members and a part of AMU leaders, most of the interviewed stakeholder were not aware of the existence of AMUs. Indeed, around 20.000 KsH were spent per AMU, a very modest amount only allowing KEFRI to organize pre visit, planning meeting, and community sensitization meeting in each expected AMU (Mukonyi, 2007). Each AMU was materialized by a list of beneficiaries and by-laws, established with the help of local leaders.

From 2007 to 2009, a sleeping period

Despite the fact that the process of AMUs establishment had been completed from 2007, there was a 2 years period during which AMUs members and *BABE Project* stakeholders and beneficiaries have been waiting for commercial activities to start. According to the KWS and KEFRI stakeholders interviewed, this problem was caused by intestine conflicts among project partners preventing them from applying for a license. But several evidence tend to show that this situation did not happen because of an internal paralysis, but rather because of administrative slowness. In fact, interview of actual BABE PIC members as well as personal communications suggested that obtaining a KWS license has been - and is still - an issue. **Table 10** summarizes all the demands done by KOKISA CBO. If for the 2 first applications, KWS couldn't issue a permit because the National regulatory device for Aloe was not ready to operate, the reason why the 26/09/2007 application failed has remained unclear. Presumably, KWS was considering that not enough AMUs had been set up and AC had not took-off enough in Baringo. According to a BABE LTD PIC member, the last permit application was done in May 2012, but at the moment of the survey (July), no answer had been given by KWS.

Table 10: KOKISA harvest permit requests to KWS from 2005 to the present.

Date	To whom	Request	Source
19/08/2005	Director KWS, Nairobi	18 tones export license	Ng'etich P., 2005
28/05/2007	District Warden, KWS, Baringo/Koibatek District, Kabarnet	10 tones export license	Chemwotei, 2007a
26/09/2007	District Warden, KWS, Baringo/Koibatek District, Kabarnet	15 000 L of sap	Chemwotei, 2007a
05/2012	Director KWS, Nairobi	?	Interview BABE PIC member

AMUs and BABE project stakeholders gathered in BABE LTD through a new project

In 2009, KOKISA CBO, KOKISA Cooperative, Land Mawe, KEFRI, KWS and the various Baringo AMUs became part of an overarching community owned enterprise called BABE LTD. BABE LTD was designed to become the umbrella in charge of organizing certified Aloe exploitation and trade in all Baringo selected AMUs. The process of gathering of the various AMUs together with the *BABE Project* stakeholders was supported from the late 2008 to 2010, by a new project funded by CDTF-CEF (CEF, 2008) for a total amount of 3 027 200 KsH. The project overall objective was to support the infrastructure development of the

factory, to strengthen the capacity of KOKISA/BABE LTD, and to link the *BABE Project* stakeholders to the various AMUs.

5.2.11. The BABE standstill

BABE LTD got its first permit and started ordering sap to AMUs

In 2009, KWS finally allowed BABE LTD to start ordering sap from the various AMUs. A license was issued for 10 tons of gum, leading BABE LTD to sign a Memorandum of Understanding with Land Mawe LTD. At that point, the prior existing conflicts between KOKISA CBO and Land Mawe LTD crystallized in the decision to give 100% of the ownership of the bio-enterprise to KOKISA CBO, instead of the 60% initially negotiated in 2004, at the beginning of the project. This decision was not playing into the advantage of Land Mawe LTD, since the enterprise role was reduced to the one of marketing agent. But the manager of Land Mawe LTD accepted the deal for it was the only solution to make sure that things could go on, after years of waiting.

Land Mawe LTD stepped down and BABE LTD was paralysed

Little time after the MOU was signed, Land Mawe LTD stepped down for unclear reason, and BABE LTD was left with unsold gum in its hands. Once the MOU signed, BABE LTD had started gathering Aloe sap from the various AMUs. The manager of the bio-enterprise then tried in vain to commercialize it through Land Mawe LTD, but the enterprise refused buying sap to BABE LTD, arguing that the way sap had been collected in the various AMUs was not appropriate. Interview of Land Mawe representative suggested that on that time the enterprise was going through a financial hardship. This decision could be also explained by the difficulties frustration of the manager Land Mawe to have been pushed out by the other project partners. This situation left BABE LTD managing team unable to market Aloe gum. Yet, buyers have never stopped contacting BABE LTD to get Aloe gum. In fact, BABE could not respond to these orders – and thus the bio-enterprise entered into a standstill - due to a combination of reasons that we analyze below.

5.2.12. Reasons for the BABE LTD standstill

BABE LTD faces a lack of working capital

The first reason explaining the BABE standstill is a lack of working capital. Interviews of BABE LTD manager and PIC members revealed that a recurrent problem affecting the bio-enterprise is a lack of capital for buying, transporting, and processing sap into gum. Without KEFRI budget or other donor supporting these activities (As it was the case for the first buying cycles), BABE LTD cannot afford anymore implementing such activities. So from 2010, the bio-enterprise has been asking without success to the various potential buyers to provide money in advance, but these propositions were not accepted, with one exception (It is a Chinese buyer that bought 500 kg of Aloe gum in 2011). Moreover, lack of funds has been preventing BABE LTD from organizing PIC meetings since August 2011.

BABE LTD faces an internal management challenge

The second factor explaining the BABE standstill is a weakness of internal management, that contrasts with the expected size and complexity of the BABE LTD mission. In fact, the BABE LTD mandate includes complex logistical and technical tasks such as the management

of long distance transports, the monitoring of AMUs, the search for market opportunities, and the request for KWS permits. Thus, the scale and mission attributed to KOKISA/BABE LTD were calling for high organizational capacity. Unfortunately, after KEFRI ended, BABE LTD revealed to be a weak organization unable to implement certified Aloe trade. Moreover, GGD suggested that BABE PIC is not active anymore, and that there is a lack of transparency in the management of the community owned enterprise.

BABE LTD faces a supplying challenge

Interview of BABE LTD active members suggested that one reason explaining the current standstill is the incapacity of BABE LTD to respond to gum orders due to disparities of responsiveness of AMUs to its call for supply. In fact, in more than half part of the BABE catchment area (in Koriema, Kimalel, and Oge AMUs), smallholders were reluctant to go and harvest sap to supply BABE LTD for the simple reason that the proposed buying price for sap is not sufficient. On the contrary, Aloe sap supply was more easy and reliable in Lake Baringo (around Loruk), Olduka (around Radat), and Kolowa AMUs, although those places are further from the factory than the other AMUs. Thus, at the conclusion of the buying cycle, BABE LTD had only managed to gather 630 kg of gum out of the expected 10 tones. Of course, BABE LTD orders only occurred twice, and so hindsight is not sufficient to draw conclusions on the capacity of the bio-enterprise to supply in its catchment area. But if this problem revealed to be systemic, it would hinder the capacity of BABE LTD to supply the international market.

The sap-processing factory lost its first reason to exist

According to interviewed BABE LTD active member, after the first buying cycle had been implemented, the managing team of BABE LTD decided to decentralize a part of the sap-processing activity for logistical reasons. The BABE LTD factory initial purpose was to boil and pack the sap bought in the different AMUs. But deterioration of sap quality due to long storage as well as high transport costs of the sap from the different AMUs to BABE factory led to a strategy change. In 2011, aided by KEFRI, BABE LTD trained boilers in the most distant AMUs (Lake Baringo, Olduka and Kolowa) so that gum could be bought instead of sap. By doing so, the factory lost somehow its main reason for existing (processing sap into gum), since only the less productive AMUs (Koriema, Kimalel, Oge) could continue to supply sap. The BABE LTD factory became no more than a point of collection for Aloe gum.

BABE LTD found itself in competition with non-official trade

GGD in Kolowa and interview of traders revealed that BABE started ordering sap to the various AMUs, the bio-enterprise found itself competing with non-official trade, both for sap supply at the AMU level, and for export market access. This situation did not play into the hands of BABE LTD, and led to adverse effects. For instance, in Lake Baringo and Kolowa AMUs, where informal trade was still operating when BABE LTD delivered its first sap orders, AMUs started entering into competition with non-official trade for sap supply when BABE LTD made its first order. This arrival of BABE LTD on the market generated an increased overall demand for sap, leading boilers to increase their buying price and smallholders to harvest more than usually. Apart from being challenged for sap supply, BABE LTD was also less competitive on the gum export market than stakeholders of the non-official supply chain because of certification costs and start-up time of the KWS certification mechanism.

5.2.13. Consequences of the certified trade's standstill

AC adoption dynamics stopped in the early 2010s

GGD in Koriema and Kolowa as well as most interviewed stakeholders agreed on the fact that in most places of Baringo County, AC has stopped spreading in early 2010s due to the combined effect of low buying prices proposed by BABE LTD for Aloe sap, and recent BABE LTD standstill. When BABE LTD made its first sap order in 2009, the buying price proposed discouraged smallholder to harvest their Aloe. The only exception was in East Pokot Division, where BABE LTD buying prices were considered as sufficient by smallholders, since they were almost twice the price proposed by boilers. Shortly after the first orders made, BABE LTD entered in a standstill and the commercial channel it represented collapsed. As a result, most Baringo smallholders stopped establishing new plantations. In Loruk (where Lake Baringo AMU had been set up), AC had continued spreading after BABE LTD standstill start, due to the presence of boilers buying sap. But recently in 2011, they had to stop when for boilers left the place. In Kolowa it seems AC continues spreading, since it is not driven by BABE LTD market opportunity but by the fear of seeing wild Aloe disappearing.

The biological resource represented by cultivated Aloe has remained

Nevertheless, Aloe crops were not replaced, and the already established Aloe plantations have remained untouched. As mentioned in section 5.1.2, despite the fact that AC was not generating income anymore, smallholders often kept their already established Aloe plantations for they hope that BABE LTD will be revived one day, and for they discovered that the plant was providing services to the other components of agro pastoral systems. Aloe being is a perennial crop, the acre of cultivated Aloe can be considered as resource that could be used if BABE LTD was revived and could propose acceptable buying price for Aloe sap.

From 2008, 3 initiatives of Aloe-based products making

GGD in Koriema revealed that in the context of early signs of conflicts between and among project partners, and difficulties showed by BABE LTD and AMUs to become operational, several initiatives of MAP have appeared between 2008 and 2011. MAP was first adopted in 2008 by a woman group from Kimalel/Sabor (Kamasaiwa), and was followed by a wider group from the same area in 2010 (Sabkor), as well as by few individual herbalists and by BABE LTD itself in 2011. More details about drivers of value addition initiatives are in section 5.3.

The Baringo Aloe-based products in a highly competitive market

The Baringo agents involved in the MAP face an increasingly competitive market. In the beginning of the 2000s, a market craze for "herbal" products (cosmetic and medicinal products made from natural medicinal herbs) has veritably blown up in Kenya, with Aloe as a lead product. This new demand for herbal products, especially among Kenyans from urban areas, has been fuelled by the increasing mistrust in chemical ailments and modern food products, together with the aggressive marketing from the international firms that sell herbal products (e.g. Duru). As in other countries, the *Aloe vera* products became the flagship herbal products.

In the context of market craze for herbal – and in particularly Aloe - products, an increasing number of small and medium enterprises based in urban areas have started the production and selling of Aloe-based products.

Indigenous Traditional Knowledge have played a key role in the corresponding innovation process. In the early 2000s, the fashion for herbal products has sparked the interest of a handful of traditional herbalists, that have engaged in the large scale making of herbal products. Relying on their knowledge on the various uses of plants, they started the medium scale production of herbal remedies, and relied on street retailers of herbal products to commercialize it to retailers. Thus, made-in-Kenya Aloe-based products have appeared on the domestic market competing the imported ones. Following international firms example, these herbalists have proposed their own "Aloe vera" or "Aloe" remedies, that were in fact made using the sap of indigenous Aloe species. In the same way than for herbalists, a certain number of small and medium enterprises have started to make Aloe-based cosmetic products (soap, body lotion, and body cream). For cosmetic products like for soap, the use of the allegation "Aloe" or "Aloe vera" in the branding became a key marketing argument.

In this increasingly competitive market, where the Baringo Aloe-based products are both challenged by imported and made-in-Kenya similar (and often better quality) products, the challenges for Baringo actors is high.

In Baringo, the making of Aloe-based products development is limited

Koriema GGD and interviews of Sapkor and Kamasaiwa representatives revealed that in addition to increasingly competitive market, MAP in Baringo is limited in scale due to number of internal factors. A first problem is the lack of working capital, that doesn't allow the production of large quantities in advance. Another issue that came recently is the increasing cost of coconut oil (from 200 to 375 KsH/L), which is the main input used for soap making. This situation led Kamasaiwa to moderate its soap production and to increase the selling price of soap, and it led Sabkor to simply stop the making of soap. Lack of credit access and low capacity to invest is also limiting the activity scale of these groups. For example, Kamasaiwa SHG would need mould to accelerate the production of soaps (for the moment the shape of the soaps is hand-laid), while also increasing quality of the final product, but such investment is out of its reach. For all the actors involved in the MAP, lack of market visibility is a last challenge. For its part BABE LTD has developed an interesting soap and labelling/branding, but its production has been outsourced until now, and the soap cannot reach a large market for it does not complete the KEBS standards, and for the BABE internal management challenge prevent the organization from revising the formulation.

Conclusion of part 5.2.

*In the light of the innovation story drawn above, we identified 3 main phases in the innovation process (**Table 11 page 79**). The first phase starts in 1984 and ends in 2004. It corresponds to the large-scale adoption of WAE in Baringo through non-official trade, and the rising awareness about the Aloe issue it provoked among scientists and policy makers. We have thus called it "Uncontrolled WAE and rising awareness". The second phase (2004-2008) corresponds to the implementation of BABE Project and the enforcement of the AMU certification scheme. We have called this period "Public intervention for AC and regulated WAE". The last phase starts in 2008, and is still going on. It corresponds to the BABE and AMUs standstill and the various initiatives of MAP that have consequently emerged. We called this phase "Failure of projects and value addition initiatives".*

Table 11: Chronology of the Baringo Aloe innovation Process

1950s	- WAE starts in Kenya in relation to the growing international demand on Aloe derivatives.
1963	- International trade of all Aloe species (at the exception of Aloe Vera) become regulated by the CITES.
1973	- Kenya becomes co-signatory of CITES.
	Period 1: Uncontrolled WAE and rising awareness
1984	- Non-official trade agents established in Northern Baringo (Actual East Pokot Division), triggering WAE.
1985	- Department of Plant & Microbial Sciences of Kenyatta University starts working on succulent species.
1986	- President Moi declares all Aloe species protected.
1991	- A lecturer from Kenyatta University criticized the presidential decree in a conference paper.
1992	- Dry lands come into the forefront of the Rio conference.
1993	- The genus Aloe becomes part of a NMK conservation program.
1997	- A research program on non-wood products (KEFRI and NMK) stimulates research on AC and WAE.
2000	- First cases of Aloe cultivation appear in Baringo (Loruk, Mogotio, Loboi). - Non-official trade agents established in Radat (Koibatek Division), triggering WAE.
2002	- Baringo is identified as a place of high ITK score, where wild Aloe is well spread, where AC already occurs.
2002	- NAREDA consultancy describes non-official Aloe sector dynamics and subsequent challenges.
2003	- A CITES consultancy emphasizes the need for a regulatory device for exploitation and export of Aloe extracts.
	Period 2: Public intervention for AC and regulated WAE
2004	- The Kenya Aloe Working Group (KAWG) is created. - KWS is mandated to formulate legislation and strategic implementation framework to regulate Aloe exploitation. - KEFRI mobilize a private investor a community in Koriema, Kimalel and Sabor (Baringo Division).
2005	- Registration of KOKISA CBO. - *BABE Development project* is carried out for 1 year in Koriema/Kimalel/Sabor: AC is promoted and a factory is built. - KOKISA CBO and Land Mawe LTD agree on co-ownership (respectively 60%/40%) of the future enterprise. - SNV provides support to strengthen the capacity of KOKISA CBO members. - AC do not takes off in Koriema/Kimalel/Sabor and the KOKISA nurseries are abandoned. - The BABE Development project sparks interest in Loruk where smallholders start AC. - Participatory Aloe resources mapping is realised at the national scale in prevision of the AMU establishment. - Baringo County Council delays the construction of the factory by asking an Environmental Impact Assessment.
2006	- Registration of KOKISA Natural Resource Co-operative Society LTD. - Kimalel, Sabor and Koromoi AMUs are set up. - The Factory is launched, but is not fully equipped (no water, no electricity). - Kamasaiwa SHG promotes AC among its members. - 8 Ugandan MPs came to visit the factory, and BABE project becomes a well know at the National Scale. - Emergence of conflicts between and among the project partners, preventing them to agree on an authoritarian MOU.
2007	- KOKISA CBO unsuccessfully looks for complementary funds and for KWS permit for Aloe exploitation. - Climate of controversy turns to hostility, leading KOKISA CBO Project Implementation Committee to be replaced. - Creation of Kolowa, Oge, and Lake Baringo AMUs thanks to KEFRI funds. AC is promoted in these areas. - Gazettement in 2007 of Wildlife (Conservation and Management) (Aloe Species) Regulation.
	Period 3: Failure of projects and value addition initiatives
2008	- KOKISA CBO claims 100% ownership of the enterprise. - A National Strategy is created to guide the enforcement of the Wildlife Regulation, but not budget is attributed - One smallholder group (Kamasaiwa SHG) starts the MAP. - One project that has activity in the building of agricultural terraces promotes AC to border terraces. - A CBO called SABKOR is created to promote AC - The Baringo Aloe Bio-Enterprise Development and Capacity Building Project starts for 17 months
2009	- Registration of the Baringo Aloe Bio-Enterprise LTD. - Consultancy designed to develop business plan for marketing of BABE products, market study, cost benefit analysis. - KWS gives a harvest permit for 10 tones of gum, valid for 3 month. - Signature of a MOU between project partners. KOKISA Cooperative obtains 100% of the enterprise ownership. - Sap collection is implemented in all AMUs, but BABE doesn't manage to gather the expected 10 tones. - Land Mawe LTD refuses to buy the Aloe gum produced by BABE LTD. - In Kolowa, non-official agents increase buying price for sap due to the competition generated by BABE LTD. - Kolowa smallholders start AC.
2010	- A second smallholder group (SABKOR CBO) starts the MAP. - Laboratory test on Baringo *Aloe secundiflora* and *Aloe turkanensis* gum (Aloein content). - KEFRI supports BABE LTD in branding, training on quality control, and KEBS laboratory tests. - BABE responds to a 5 tones gum order. Sap-processing is decentralized to Kolowa and Lake Baringo AMUs. - BABE PIC meetings stop.
2011	- The BABE soap sample failed to comply the standard of Kenyan Bureau of Standards.

5.3. Triggers and drivers of the Innovation Process

In the precedent parts of the report, we have identified 3 major innovations that correspond to 3 forms of activation of the Aloe resource (WAE, AC, MAP), and we analysed the history leading to their existence. Indeed, each one of the 3 innovations was adopted by different stakeholders, in different areas, and at different moments. In this part, the objective is to go beyond the simple description of temporal/spatial diversity and complexity, and to catch the underlying causes of innovations adoption. We begin by looking back on the different places and moments where our 3 innovations occurred, and for each one of them, we highlight the triggers, drivers, and enabling/disabling factors that have determined the various innovation adoption. We finish by cross analyzing the drivers, and enabling factors from the 3 innovations.

A trigger is here understood as the factor that causes the start of the process leading one innovation to emerge. It is different from the notion of driver, which refers to any factor that encourages the innovation adoption by stakeholders. For their part, we consider that enabling/disabling factors are elements facilitating/making difficult the innovation adoption. To correctly understand the difference between these notions, consider that if any driver do not comes into play, enabling factors alone will not lead to innovation adoption. On the other hand, disabling factors can prevent innovation to be adopted although drivers are playing.

5.3.1. Triggers of the innovation process

In the light of the innovation story drawn above, we now identify the triggers of the innovation process. It appears that the trigger of the whole process leading to the adoption, up-scaling and institutionalization of WAE, AC and MAP is the arrival of Aloe traders in Baringo County. It is mainly this event that has initiated the whole process. But we formerly showed that in 3 innovations had come into play in the innovation process: WAE, AC, and MAP. Thus, we also identify triggers for each one of these innovations: If WAE adoption was actually triggered by the arrival of Aloe traders, AC and MAP adoption were respectively triggered by the *BABE Development Project*, and by the standstill of both BABE LTD and AMUs certification scheme (**Figure 22** page 84).

5.3.2. Drivers and enabling/disabling factors of wild Aloe exploitation

Where/when wild Aloe exploitation appeared

WAE first appeared in East Pokot and Koibatek Divisions in connection with non-official trade. More precisely, it appeared in Tangulbei and Mukutani in 1984, and spread the year after to Loruk, and finally reached Kolowa and Radat in the 2000s. In the late 2000s, WAE has promptly happened in other Baringo and Baringo Noth Divisions in connection with BABE LTD demand and AMUs certification scheme.

Drivers of wild Aloe exploitation

In all cases, WAE adoption was driven by the market opportunity generated by the Aloe sap demand of buyers (non-official Aloe sap traders and later BABE LTD).

But if WAE linked with non-official supply chain remained concentrated in East Pokot and Koibatek Divisions, it also due to low opportunity cost of harvesting wild Aloe in these socio-economical context. In East Pokot Division, WAE represented an alternative livelihood

option in a context of high poverty prevalence, scarcity of livelihood sources, and lack of market access due to poor level of infrastructures. This low opportunity cost is also linked with pastoralist household organization. The latter is compatible with WAE, since it often leads to low rate of women employment, and to the necessity for women to find income sources during the dry season when men take care of the livestock. Last but not least, high prices of staple food due to poor market access enable the barter trade (exchange of Aloe sap against food) to operate, without which non-official trade could difficultly operate.

In the specific case of Loruk (East Pokot Division), things globally followed the same trend but interviews in this area revealed that a tribal conflict has also contributed to drive the WAE adoption. In this area, the Tugen's tribe is dominant, and the harvest of Aloe was taboo for them (it was presumably an institutionalized way of protecting soils from erosion). But Pokot women started coming on Tugen's lands in order to harvest Aloe, leading to inter tribal tensions. Finally, the Tugen's tribe taboo was relaxed by the will to exploit the Aloe resource rather than letting Pokot tribe do it alone.

In Koibatek Division, livelihood options were more diversified and poverty less prevalent than in East Pokot Division, but harvest of wild Aloe and sap selling took the shape of a side activity, mainly implemented during the hunger gap. Its intensity was negatively correlated with the success of the growing season.

Enabling/disabling factors of wild Aloe exploitation

Although in all parts, WAE adoption was facilitated by the availability of Aloe in the wild, there were spatial disparities in the trends of WAE adoptions due to number of disabling factors that have come into play. In Baringo, Baringo North, and Koibatek Divisions, adoption of WAE through certified trade was disabled due to the high opportunity cost of commercial Aloe harvesting in this socio-economical context. This high opportunity cost was due to diversity of livelihood sources, good market access, relatively low price of staple food, and high rate of women employment, all of which discouraged smallholders from harvesting Aloe.

Opportunity cost put aside, an other factor explaining the good responsiveness to the BABE call for supply in East Pokot and Koibatek Division, is the prior existence of wild Aloe harvest and sap selling to boilers. In these areas, prior existence of informal trade generated high degree of dependency on Aloe, integration of Aloe harvest into family organisation, and indigenous knowledge on harvesting and boiling practices, that made it easy to supply BABE much-awaited order (for the price proposed by BABE for sap was higher than the one proposed by boilers). As mentioned above, in the specific case of Loruk (East Pokot Division), WAE was however discouraged at the beginning by a taboo concerning the harvest of wild Aloe.

5.3.3. Drivers and enabling/disabling factors of Aloe cultivation

Where/when Aloe cultivation appeared

AC was first implemented in late 1990s/early 2000s by a few smallholders in Mogotio, Loboi, Loruk, but really started spreading from 2005 in Koriema, Kimalel, and Sabor (Baringo Division) and Loruk (East Pokot Division) when BABE Development project started its promotion. In the late 2000s cultivation also appeared in Kolowa (East Pokot Division).

Drivers of the first cases of Aloe cultivation

The first isolated cases of AC that occurred in Mogotio, Loboi, and Loruk in late 1990s/early 2000s were driven by heterogeneous factors, coming from land use change to threat on wild Aloe, and passing through soil erosion. In Mogotio, a stakeholder that had heard of the economical value of Aloe decided to create an *Aloe secundiflora* plantation by collecting Aloe suckers and mature plants from neighbour's lands before they started clearing it (the late 1990s was a period of accelerated land use change, from "forestland" to agriculture lands). In Loboi in the same period, a schoolteacher established a small *Aloe secundiflora* plantation in the schoolyard with the sole aim of covering the naked soil and stabilizing it. In Loruk in 2000, a farmer who had witnessed overexploitation of wild Aloe decided to plant *Aloe turkanensis* in his farm in order to reduce his dependency on wild Aloe in case it would disappear.

Drivers of Aloe cultivation in Koriema, Kimalel, and Sabor

When AC started spreading in Koriema, Kimalel, Sabor (Baringo Division) from 2005, AC adoption was driven by the market opportunity for Aloe sap and by diversification strategies of smallholder groups. Indeed, GGD revealed that what first conducted stakeholders to start AC was the promise of a remunerative market for Aloe sap through the bio enterprise under construction. For their part, smallholders groups that started AC were often already established for other purpose that Aloe, and caught the opportunity of cheap seedlings and KEFRI support to diversify their activity through AC.

In 2007-2008, AC continued spreading, driven by conflicts on the wild Aloe resource, and by agricultural terraces construction. In fact, 2 external interventions have driven these new dynamics of AC, although it was not the goal of the intervening actors. On the one hand, a project called *Community Development Committee* (linked with *Arid Land Management Programme*) that was active in the buying of Aloe seed buying project generated territorial conflict for the right to harvest wild Aloe seeds. This conflict raised the awareness of smallholders about the necessity to reduce dependency on conflictual wild Aloe resource in anticipation of the day when BABE would start ordering sap. This led to the creation of a Community Based Organization (called Sabkor) encouraging AC. On the other hand, a World Bank project called Baringo Arid & Semi Arid Programme that had activity in the construction of terraces promoted the use of Aloe to border terraces with the purpose of stabilizing them.

In both cases (Aloe seed buying project and terracing project), AC adoption by smallholders was also driven by their awareness about the ability of Aloe to retain water and soil through observation of the first Aloe plantations, and by the awareness about the interest of Aloe as an intercropping plant.

Out of this, with the other cases of AC adoption, it is difficult to speak about drivers: The few smallholders who established Aloe plantations were often the active members of KOKISA, and personally wanted to support this initiative. For their part, schools started AC for the very reason that KEFRI used them to establish Aloe demonstration plots.

Enabling/disabling factors of Aloe cultivation adoption in Koriema, Kimalel, and Sabor

In Baringo Division AC adoption was enabled by access to cheap Aloe seedlings, Aloe suckers available in the wild, by trainings, and by support to the emergence of a smallholder organization (KOKISA) through *BABE Development Project*.

But AC did not take off since smallholders were discouraged by low sap price, high investment required, lack of trust to the project backer smallholder organization, and uncertainties about the promised market through the bio-enterprise. In fact in this area, most

smallholders were reluctant to start AC because it required an initial investment linked with the buying of seedlings and the fencing of the Aloe field. In addition, the return on investment was long, since Aloe can only be first harvested 3 years after plantation, while at the same time, Aloe was available in the wild. Moreover, this reluctance was reinforced by absence of tangible market through the bio-enterprise whose starting was delayed, and by the community increasing mistrust toward KOKISA CBO and Land Mawe LTD, due to never ending conflicts and delays in the issuance of KWS harvest permits.

Drivers of Aloe cultivation in Loruk and Kolowa

When AC started spreading in Loruk (East Pokot Division) from 2005, drivers of AC adoption were the market opportunities generated by the upcoming bio enterprise and non-official supply chain, as well as by strategies of land appropriation. Thus, encouraged by the market promise represented by the new-born factory, 25 smallholders from Loruk (East Pokot) started cultivating Aloe, although they did not benefit from any external support. But what has also driven the establishment of Aloe plantations in Loruk was the presence of a tangible market opportunity represented by boilers, as well as strategies of land appropriation through establishment of perennial crops (during upcoming land demarcation, lands might be considered owned by those who cultivate them).

In Loruk, other drivers of AC adoption were the awareness about the economical interest of Aloe (due to prior existence of WAE), and about the ability of Aloe to maintain grass cover. In the framework of pastoral/agro pastoral livelihood systems, maintaining a grass cover next to home through Aloe is indeed an advantage.

For its part, the AC adoption dynamic that occurred in Kolowa (East Pokot Division) in the late 2000s was driven by a threat on wild Aloe. More precisely in 2009-2010, it is the degradation of wild Aloe due to overharvest that emphasized the necessity to reduce dependency on wild Aloe in case it would disappear, leading to AC.

Enabling/disabling factors of Aloe cultivation adoption in Loruk and Kolowa

In Loruk and Kolowa, AC adoption was also facilitated by prior existence of WAE, that had made smallholders dependant on Aloe sap selling and that had eased integration of Aloe management into family organisation. In Loruk and Kolowa, AC adoption was also eased by the presence of stakeholders providing training. In the case of Loruk, a local leader that was already cultivating Aloe has informally played the role of demonstration plot. In Kolowa, smallholders were trained on AC by *Barpello sisters high school,* a project disconnected from the BABE Development Project.

5.3.4. Drivers and enabling/disabling factors of the making of Aloe-based products

Where/when the making of Aloe-based products appeared

MAP was first adopted in 2008 by a woman group from Kimalel/Sabor (Kamasaiwa), and was followed by a wider group from the same area in 2010 (Sabkor), as well as by few individual herbalists and by BABE LTD itself in 2011.

Drivers and enabling/disabling factors of the making of Aloe-based products

When adopted by the 2 smallholders groups in 2008 and 2010, MAP adoption was driven by diversification strategies of theses groups and market opportunity. In a context where BABE project was showing the first signs of failure, the 2 smallholders groups that had been

constituted in the purpose of cultivating Aloe to supply the BABE LTD factory felt the need to diversify their activities in order to continue to exist as a group. The starting of this activity was also driven by the market opportunity represented by the market craze for Aloe-based cosmetic products.

In 2011, in a context where BABE was activity was affected by sap supplying and internal management challenges, BABE manager outsourced the fabrication of soaps as a way starting a diversification strategy. The recourse to soap making was highly facilitated by KEFRI that formulated the soap and created its branding.

In all cases, MAP adoption was enabled by the availability of Aloe in farm and in the wild, and by the trainings provided by KEFRI in the framework of *BABE Development Project*. **Figure 22** summarizes the triggers and drivers identified in the Baringo Aloe innovation process.

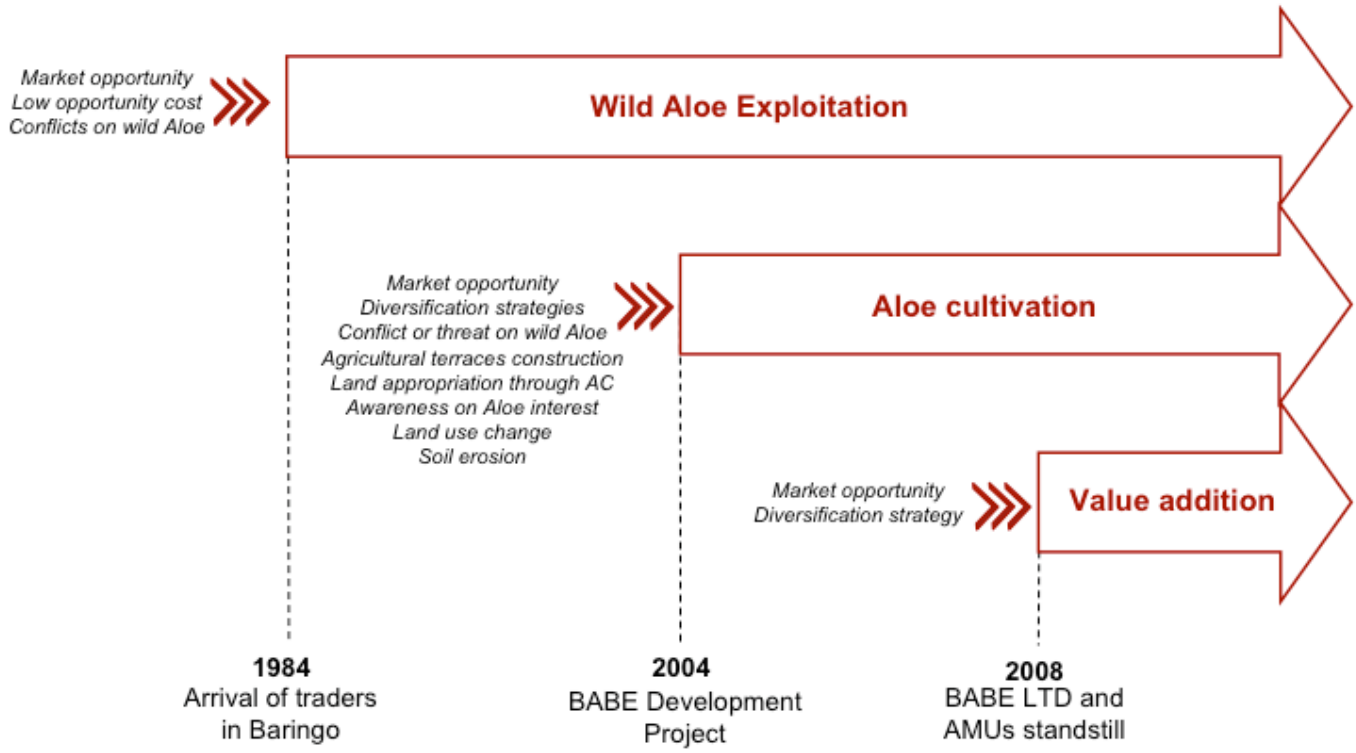

Figure 22: Triggers and drivers of the innovation process

5.3.5. Cross analysis of drivers and enabling/disabling factors

Cross-analysis and typology of drivers

In order to cross analyse drivers, we used a table summarizing the various drivers identified above for the 3 innovations of WAE, AC and MAP (**Table 12** page 85).

Table 12: Cross-analysis of drivers

Innovations	Drivers
WAE	**D1.** Market opportunity generated by non-official Aloe sap supply chain or BABE LTD **D2.** Low opportunity cost due to poverty, scarcity of livelihood sources, and low market access, and high rate of women unemployment **D3.** Conflict on the wild Aloe resource
AC	**D4.** Market opportunity generated by the upcoming bio enterprise or non-official supply chain; **D5.** Diversification strategies of smallholder groups; **D6.** Conflicts or threat on the wild Aloe resource; **D7.** Agricultural terraces construction **D8.** Strategies of land appropriation through AC **D9.** Awareness about interest of Aloe as an intercropping plant **D10.** Awareness about the ability of Aloe to retain water and soil **D11.** Awareness about the ability of Aloe to maintain grass cover **D12.** Land use change **D13.** Soil erosion
MAP	**D14.** Market opportunity generated by the market craze for herbal products **D15.** Diversification strategies of smallholders groups

The cross analysis of the various drivers (noted **D1-D15**) of WAE, AC, and MAP adoption in **Table 12** allows us to identify 6 families of drivers that have played in the Baringo Aloe innovation process:

- Market opportunity (**D1, D4, D14)**
- Low opportunity cost of innovation adoption linked with socio economical and cultural factors (**D2)**
- Structural change of farming systems (**D7, D8, D12)**
- Conflicts or threat on a livelihood source (**D3, D6, D13)**
- Diversification strategies of established groups (**D5, D15)**

Awareness about the advantages brought by the innovation (**D9, D10, D11)**

This table also shows that market opportunity is a common driver of the 3 innovations, and it also highlight the importance of conflicts or threat on wild Aloe resource and diversification strategies of prior existing groups as drivers.

Cross-analysis and typology of enabling/disabling factors

The single analyse of triggers and drivers cannot explain the diversity observed in innovation adoptions trends, since a diversity of enabling/disabling factors were playing throughout the innovation process. In order to cross analyse enabling/disabling factors, we used a table summarizing the ones identified above for the 3 innovations of WAE, AC and MAP (**Table 13** page 86).

Table 13: Cross-analysis of enabling/disabling factors

	Enabling factors (Ef)	Disabling factors (Df)
WAE	**Ef1.** Availability of Aloe in the wild **Ef2.** Prior existence of WAE	**Df1.** Taboo concerning the harvest of Aloe; **Df2.** High opportunity cost due to diversity of livelihood sources, good market access, relatively low price of staple food, and high rate of women employment
AC	**Ef3.** Presence of actors providing trainings **Ef4.** Availability of Aloe seedlings for cheap **Ef5.** Availability of Aloe suckers in the wild **Ef7.** Presence of smallholders already depending on Aloe sap selling through WAE	**Df3.** Low sap prices **Df4.** High investment required and long return on investment; **Df5.** Lack of trust to the project backer smallholder organization; **Df6.** Uncertainties about the promised market through the bio-enterprise **Df7.** Absence of regulatory device till 2008 **Df8.** Availability of Aloe in the wild
MAP	**Ef9.** Presence of actors developing products formulation and labelling **Ef10.** Presence of actors training smallholders **Ef11.** Availability of Aloe on farm	

The cross analysis of the enabling/disabling factors (Respectively noted **Ef1-Ef9** and **Df1-Df6**) of WAE, AC and MAP adoption in **Table 13**, led us to identify the 4 families of enabling factors and 4 families of disabling factors conditioning innovations adoption. These factors relate to the knowledge on the innovation, the interaction between the innovation nature and the environment, and the history contingency.

Enabling factors

- Knowledge access facilitating the innovation adoption (**Ef3, Ef8, Ef9, Ef10)**
- Innovation based on prior-existing practices (**Ef2, Ef7**)
- Availability of inputs facilitating the innovation adoption (**Ef1, Ef4, Ef5, Ef11)**
- Influence of a stakeholder who already adopted the innovation (**Ef6)**

Disabling factors

- Existence of substitutable practice for the innovation (**Df8)**
- Existence of institutions or laws acting as barriers to the innovation adoption (**Df1, Df7)**
- Uncertainties about the benefits generated by the innovation adoption (**Df3, Df4, Df5, Df6)**
- High opportunity cost of innovation adoption due to diversity of livelihood sources, good market access, relatively low price of staple food, and high rate of women employment (**Df2**)

Conclusion of part 5.3.

Beyond the complexity and temporal/spatial diversity that characterize the Aloe Baringo innovation system, the cross-analyze of 3 innovations that correspond to 3 forms of activation of the Aloe resource in Baringo led us to point out one trigger for each innovation, as well as a 6 families of drivers, 4 families of enabling factors and 4 families of disabling factors that have determined the various innovation adoption. ***Figure 23*** *represents them in a synthetic way.*

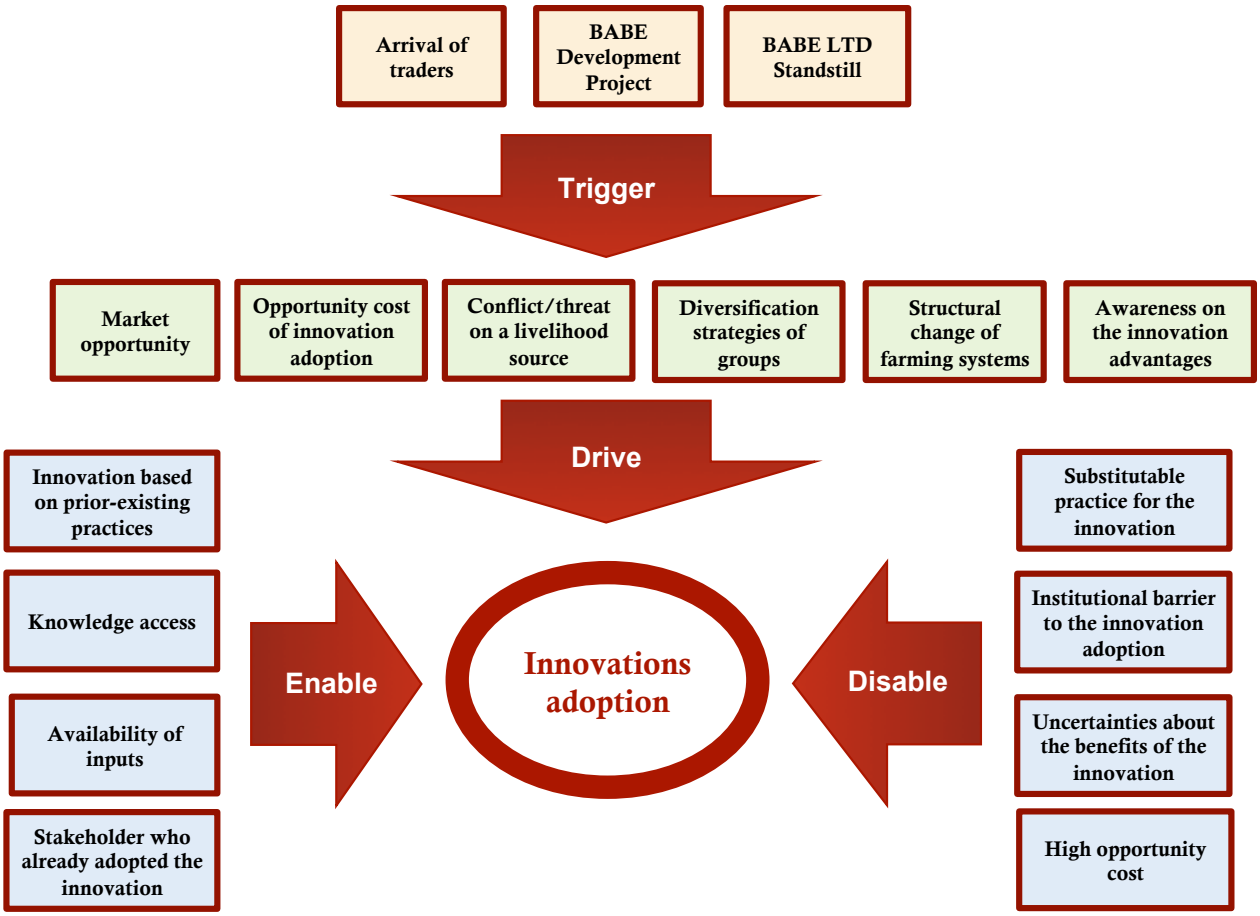

Figure 23: Triggers, drivers, and enabling/disabling factors of WAE, AC, and MAP adoption

5.4. Stakeholder networks analysis

In this section, we show that 4 successive networks of stakeholders have successively emerged and contributed to the adoption, up-scale and institutionalization of the 3 innovations by spreading knowledge and setting up organizations.

5.4.1. Four stakeholder networks

The innovations embedded into 4 successive networks

In Baringo, 4 successive networks of stakeholders have emerged and contributed to the adoption, up-scale and institutionalization of the 3 innovations (**Table 14**).

Table 14: Contribution of each stakeholder networks to the adoption, up-scaling and institutionalization of the 3 innovations

Phases	Stakeholder network	Role of the network in the Innovation Process
Phase 1 (1984-2004)	Non-official supply chain network	Adoption of WAE
Phase 2 (2004-2008)	BABE Development Project network	Adoption of AC
		Adoption of MAP
	Certified Aloe exploitation and trade network	Up-scale and institutionalization of WAE and AC
	Smallholder groups network	Up-scale of AC
Phase 3 (2008-2012)		Adoption of MAP

WAE was adopted through the *Non-official supply chain network*

During the first phase (1984-2004), WAE was adopted through a first stakeholders network involving of the actors of the non-official supply chain (Traders, boilers, traders, and pastoral households) (Stakeholder network N°1 on **Figure 24** page 90). Established in East Pokot in the 80s, and in Radat (Koibatek Division) in the early 2000s, it is through this first network of stakeholders that traders have triggered WAE by training smallholders and boilers, and by providing market opportunity.

AC was adopted through the *BABE Development Project network*

During the second phase (2004-2008), AC was adopted through a second network composed of the stakeholders of the *BABE Project* (Stakeholder network N°2 on **Figure 24**). Established in 2004, this second network of stakeholders was involving KEFRI, KWS, CDTF-BCP, Land Mawe Ltd, and an agro pastoral community of Baringo Division located in Koriema, Kimalel and Sabor. It is through this network that KEFRI has encouraged AC and set up a bio-enterprise designed to become the node of an official supply chain. KEFRI used the incentive of a CDTF-BCP call for proposal to mobilise the community of Koriema, Kimalel and Sabor on the one hand, and Land Mawe LTD on the second hand, and

encouraged the creation of KOKISA CBO (and later KOKISA Cooperative) and of a multiple partnership between KOKSIA-Land Mawe LTD-GoK. Through this network, KEFRI actively promoted AC, by promising future market for sap through Aloe sap processing factory, and by providing appropriate trainings.

AC and WAE were up-scaled and institutionalized through the Certified Aloe exploitation and trade network

Still in the second phase (2004-2008), WAE and AC were up-scaled and institutionalized by a third network composed of the actors involved in certified Aloe trade (Stakeholder network N°3 on **Figure 24** page 90). Established between 2006 and 2010, this third network was composed of CITES, of the stakeholders of the *BABE Project* (KWS, KOKISA CBO, BABE LTD), and of the Aloe Management Units (AMUs) located in all Baringo County. This network was constituted as a result of the enforcement of the AMU certification scheme, which was part of the *National Strategy*, launched by GoK in 2007-2008 to meet the CITES standards for Aloe exploitation and trade. This strategy consisted in the establishment of (AMUs), seen as delineated area with internal management structure where Aloe cultivation and sustainable wild Aloe exploitation are controlled through certification and quotas. KWS used the prior-existing stakeholders and infrastructures built in Koriema, Kimalel and Sabor (the only one existing in the country in fact) as a basis to set up AMUs in all Baringo. Thus a new network was built, involving the players committed to the 2004 public intervention as well as communities located in Baringo North, Koibatek, and East Pokot Division. Through the *Certified Aloe exploitation and trade network,* smallholders from these areas were trained on AC and WAE (with emphasis on sustainable leaf harvesting). Later in 2010, an overarching organization called BABE LTD was created with the help of CDTF-CEF funds, to embrace both AMUs and KOKISA.

AC was up-scaled and MAP was adopted through the *Smallholders groups network*

During the third and last phase (2008-2012), MAP was adopted by a fourth network composed of smallholders' groups and herbalists (Stakeholder network N°4 on **Figure 24**). In the area of Koriema, Kimalel and Sabor where initial CDTF-BCP project was implemented, several smallholders groups were formed or diversified from 2006 with main objective of starting AC. From 2008, the spectre of BABE project failure led these network to diversify their activity by starting MAP.

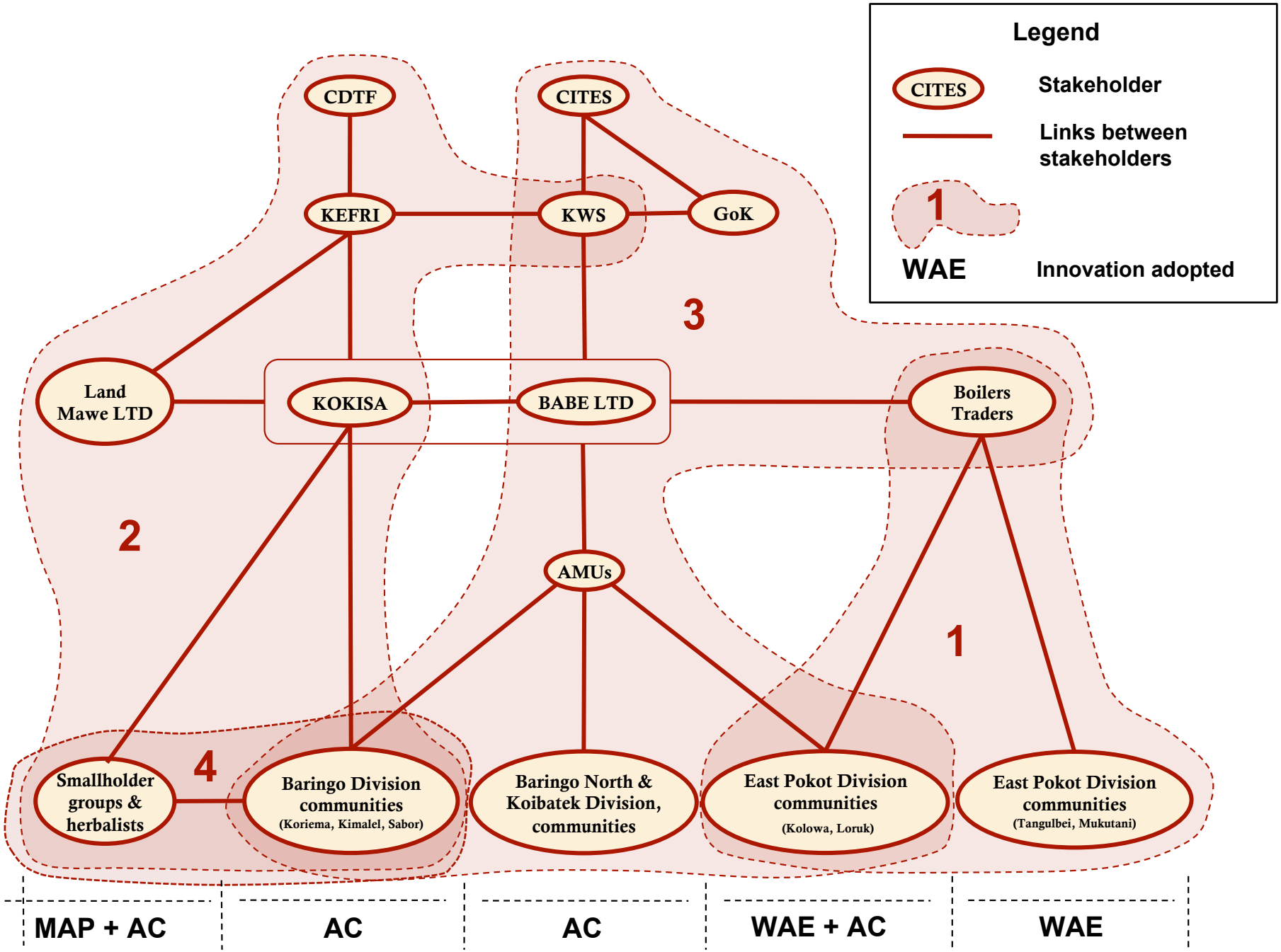

Figure 24: Representation of the 4 stakeholder networks of the innovation process

5.4.2. *Stakeholders networks have emerged and evolved under the influence of each other*

The history described above reveal that each stakeholder networks has emerged and evolved under the influence of the preceding one (**Figure 25**). By initiating WAE in a way posing environmental and social questions, the non-official supply chain stakeholders network has contributed to raise awareness of scientists and policy makers about the economical value of Aloe, and the necessity to regulate its exploitation and trade. In this perspective, the emergence in the 2000s of both *BABE Project* and national regulatory device promoting AC and sustainable WAE can be seen as a response to the issues rose by the first network. For its part, the smallholder group network that has been promoting AC has emerged in the mid 2000s as a sub group of the actors of BABE Development Project, partly in response to the market perspective promised by BABE. Finally, the BABE and AMUs standstill of Aloe gum export at the beginning of the 2010s led both *BABE Development Project* and *Smallholder Groups* networks to diversify activity through the MAP.

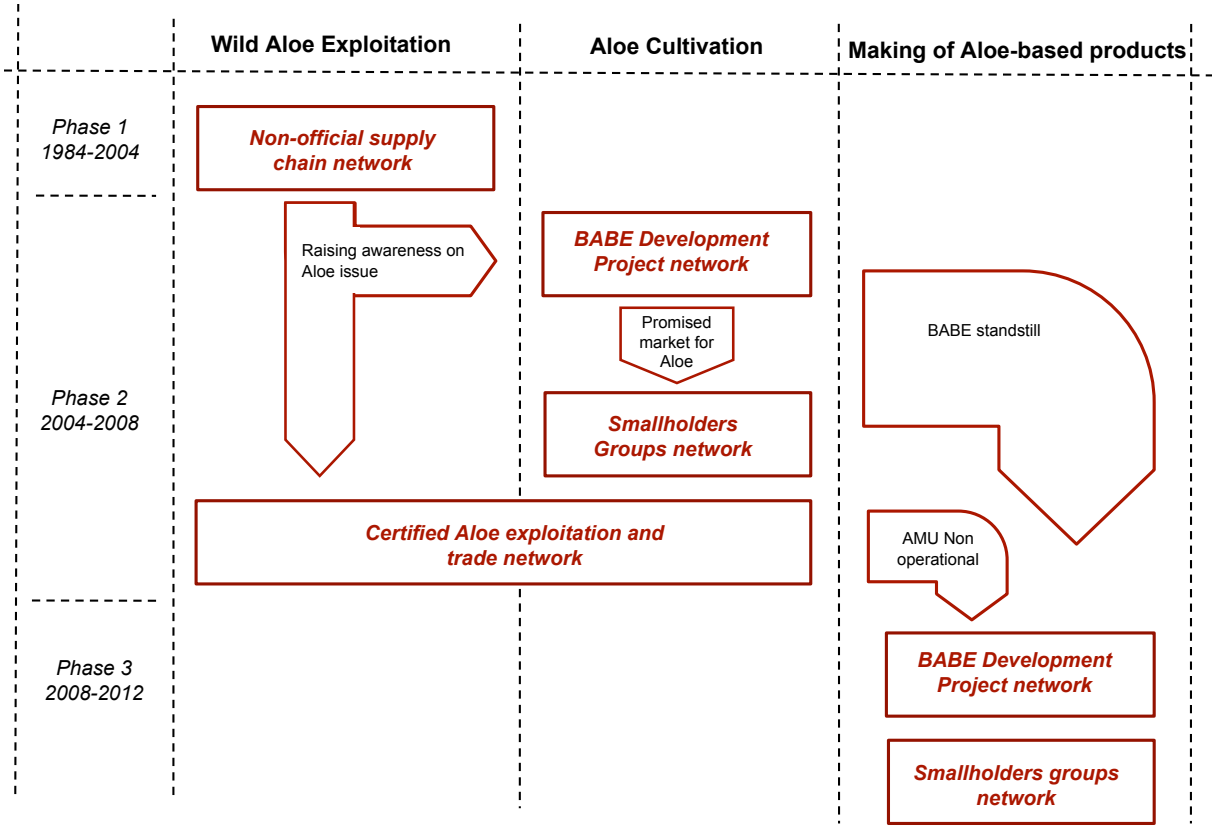

Figure 25: Emergence and evolution of the various stakeholder networks

5.4.3. *The interaction between the various networks explains innovation adoption*

The interaction between the various networks explains a certain number of trends observed in the IP. Firstly, although AC did not take off in most places, and was only adopted with enthusiasm only by smallholders in the places where WAE was already widely spread. On the network map (**Figure 24** page 90), it corresponds to the communities of Loruk and Kolowa, which are at the junction between the AMUs network and the non-official supply chain network. It is also in these areas that smallholders actively responded to the BABE LTD call for supply in 2009. On the contrary, in the places where AMUs were not established

(Tangubei, Mukutani), there was no initiative of AC. In the places where communities were not linked with the non-official supply chain network, AC did not take off, and the buying price proposed by BABE LTD for Aloe sap failed to catching the interest of smallholders (although this buying price was much higher than the one proposed by traders).

Then, MAP was only adopted in the communities of Koriema, Kimalel and Sabor, where smallholders groups had been trained and sometime empowered through the *BABE Project*.

5.4.4. Achievement and challenges of each stakeholder network

By playing a role in the adoption, up-scale and institutionalization of the 3 innovations, each one of the 4 stakeholder networks introduced above have contributed to activate the Aloe resource in Baringo, but are still facing challenges. Achievement and challenges of each network are synthesized in **Figure 26** (page 93). In the discussion of this report, we propose way forward to Baringo Aloe stakeholders, designed to in the light of this diagnosis.

5.4.5. Stakeholder networks and knowledge circulation

Knowledge linked with WAE, AC, and MAP

In this part we rely on the previous analysis of stakeholders networks to emphasized how knowledge has been generated, mobilized, diffused throughout the IP. We begin by describing the various knowledge found in the IP, and identifying the stakeholders that have brought them. We then show how these knowledge have spread throughout the various innovation networks. The knowledge linked with WAE, AC, and MAP are synthesized in **Table 15** page 94.

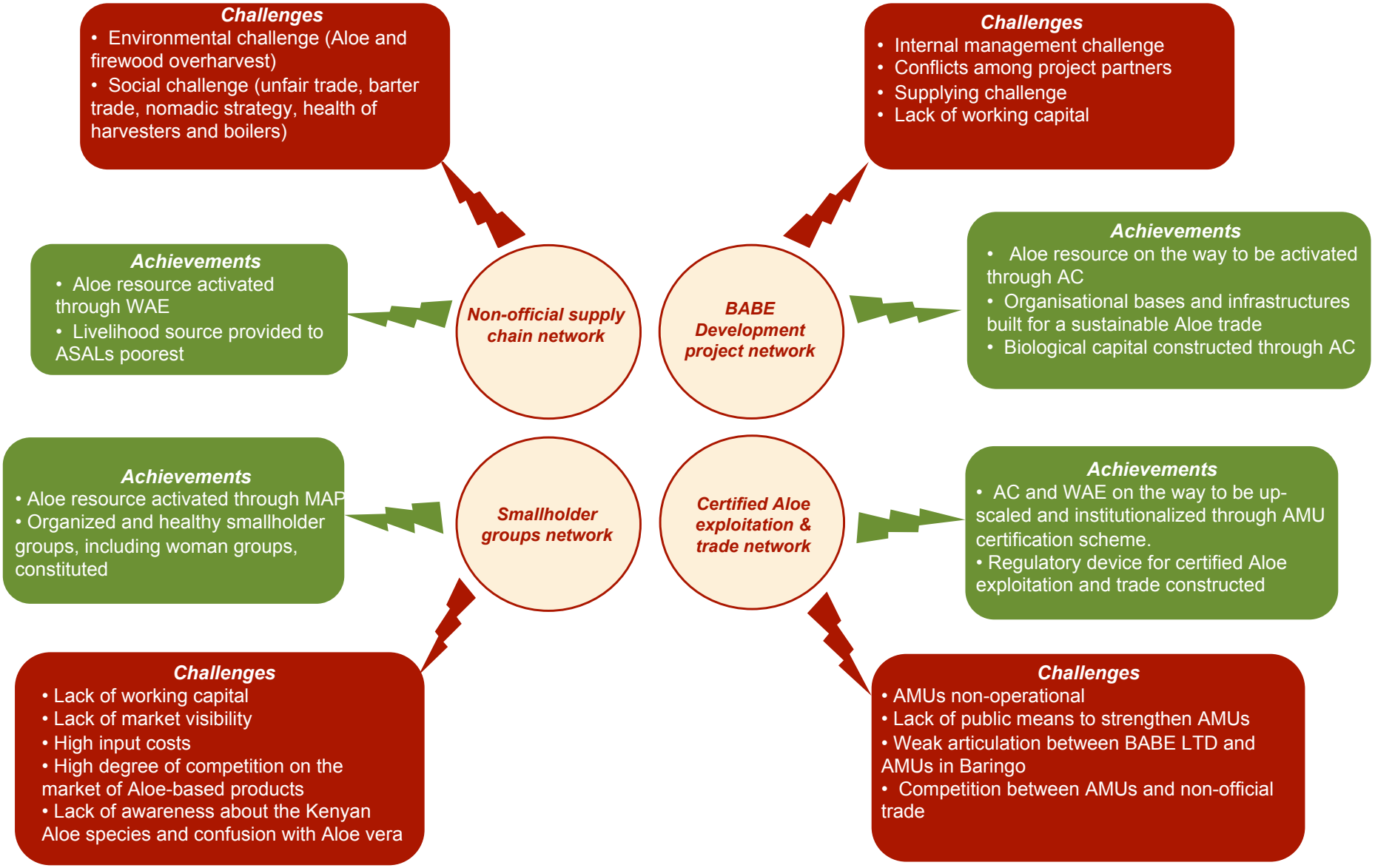

Figure 26: Achievement and challenges of each stakeholders network

Table 15: Techniques and knowledge linked with WAE, AC, and Map

Technique	Corresponding knowledge	Knowledge source
Knowledge linked with wild Aloe exploitation		
Aloe leaf harvesting	Choice of plants to be harvested (3-4 years old minimum), choice of season, cut the leaves starting with the outer layers and work inward, immediately place cut leaves in a slanting position in a receptacle, possibly pill the leaves on to of each other, leaving draining for 30 minutes.	Traders
Sustainable Aloe leaf harvesting	Same than before. The only difference consists in leaving uncut the 2-6 top leaves of the Aloe shrubs while harvesting.	
Aloe sap processing into gum	Boiling of Aloe sap in barrels, in order to transform it into Aloe gum to facilitate further storage and transportation. Boiling time to avoid overboiling	
Cooling of the semi liquid gum	Pouring of the boiled sap on a soft soil or into a semi buried bag which is then closed, and remain cooling during one day.	
Viscosity based purity test	Pouring of one drop of sap on soft soil, or on the border of a basin, and checking weather it retains its shape or it stinks down.	
Sieving of Aloe sap	Using of sieve during or after extraction of sap, in order to get a purified sap or gum. It can be both done before and during the sap boiling.	
Knowledge linked with Aloe cultivation		
Propagation of Aloe from seeds	Seed collection (Identification and harvest of mature ripe pods, pounding of dry pods to extract the seeds), seed sowing (sowing of seeds in furrows and covering with a thin film of soil), and transplanting germinated seedlings into polyethylene tubes.	KEFRI
Propagation of Aloe from suckers	Detachment of sucker from mother plant using a stick, pricking out sucker into a polyethylene tube, or directly transplant in the field.	
Aloe nursery management	Choice of the location and orientation of the nursery, preparation of nursery beds with polyethylene sheet, fencing of the nursery, potting.	
Transplanting seedlings	Choice of the land (well tilled is better), pruning of the root system, selection of seedlings with good growth after 6 months, determination of the spacing (generally 100x100 cm), digging of holes, transplanting and filling hole with humus.	
Maintenance of Aloes crops	Weeding, thinning for Aloes that sucker (e.g. *A. turkanensis*).	
Inter-cropping Aloe	Intercropping of Aloe with maize, beans, and other crops.	
Terracing using Aloe	Double line plantation of Aloe on the border of terraces.	
Knowledge linked with the making of Aloe-based products		
Aloe sap processing into soap and cosmetic products	Using Aloe sap or gum in the formulation of soap, lotion, and other cosmetic produces.	KEFRI
Aloe sap processing into pharmaceutical products	Using Aloe sap or gum in the formulation of medicinal products	Herbalists
Labelling, packaging and Branding	Label and package Aloe-based products.	KEFRI, herbalists

Knowledge circulation

In the Baringo Aloe innovation process, knowledge linked with WAE, AC and MAP (described in **Table 15** page 94) were mobilized and diffused through the 4 stakeholders networks we identified above (**Figure 26** page 93). The way knowledge has spread through these networks is detailed in **Figure 27**. Through the first network, traders diffused the knowledge linked with WAE in most parts of East Pokot Division, and later in Radat (Koibatek Division). They trained smallholder through Madrasa (village meeting) on Aloe leaf harvesting, viscosity based purity test, and in some cases on sustainable Aloe leaf harvesting. They also trained boilers on Aloe sap processing into gum, cooling methods, viscosity based purity test, and sieving of Aloe sap. Through the second network, KEFRI diffused the knowledge relating to AC and MAP to individuals, institutions, and smallholders groups in the area of Koriema/Kimalel and Sabor. Through the third network, KEFRI spread knowledge linked with AC and WAE to other areas in Baringo although it was already known in Loruk. On that stage, boilers from non-official sector were employed by KEFRI to train stakeholders on Aloe sap processing into gum, cooling methods, viscosity based purity test, and sieving of Aloe sap. Through the fourth network, one SHG (Kamasaiwa) mobilized knowledge brought by KEFRI few years ago to start the MAP, and the other group (Sabkor) mobilized the Kamasaiwa experience together with external trainings to start doing the same.

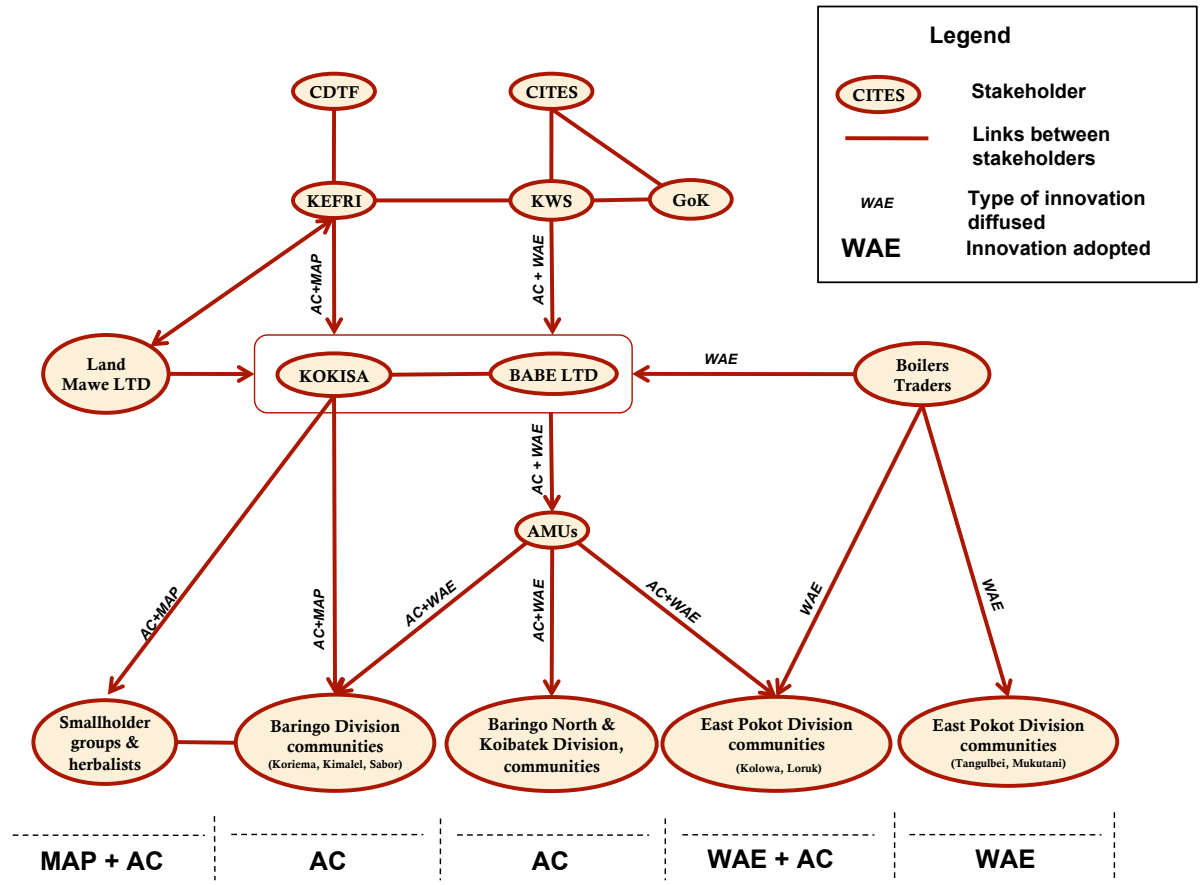

Figure 27: Knowledge circulation in the Baringo Aloe Innovation Process.

Identification of knowledge brokers

The main knowledge brokers in the innovation process were traders, KEFRI, and KWS. Traders had a particularly important role since they were mobilized by KEFRI and BABE to conduct trainings on WAS techniques. We can nevertheless point out that knowledge access was never sufficient for smallholders to adopt any innovations.

Role of knowledge in the innovation process

If knowledge access was always required for actors to adopt innovations, it does not appear to have played a driving role for innovation adoption (see section 5.3). Thus, the use we made of network mapping (**Figure 27** page 95) only allows us to take stock of the way knowledge has spread.

5.4.6. Contribution of indigenous traditional knowledge to the innovation process

Traditional knowledge related to Aloe in Baringo

Our survey shows that in Baringo County, the sap, leaves, and rhizome of *Aloe secundiflora* and *Aloe turkanensis* are extensively used in the preparation of medicine, repellent, and traditional brew for both humans and livestock. **Table 16** (page 97) details the traditional uses of Aloe identified at the conclusion of the Baringo Aloe CCA. Apart from the traditional uses described in the table below, stakeholder often say traditionally "using" Aloe shrubs for soil conservation, although it is not clear weather they actively grow aloe for this purpose or weather they just observed this properties of Aloe in the wild. The only area where we found such practices is Koriema, Kimalel and Sabor, where smallholders grow Aloe in order to stabilize terraces, but only from the late 2000s. In the same line, smallholders often said – and literature reports it - that dry leaves of Aloe are used as fodder for livestock. But our survey show that this so-called use seems to boil down to the fact that smallholders have observed goats eating dry leaves on wild Aloe shrubs.

Contribution of Indigenous Traditional Knowledge to the Innovation Process

It should be pointed out that the Indigenous Traditional Knowledge (ITK) relating to Aloe described in were not mobilized at the Baringo scale, but rather at the national scale. Nevertheless, a study on Aloe innovation process at the Kenyan scale would have shown the fundamental role of ITK. In the 2000s, some urban herbalists from Nakuru and other towns have engaged in the large-scale production and commercialisation of herbal remedies including Aloe ones. For this purpose, they have relied on their knowledge on the various uses of plants, especially the one relating to the use of Aloe sap (**Table 16**). Thus, made-in-Kenya Aloe-based products have appeared on the domestic market competing the imported ones, and the innovative actors that have come up with it relied on ITK on Aloe use.

Table 16: Traditional uses of Aloe in Baringo.

Part of Aloe used	Preparation	Function
Sap of *Aloe secundiflora* or *Aloe turkanensis*	Aloe sap applied to wound	- Protection of wounds from infection, - Accelerate cicatrisation
	One drop of Aloe sap	- Traditional glue on arrow
	Aloe sap applied to teeth	- Weaning of children
	Aloe sap diluted with water, mixed with honey, and drunk	- Human medicine against stomach acidity, stomach upsets, bile problems, diarrheal, malaria, typhoid. - Gastric washing - Antivenin
	Aloe sap diluted with water, and drunk.	Livestock medicine against coccidies, (Poultry), Newcastle Disease (Poultry), and Contagious Caprine Pleuropneumonia (CCPP) (goats)
	Aloe sap diluted with water, and spread on the infected zones	- Livestock medicine against foot and mouth disease (cows) - Livestock antibiotic used on ticks bites (goats) - Livestock repellent for the ticks
Leaves of *Aloe secundiflora* or *Aloe turkanensis*	Fresh leaves burnt and grinded till it becomes a powder	- Human medicine against stomach problems
Rhizome of *Aloe secundiflora* or *Aloe turkanensis*	Rhizome boiled, resulting liquid mixed with honey, soup, milk, or soda	- Medicine against children stomach diseases
	Rhizome cut in 2 parts, spread grinded charcoal on it, and put it in a mix of honey and water, Wait 4-5 days	- Traditional alcohol called Maratina, consumed during festive occasions

5.4.7. Embedding of the innovation Process into projects

The innovation process is embedded into several projects that have contributed to the various innovation adoptions, but had limited impact. During the 2000s decade, several public interventions were undertaken in Baringo, so as to promote AC and the bases of a regulated export supply chain of Aloe gum (see table in **Appendix 14**). The first one is the Baringo Aloe Development Project *(BABE Project)* that occurred in 2004-2005. It aimed at promoting AC and at building up an Aloe sap-processing factory owned by a community owned enterprise in Koriema, Kimalel, and Sabor. During the project implementation, SNV provided complementary funds to train KOKISA Project Implementation Committee on internal management. In 2007, KEFRI used its annual budget to BABE to support the creation of new AMUs and to strengthen the existing ones so that KOKISA could get a KWS license to exploit Aloe. From 2008 to 2010, a new project was implemented thanks to CDTF-CEF funding, so as to develop the BABE factory's infrastructure, to build the capacity of KOKISA/BABE LTD, and to link the *BABE Project* stakeholders to the various AMUs (by forming an overarching organization called *BABE LTD*). In 2010, in a context of standstill of the certified gum trade, KEFRI reoriented its support to *BABE LTD*, by putting aside the support to gum production and commercialization, and by focusing on helping the organization to start the production and selling of soap. In total, these public interventions represent an input of around 16 million KsH (around 142 000 euro). However, we showed that this succession of projects has had a limited impact so far in term of innovation adoption.

Interviews of Land Mawe LTD and KEFRI representatives explain this by remarking that the various interventions were not well coordinated, and sometime rushed. It also appears to us that in the first project, means attributed (in term of scale and time) were insufficient compared with the ambition of the project, and that the following projects were in fact a succession of punctual interventions designed to fill the gaps left by the first project, or to propose exit strategy (through the MAP with the last KEFRI support to BABE).

Conclusion of part 5.4.

WAE, AC and MAP were adopted, up scaled and institutionalized through 4 stakeholders networks, that have successively emerged and contributed to a beginning of the Aloe resource activation in Baringo. They did so by mobilizing and disseminating knowledge and above all by raising issues that have encouraged further innovation adoptions.

6. Discussion

In this section, we discuss our findings in the light of the research issues listed in section 2. We begin by a rapid synthesis on how the innovation process unfolds, and we highlight its key features. We then discuss weather the innovation process has contributed or not to transform *Aloe secundiflora* and *Aloe turkanensis* into an economical resource, and to what extent it has mitigated poverty and environmental threat in Baringo ASALs. We finish by discussing the interests and limits of the method we employed, as well as of the JOLISAA case study approach.

6.1. How did the Baringo Aloe innovation process unfold?

The Baringo Aloe case is a 30 years innovation process characterized by 3 periods of time during which 3 innovations - Wild Aloe exploitation (WAE), Aloe Cultivation (AC), and the Making of Aloe-based Products (MAP) – have been adopted, up-scaled, and institutionalized. During the first period (1984-2004), WAE was adopted in Northern Baringo, triggered by the arrival of Aloe traders who built a non-official export supply chain of Aloe derivates. During the second period (2004-2008), the social and environmental issues raised by WAE led to 2 major public interventions in Baringo County, that constructed the bases of a certified supply chain following the CITES (Convention on International Trade of Endangered Species) specifications: The first one was a project called *BABE Development Project* (BABE Project) in a restricted area of Southern Baringo, that has encouraged AC, constructed a sap-processing factory, and created of a community owned bio-enterprise (BABE LTD) designed to supply the international market with Aloe gum. The second one consisted in the enforcement of a new legislation in all Baringo through the setting up of local regulatory organizations (Called Aloe Management Units) in charge of up-scaling and institutionalizing WAE and AC. But while in the BABE Project intervention zone, AC was timidly adopted, the AC knew more success in Northern Baringo, where less public effort had been invested, but where smallholders were already relying on WAE for their livelihood. During the third period (2008-2012), a standstill of the certified trade of gum led AC adoption and up-scaling dynamics to be hindered, and encouraged several smallholder groups empowered by BABE project to diversify through the MAP. Thus, these 3 innovations were adopted, up scaled and institutionalized through 4 stakeholders networks, that have successively emerged and contributed to a beginning of the Aloe resource activation in Baringo. They did so by mobilizing and disseminating knowledge and by raising issues that have encouraged further innovation adoptions.

6.2. What are the key features of the innovation process

All the trends already identified for the JOLISAA inventory (Triomphe et al., 2012) were reflected in the Baringo Aloe innovation process. Indeed, we observed the occurrence of 3 “innovation bundles” (WAE, AC and MAP), as well as a relatively long time frame (30 years), the strategic importance of market opportunities as a driver, the key role of externally-funded projects as a trigger (BABE Development project followed with other project). Our investigation allowed us to identify other trends as well, such as the important role of opportunity costs in innovation adoption, the fundamental role of market agents as knowledge brokers, the high degree of smallholder innovativeness, especially when groups were

preliminary empowered, and the importance of already established stakeholders networks. Another specificity of this innovation process is the existence of spatial divergences in the process of adoption of the various innovations. They result from strong socio-economical divergences within Baringo.

6.3. Has the innovation process contributed to transform Aloe into an economical resource for ASAL?

We made the assumption that *Aloe turkanensis* and *Aloe secundiflora* were transformed into an economical resource through 3 successive innovations: WAE, AC and MAP. Our results suggest that WAE, AC and MAP represent in fact 3 increasingly elaborated forms of Aloe resource activation. First, WAE through non-official supply chain has definitely activated the Aloe resource in the Baringo ASAL. Then, AC has emerged in the perspective of supplying sap to BABE LTD factory as a technically more elaborated form of Aloe resource activation. One of its potential interests is to decrease dependency on a sensitive and conflictual resource. Finally, MAP has emerged as a third form of valorisation of the Aloe resource in Baringo, involving a range of new knowledge and techniques, and led to a high value addition on the Aloe sap.

However, the process of transformation of the Kenyan indigenous Aloe species into a sustainable economical resource for Baringo ASAL has only begun up to now, and it has not yet reached a point where it can be considered as achieved and sustainable. First, several evidences tend to show that WAE through non-official trade is not a sustainable way to activate the Aloe resource. Then, BABE LTD is today blocked, and AMUs are not operational. This situation prevents stakeholders from benefiting from the certified trade AC and certified WAE, and thus to transform cultivated Aloe into a direct income source. Finally, it has to be emphasized that the MAP initiatives are only implemented at a very small scale, and the transition from handcraft to industrial production is made difficult due to the lack of working capital and investment capacity of the involved stakeholders. Moreover, the latter face a highly competitive market.

On the other hand, the various activities implemented so far led to the construction of resources, which are still immature but usable as a strong basis for further projects. Indeed, at the Baringo scale, the various public interventions have conducted to organisational innovations and an infrastructure development enabling BABE LTD to become the node of a certified Aloe supply chain. They also led to the creation of a know-how and a biological resources - through cultivated Aloe that were not removed - potentially useable if BABE LTD was revived. At the national scale, the establishment of a legal and administrative framework is a strong achievement, and it owes partially its existence to the BABE Development project. Thanks to this regulatory device, Aloe is today recognised as commercial species in Kenya, and the country meets the CITES requirement thus allowing it to trade Aloe products on international market. This institutionalization of the Aloe exploitation and trade, enables any organized smallholder organization to set up an AMU, and to start the cultivation and commercialization of Aloe derivates. In the next future, further public interventions may rely on the existing stakeholders, organizations, knowledge, and already established Aloe plantations, and put the finishing touches leading Aloe to become a sustainable resource for Baringo dry lands.

6.4. Has the innovation process contributed to reduce poverty and marginalization among ASAL communities in Baringo?

We had made the assumption that innovation process had contributed to poverty mitigation among the marginalized pastoral communities living in Baringo ASAL. Our study suggests that although the innovation process has brought a new livelihood source in Baringo ASAL, it has at the same time increased inequalities and marginalization of pastoral communities.

On the one hand, WAE has been providing a livelihood source for the poorest pastoral households in Northern Baringo, to the extent that in some places, this activity became the second livelihood source (e.g. Kolowa). On the other hand, the market mechanisms (price taker position of Aloe harvesters, low buying prices, recourse to barter trade) and the nomadic strategies employed by the non-official trade agents do not benefit to the Baringo ASAL communities. In a way, they contribute to the economical marginalization of pastoral household, and especially women, who are somehow trapped into an unfair and unreliable relation of dependency toward the increasingly endangered Aloe resource (due to uncontrolled WAE).

Our study also suggests that AC and certified WAE through BABE project and AMUs provided only very few benefit to ASAL communities, and rather contributed to widen inequalities. Indeed, BABE Development project represents a high public investment aiming at promoting AC and building a community owned bio enterprise, with the underlying idea to set the bases of a fair and sustainable Aloe supply chain. But AC had no significant direct effect on smallholders' income, since BABE LTD only bought Aloe sap to AMUs twice. The only exception occurred in Loruk, where Aloe growers were harvesting their Aloe field to supply boilers, before the latter withdraw. Nevertheless, in places where AC was adopted, smallholders got indirect benefit from it since it provided services to the other compartments of agro pastoral/pastoral livelihood systems (soil-conservation, water retaining, grass establishment, bee forage).

But the greatest paradox comes from the fact that *BABE Project* as well as most public interventions in relation with Aloe, targeted a zone that was not among the poorest, and where WAE was not occurring. For a number of reasons, partly inherent in the geographical location of the public research/extension actor that was behind the project, the latter was implemented in Koriema, Kimalel and Sabor locations, an agro pastoral area of Southern Baringo where WAE was not occurring, and where livelihood sources were relatively diversified compared with Northern Baringo where poverty-driven WAE was occurring. Even though the bio-enterprise expected catchment area was very large (all Northern-Western Kenya), the 11,7 MKsH CDTF-BCP project was implemented in the restricted areas of Koriema, Kimalel and Sabor. The next strong public intervention in Baringo (a 1,56 MKsH SNV project implemented in 2006) was designed to strengthen the organisational capacity of KOKISA CBO, again in the same areas. The third and last project (3,03 MKsH in 2008) was the only one targeting all Baringo County since one of the objectives was to set up operational AMUs all over the County, and link them to BABE LTD. But only 4% of the budget was allotted to the AMUs establishment (it explains why AMU creation was rushed), while the rest of the funds came to support KOKISA CBO internal management and develop the Koriema factory. The fact that AMUs establishment was not enough supported also came from a lack of public supports in legislation enforcement and National Strategy.

Last, the MAP contributed to the livelihood of already innovative smallholders groups in the Koriema area, but this did not happen in the pastoral areas of Northern Baringo, probably because no prior-existing smallholders groups had been created in this area.

6.5. Has the innovation process contributed to decrease pressure on wild Aloe resource and to improve management of natural resources?

Our assumption was that the innovation process had led to a sustainable management of the Aloe resource through Aloe cultivation in the Baringo dry lands. Our finding suggests that WAE, AC, and MAP have had various environmental impacts. As already mentioned, WAE may have often led to environmental concern due to overexploitation of wild Aloe and of firewood used for boiling. For its part, although AC had been promoted as a way of decreasing pressure on wild Aloe, the environmental consequences of AC adoption are unclear. In Koriema, Kimalel and Sabor, where AC was first promoted, WAE was not occurring in the past. So it is likely that AC did not contribute to decrease human pressure on Aloe resource. Moreover, Aloe plantations were often established buy using Aloe suckers or mature plants drawn from the wild (instead of Aloe seedlings), which raise questions about the environmental impact of AC in Koriema, Kimalel and Sabor. That said, AC may have had positive effect on the overall ecosystems since it contributed to improve soil conservation through the cultivation of Aloe bordering terraces. In Loruk, AC adoption also relied on wild suckers, and it led smallholders to focus on their cultivated Aloe to supply boilers. So this innovation has potentially decreased the pressure on wild Aloe. In Kolowa, AC has started recently, and is not used yet to supply boilers for the cultivated plants are not ready yet able to produce. Finally, as far as MAP is concerned, there are probably no positive or negative environmental consequences, given the low amounts of Aloe sap used in the MAP.

6.6. What has hindered the innovation process?

We made the hypothesis that the IP had been hindered in its development by external shocks that had caused competitiveness loss in the community owned bio-enterprises. Our findings lead us to correct this statement. First we can say that IP components have not all been hindered: only AC development, and WAE upscale and institutionalisation have suffered from these external shocks. Our investigation also suggests that these trends were in fact due to the BABE LTD standstill, and to the weak AMUs enforcement. Contrary to our first assumption, this situation of BABE LTD and AMUs was not caused by external shocks, but rather by internal problems within BABE LTD, triggered by a lack of public supports to the enforcement of the certification scheme. Finally, our findings suggest that although AC development and WAE upscaling and institutionalization have been hindered, they are very susceptible to restart quickly if BABE LTD and the AMUs would be operationalized. Baringo smallholders are only waiting for a remunerative and tangible market.

6.7. Interests and limits of the methods used for the study

Even though the Baringo Aloe Collaborative Case Assessment (CCA) led to consistent results, it also met limits that we point out here.

The first critic is that the CCA team met difficulties to implement the innovation system approach. Despite the clarity of the CCA guidelines, the CCA team met many difficulties to understand the complex innovation system approach. This situation conducted its members to often lose sight of the overall JOLISAA research objectives – to understand how the innovation process unfolds – to focus on trying to answer local research questions (e.g. Why the Baringo Aloe Bio Enterprise entered in a standstill), or to stick to classical assessment approaches for which members were comfortable with (e.g. Supply chain analysis). This was probably reinforced by the fact that there was not a clear method to assess innovation systems proposed by JOLISAA's WP1.

Another point of criticism refers to General Group Discussions (GGD). The 3 GGD we undertake were critical steps of the data collection procedure, and they led the CCA team to collect consistent and contextual data on the Baringo Aloe innovation process. However, they didn't allow the team to consider the internal variability in the testimonies and opinions of participants and in certain cases, questions only led to consensual and "politically correct" answers. Indeed, the method that was used – a facilitator following semi structured interview guide and noting collective answers on a flipchart – implied that each question asked to the assembly resulted a single answer, outcome of discussions and negotiations among GGD participants, sometimes influenced by power games. This gap could slightly be offset by individual interviews, although time did not allow us to survey enough Aloe farmers and wild harvesters. In addition to these problems, we couldn't catch all the GGD and interview's details since a part of them was conducted in Kiswahili language, without possibility to get translated all steps of discussions.

Last but not least, we should also point out that the attempt we made to give meaning to the complex history of the Baringo Aloe innovation process led us to probably not focus enough on economical analyses that could have strengthen our results. To give just a few examples, we could have calculated exportation costs, value addition repartition within the agents of the Kenyan Aloe supply chain, and opportunity cost of WAE and AC in both Northern and Southern Baringo. We also could have compared the economical yield between WAE and AC considering different surfaces exploited.

6.8. What are the interests and limits of the case study approach employed in the thesis?

The main interest of the case study approach implemented through the Baringo Aloe CCA was obviously to move from the complex theory of innovation systems to practice. By doing so, we unavoidably fall into the complicated and contingent nature of innovation systems. On the other hand, the case study approach led to the identification of recurrent drivers, as well as to the understanding of the reasons of project and policy failures. The limit of the single case study approach is that the drivers, triggers, and enabling factors found, as well as the final messages to public policies are hardly generalizable. Thus, the ones we produced were mainly dedicated to feed the overall JOLISAA cross-case approach, which may lead to go beyond this limit.

7. Way forward and Policy messages

In this section, we propose some ways forward to the stakeholders involved in the Baringo Aloe innovation system, and especially to Government of Kenya and donors. Out of this innovation case, we also draw a certain number of messages dedicated to the public policies and donors involved in the fostering of multi-stakeholder rural innovation systems in Sub-saharan Africa.

7.1. Which way forward could be suggested for the stakeholders involved in the Baringo Aloe innovation system?

7.1.1. Way forward for non-official supply chain

- Recognize the non-official supply chain as a key player
- Encourage the non-official trade agents to get gradually involved in the various AMUs.
- Foster customs and on-site controls.

7.1.2. Way forward for BABE LTD

- Revitalize BABE LTD through an enhanced organizational support and monitoring, and through the creation of a new partnership with Land Mawe LTD or another private investor. This could include a redefinition of the share and role of each project partner in the bio-enterprise.
- Continue to decentralize the Aloe-sap processing at the AMU level.
- Redefine the role of the BABE LTD factory by focusing on 3 activities: large scale production of Aloe-based products, storage of the gum collected in the various AMUs and negotiation with exporters, and Aloe-based tourism catching the lake Baringo/Bogoria touristic flux.
- Strengthen the existing links with AMUs, before linking BABE LTD to new ones.
- Revise the formulation of the BABE soap and apply for a KEBS certification
- Enrich the range of BABE products
- Link up BABE LTD to fair trade operators so that the Baringo Aloe gum and Aloe-based products could find a remunerating market niche.

7.1.3. Way forward for certified Aloe trade

- Attribute a budget to the implementation of the *National Strategy for Management and Trade of Commercial Aloe Species*
- Operationalize AMUs by providing a constant support to their internal management
- Allow AMUs to operate independently from BABE LTD.
- Promote AMUs as an arena of negotiation between Aloe traders and smallholders.

- Develop a KEBS standard for Aloe gum.

7.1.4. Way forward for smallholders groups

- Promote an up-scaled activity and improve quality management for existing smallholders groups by linking them with donors;
- Develop interaction with BABE LTD, so that means could be shared to access new markets;
- Orientate to cheaper kind of oils than coconut oil as a raw material

7.1.5. Way forward for public research and development

Foster research on:

- Non-official Aloe supply chain functioning to facilitate convergence toward certified trade;
- Aloe cultivation techniques and Aloe varieties development so as to increase yields;
- Ethno pharmaceutical uses of commercial Aloe species to better understand their biological and medicinal properties, and to formulate new or improved cosmetic and pharmaceutics products;
- Alternative Aloe sap processing methods, using solar energy for instance;

7.2. What policy messages can be drawn from the Baringo Aloe case?

7.2.1. Projects aiming at tackling a particular issue should be implemented in the places where this issue exists.

The *BABE Development Project* emerged as a result of a 20 years raising attention period, at the conclusion of which an Aloe-based public initiative had been identified as a pertinent way of addressing the double challenge of poverty and uncontrolled WAE in Kenyan ASAL. But the project in question was implemented in the area of Koriema, Kimalel, and Sabor, where livelihood sources were already quite diversified, and where wild Aloe was not threatened by uncontrolled WAE. Even though the expected operation scale for the bio-enterprise was larger than this restricted area, it appeared that most public intervention to promote AC, empower smallholders, and bring required assets were not concentrated in the most problematic areas, thus contributing to an increase in spatial inequalities among Baringo smallholders.

7.2.2. In ASALs, massive investment is required to decrease spatial inequalities

The Baringo Aloe case shows us that one of the main reasons why *BABE Development Project* was not implemented "at the good place" was a lack of access to the targeted communities. As already mentioned, the real potential beneficiaries for an Aloe-based project were the smallholders located in East Pokot (Northern parts of Baringo County). But for KEFRI (the Kenyan public organization implementing the project), an intervention in East

Pokot was difficult due to the poor level of roadway infrastructure serving this area, to recurrent tribal conflict climate, and to the absence of a KEFRI centre important enough to implement such a project. The limits of the *BABE Development project* intervention strategy somehow reflects the fact that ASAL were neglected in the past, and shows us that without prior massive investment in ASAL for infrastructural development, peace keeping, and for research/extension services development, any project or public policy aiming at addressing a specific issue or sub-sector's challenge might fail.

7.2.3. Opportunity cost of adopting an innovation should be calculated before innovation to be promoted.

In Baringo district, BABE Aloe sap supply through AMUs was more easy and reliable in Loruk, Radat and Kolowa, although these areas are more far away from the factory, and have received less external support than Koriema, Kimalel, and Sabor. This difference of responsiveness to the BABE call for supply is mainly explained by differences in opportunity costs, linked with deep contrasts in socio-economical context (poverty level, market access, food price, family organisation to name just a few). This situation somehow hinders the capacity of BABE to supply the international market, for half of its catchment area is not able to supply properly the factory, and the other half is not easily accessible to BABE. This situation could have been anticipated (and the place of intervention better selected) before the project start by calculating the opportunity cost of harvesting Aloe in relation to the market price for sap in the different targeted zones.

7.2.4. There are more chances of successful outcome when innovation builds on existing smallholder practices or stakeholder networks.

In the Baringo Aloe case shows, various example tend to show that relying on pre-existing practices/stakeholder networks for innovation diffusion could be more effective and less risky than creating a new one.

Opportunity cost considerations put aside, the difference of responsiveness to the BABE call for supply is explained by prior differences in wild Aloe harvest and sap selling to boilers. In Loruk, Radat, and Kolowa, a high degree of dependency on Aloe linked to informal trade, the integration of Aloe harvest into family organisation, and the indigenous knowledge on harvesting and boiling practices, facilitated the supply of sap to BABE. Further, stakeholders in these areas were willing to sell their production to BABE because the prices it proposed was higher than the one proposed by boilers. In Loruk, prior existence of Aloe business also raised the awareness of non-involved stakeholders on the economical interest of Aloe, leading them to start medium scale domestication project (0,5 to 4 ha) when they knew BABE factory was to open. In the other livelihood zones (Koriema, Kimalel, Sabor), absence of prior Aloe-based activities constituted an obstacle to the adoption of Aloe domestication and commercial harvest. This statement is closely linked to the preceeding one, as the pre-existence or non pre-existence of informal trade is an indicator of sufficient/insufficient opportunity cost to adopt an innovation.

In Baringo, the choice of short cutting the stakeholders network involved in non-official Aloe trade led to failure, adverse effect, and mistakes. Although a non-official Aloe supply chain was already organized and efficient, the choice was not to support its stakeholders toward certified trade, but to shortcut their network by creating a new one. Thus, BABE LTD and AMUs were created, with main purpose to set and organize a certified Aloe supply chain in

accordance with CITES, and to progressively replace the informal Aloe trade that was accused of threatening wild Aloe through overharvest. Unfortunately, the lack of funds to support BABE LTD internal management and the establishment AMUs of as well as administrative slowness led to the emergence of a weak network of un-prepared stakeholders, unable to organize certified Aloe trade. The choice of short cutting the network of non-official trade led to other problems. In the Kenyan context where non-official trade is not tackled (no law enforcement, porous police and customs), BABE LTD found itself competing with non-official trade, both for sap supply at the AMU level, and for export market access. This situation did not play into the hands of BABE LTD, and led to adverse effects. For instance, in Loruk and Kolowa where informal trade was still operating when BABE delivered its first sap orders, the arrival of BABE generated an increased overall demand for sap, leading boilers to increase their buying price and smallholders to harvest more than usually. Apart from being challenged for sap supply, BABE was also less competitive on the gum export market than stakeholders of the non-official supply chain because of certification costs and start-up time of the KWS certification mechanism. Eventually, the choice of short cutting the network of non-official trade led to mistakes in the logistical planning of the certified supply chain. The BABE LTD factory initial purpose was to boil and pack the sap bought in the different AMUs. But deterioration of sap quality due to long storage as well as high transport costs of the sap from the different AMUs to BABE factory led to a strategy change. Aided by KEFRI, BABE trained boilers in the most distant AMUs (Kolowa, Loruk, Olduka) so that gum could be bought instead of sap. By doing so, the factory lost somehow its main reason for existing (processing sap into gum), since only the less productive AMUs (Koriema, Kimalel, Sabor) could continue to supply sap. The BABE LTD factory became no more than a point of collection for Aloe gum. However, a preliminary examination of the non-official supply chain organisation would have probably emphasized the difficulty represented by the remoteness of the Aloe sap producing places. Indeed, in the context of non-official trade, boiling activity is decentralized, allowing middlemen to come every 3 month to collect gum, and to store it in Marigat. Thus, what BABE story teaches us is that building upon pre existing network of stakeholder could be less risky, less expensive, and more efficient. This hypothesis is supported by the fact that the most important innovation brokers of the Baringo Aloe Innovation System are the stakeholders involved in the illegal trade, and that they have been promoting good harvest practice from the early 2000s.

7.2.5. Resources should match expected ambitions of projects/organizations.

Several examples found in the Baringo Aloe story show us that a success factor is a good balance between expected scale/complexity of action of projects/organizations and the means available to support and monitor them. KOKISA CBO (and later BABE LTD) was created with the purpose of organizing and sustaining a certified Aloe supply chain in a huge catchment area including south Baringo, the whole Kerio Valley, the Tugens hills, and the Lake Baringo. Its mandate included complex logistical and technical tasks such as the management of long distance transports, the monitoring of AMUs, the processing of sap into gum and end products (soap, lotions), the search for market opportunities, and the request for KWS permits. Thus, the scale and mission attributed to KOKISA/BABE LTD were calling for high organizational capacity. Unfortunately, there was a weak follow up and organizational support of KOKISA CBO PIC (and later BABE LTD PIC), in stark contrast to the ambition of the project in terms of expected scale and organizational capacity of stakeholders. It led to most of the challenges BABE LTD is today facing (lack of working capital, internal management issues). Moreover, the external support to BABE LTD stopped

only one year after the official beginning of its activities. On their side, AMUs were created so as to become operational units managing the Aloe resource. But lack of funds for the implementation of the National Aloe strategy led to the failure of AMUs in their purpose of regulating and monitoring the production of Aloe sap. Instead of becoming delineated area with internal management structure and production standards, AMUs remained basic point of collection for sap. On the other hand, Kamasaiwa and Sabkor were successful although they had received less external support (including support aiming at building organisational capacities). One factor that could explain their success is a relatively low geographical operational scale, that simplify the internal organization and communication between members.

7.2.6. In projects backed on multi-stakeholders partnership, rigorous recording of partners contribution is a basis for sane relationship.

In Baringo, absence of clear records able to inform the contribution and activity of each partner of the BABE Development Project led to misunderstanding and conflict. More precisely, the conflict generated by the controversial contribution of Land Mawe LTD on the one hand, and the conflict generated by the unclear use of the KOKISA CBO assets on the other hand, led to a climate of misunderstanding and hostility between and among the BABE Development project stakeholders. The latter hampered many years the signing of an authoritarian MOU between them, discouraged smallholders from investing in AC, and finally conducted Land Mawe to step down.

7.2.7. Inappropriate public policy can stimulate innovativeness.

In Kenya, although the presidential ban on commercial Aloe harvest had no significant effect on the ground, it contributed to raise attention on the potential of Kenyan indigenous Aloe species to become a resource for drylands, which led to consistent changes some years later. The 20 years period of growing attention on the Aloe issue led number of national and international research and development institutions dealing with rural development and management of natural resources to start research programs and projects on Aloe. The major materialization of the process triggered by this “inefficient” policy was the implementation of the BABE Development Project in Baringo.

8. Conclusion

In Baringo Arid and Semi Arid Lands (ASALs), pastoralists' livelihoods are weakened by hostile marketing systems, environmental degradation, and inappropriate or insufficiently funded past development policies. To address the double challenge of poverty mitigation and sustainable use of ASAL resources, the promotion of a sustainable exploitation of ASALs' resources has been identified by Government of Kenya (GoK) as a policy priority. Among other natural products found in ASALs, Kenyan indigenous Aloe species have been described as particularly interesting livelihood diversification options, since these plants were adapted to dry condition, and their sap had a commercial value.

The Baringo Aloe case is a 30 years innovation process characterized by 3 periods of time during which 3 innovations - Wild Aloe exploitation (WAE), Aloe Cultivation (AC), and the Making of Aloe-based Products (MAP) – have been adopted, up-scaled, and institutionalized. They represent 3 successive and increasingly elaborated forms of Aloe resource activation. However, the process of transformation of the Kenyan indigenous Aloe species into a sustainable economical resource for Baringo ASAL has not yet reached a point where it is achieved. Moreover, our study suggests that the process of activation of the Aloe resource in Baringo has reproduced the past dynamics of marginalization and natural resource degradation of ASALs. On the one hand, a non-official Aloe supply chain maintains a market mechanism that traps pastoral household, and especially women, into an unfair and unreliable relation of dependency toward the increasingly endangered Aloe resource. On the other hand, projects designed to address ASAL challenges and Aloe uncontrolled exploitation through an Aloe-based initiative somehow "missed the target", and left aside Northern Baringo pastoral communities. In the meanwhile the national Aloe regulatory device was weakly enforced, due to a lack of fundings for the implementation of the AMU certification scheme. Thus, the Baringo Aloe innovation process reveals the limits of projects and public policies aiming at addressing the double challenge of poverty mitigation and sustainable management of ASAL resources. By being highly shaped by difficulties to access targeted communities, their intervention strategy contributed to increase spatial inequalities.

Nonetheless, the various public interventions implemented so far led to the construction of organisational, institutional, biological, and knowledge resources, which are still immature but usable as a strong basis for further projects.

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List of Appendixes

Appendix 1

The JOLISAA institutional partners and their role in each Work Package.

The JOLISAA institutional partners are CIRAD (International Research Centre in Agriculture for Development), WUR-LEI (Agricultural Economics Research Centre of Wageningen University), ICRA (International Centre for development oriented Research in Agriculture), ETC Foundation in Europe, as well as KARI (Kenya Agriculture Research Institute), UP (University of Pretoria), and FSA-UAC (Faculté des Sciences Agronomiques of the University of Abomey-Calavi) in Africa (**Table**). While CIRAD is in charge of the overall coordination of the JOLISAA project (WP6) and the Assessment of agricultural/rural innovation experiences (WP2), WUR-LEI main mission is to develop an integrated framework and approach for assessing agricultural/rural innovation systems and local/traditional knowledge (WP1). The mandate of ICRA is to strengthen capacities of all JOLISAA partners to assess and learn from their own experience (WP3), and the one of ETC Foundation is to facilitate the sharing, learning together and disseminating of information (WP4). The African partners represented by KARI, UP, and FSA-UAC are respectively the JOLISAA national convenor for Kenya, South Africa, and Benin. They co-lead WP2 together with CIRAD. Synthesis and setting of the agenda for future research, practice and policy (WP5) is a shared responsibility of ETC Foundation and CIRAD.

Table: The JOLISAA institutional partners

JOLISAA partner		Specific role in JOLISAA
cirad LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT	**CIRAD** (International Research Centre in Agriculture for Development) is a French scientific organisation specialised in development-oriented research with main offices in Montpellier, France.	CIRAD coordinates the overall project, is leader of WP2 and WP6 and co-leader of WP5, while providing support to WP1, WP3 and WP4.
ETC FOUNDATION	**ETC Foundation** is a not-for-profit research and advisory organisation specialised in development programmes and is registered in the Netherlands.	The AgriCulture unit of ETC is involved in the JOLISAA project by leading WP4, co-leading WP5 and providing support to WP2, WP3 and WP6.
FACULTE DES SCIENCES AGRONOMIQUES UNIVERSITE D'ABOMEY CALAVI FSA - UAC	**FSA-UAC** (Faculté des Sciences Agronomiques of the University of Abomey-Calavi) is a high education centre responsible for agricultural engineering education in Benin since 1974.	UAC is the national convenor for Benin, co-leads WP2 and WP4, and provides support to all other thematic WPs.
ICRA	**ICRA** (International Centre for development oriented Research in Agriculture) is a capacity-strengthening institution that has long-standing experience in implementing Agricultural Research for Development learning programmes. ICRA's main offices are in Wageningen (Netherlands) and Montpellier (France).	ICRA is leader of WP3, and contributes to WP2, WP4 and WP5.
KARI	**KARI** (Kenya Agriculture Research Institute) is a Kenyan research institution mandated to conduct crop, livestock, natural resource management, and social and economic research in Kenya.	KARI is the JOLISAA national convenor for Kenya, and co-leader of WP2 and WP4, and provides support to all other thematic WPs.
University of Pretoria	**UP** (University of Pretoria) is the largest residential university in South Africa. Its department of Agricultural Economics, Extension and Rural Development is internationally recognized for quality teaching and research in the fields of agricultural economics, extension and rural development.	UP is the national convenor for South Africa and co-leader of WP2 and WP4. It also provides support to other thematic WPs.
WAGENINGEN UR For quality of life	**WUR-LEI** (Agricultural Economics Research Centre of Wageningen University) is the leading organisation in the Netherlands for business economics and socio-economics in agriculture, horticulture, fisheries, forestry and rural areas.	WUR-LEI is the leader of WP1, while providing support mostly to WP2 and WP5.

Appendix 2

The grant for field research corresponding to the internship

Grants for field research (M. Sc or Ing. level) on case studies about multi-stakeholder innovations processes in Africa (Benin, Kenya, South Africa) from March-April to August–September 2012

Official version, December 12, 2012

Context and objectives of the work to be conducted

Within the framework of the EU-funded JOLISAA project (www.jolisaa.net), CIRAD is seeking 3 qualified students to conduct research in the 3 JOLISAA target countries: Benin, Kenya, South Africa. The objective is to assess in a collaborative manner selected case studies with multi-stakeholder innovation processes in which small holders and other local rural stakeholders play an active role.

Between 3 and 6 cases will be assessed in each country. Together, they illustrate a broad diversity of innovation types (technical, organizational, institutional) and domains (production, transformation, NRM, value chains), varying degrees of involvement of stakeholders such as farmers and farmers organizations, extension, research, private sector, government, as well as different phases and scales at which the innovation process is unfolding. The following cases have been selected so far:

- Kenya: Management of Prosopis, Domestication and marketing of Aloe Vera, Butterfly farming, large-scale commercialization of lime, mango processing, Gaddm sorgum commercialization
- South Africa: In-field rainwater harvesting, developing a fertilizer bulk buying system, enhancing farmers' capacities for soil fertility management
- Benin: (selection about to be finalized)

JOLISAA research questions aim to provide insights about how a given innovation process unfolds over time. They include among others the following:

- What specific factors and conditions have allowed given stakeholders to take an active role in the innovation process, or on the contrary, have prevented them from doing so?
- What sequence of innovations has unfolded in the course of the innovation process, how has it happened, what relations have these innovations had one with the other, and why has each of them been important for the actual impact (results) obtained?
- How were the knowledge, skills and other contributions of the stakeholders mobilized in the innovation process, and with what results?
- *Other questions will focus on specific issues (e.g. link of innovation with marketing, link between project fraemworks and innovation, etc.), or will attend concerns of case stakeholders*

To answer these questions, collaborative case assessment (CCA) teams will use participatory research methods, including semi-structured interviews, focus groups, and multi-stakeholder workshops.

Contents and calendar

The research is expected to last approximately 5 to 6 months (depending on student's actual availability) and includes 3 successive phases:

1. A first phase of 2-3 weeks towards March 2012 in CIRAD Headquarters in Montpellier to prepare for field work (literature review on innovation processes and how to assess them and on the case topic matters, development of a work plan).

2. A second phase of about 3-4 months (April to July 2012) to be spent in one of the 3 JOLISAA countries, and encompassing 1 or possibly 2 innovation cases. It will include a mix of field periods in the case area and desk work (next to where national team members are based).
3. A third phase of about 1 month (August-September 2012) for redacting the report and other linked outputs.

For the duration of his/her stay in-country, the student will work in close interaction with other members of CCA teams, which comprise a mix of JOLISAA national members, representatives of local stakeholders, national students or young graduates and EU-based students, supported by EU-based resource persons. The student will be particularly in charge of developing, administering and analyzing semi-structured interviews, as well as identifying and applying other suitable methods for tackling JOLISAA research questions. The student will also contribute to preparing and holding at least one multi-stakeholder workshop during which findings of the previous stages of assessment will be presented and discussed with local stakeholders. The student will be expected to contribute actively to joint learning among all the parties involved in the assessment. Time and resources allowing, the student may opt to develop a more autonomous research componenet on specific relevant issues related to the case, which goes besides and beyond JOLISAA's terms of reference.

Grant amounts and supervision

The grant includes the following:

- Monthly stipend of 420 € over the duration of the research (including time in Europe)
- Round Trip Montpellier / target country
- Reasonable local operational expenses (transport, office supplies & communication, translation arrangements – note that no housing allowance will be paid)

Supervision will be ensured:

- In Montpellier : Bernard Triomphe or other colleagues from CIRAD UMR Innovation, depending on country cases
- In Country: one assigned member of national JOLISAA team (attached to KARI for Kenya, University of Pretoria/ Institute of Natural Resources in South Africa, UAC-FSA in Benin)

Requirements

- Basic knowledge in Farming Systems / Innovation studies / Participatory research
- Interest for and initial practice in participatory research methods applied to an agricultural /rural context
- Ability and willingness to be a team player
- Autonomy and adaptation capacity to tropical context
- Good working knowledge of English (written and oral)

Further information & contact

Please submit your inquiries, letters of motivation (including target countries) and CV to:

- Bernard Triomphe (UMR Innovation, CIRAD): bernard.triomphe@cirad.fr Tel 33 467 615 614
- More information on JOLISAA at www.jolisaa.net,

**** Deadline for submitting candidacies:**
January 13, 2012 or until all positions are filled **

Appendix 3

Table linking research questions, sub-question, and tools of data collection and processing

Analytical issue	Research questions (RQ)	Research subquestions (SQ)	Methods & tools of data collection	Methods & tools of data analysis
		Understand the general and local context		
1. National context	**What are the main policies influencing the local Innovation process?**	**Public policies** What are the main national and international policies regarding the case objects? What is their content? Are they applied? **Network** What are the main channels of diffusion of information in Kenya?	**Bibliography:** Core data about characteristics, strengths and weaknesses of the national ASTI. National and international policies supporting or interfering with the A&P products sectors (innovation policy, natural resource management policy, economic partnership agreement, Convention, declaration, or treaties)? ASTI mapping by experts	Synthetic ASTI mapping, Value chain analysis
	What are the main market drivers influencing the local Innovation process?	What are the main markets for A&P products? What are the dynamics of those markets? What are the main enterprises involved in the Aloe production and supply chain? In which way the markets and value chains have influenced the local IP?		
	What are the main public organizations influencing the innovation process?	In which way the research and training institutions are influencing the local IP? In which way the public policies are influencing the local IP? In which way the diffusion networks are influencing the local IP? To what extent has the local IP been embedded in or determined by projects? To what degree has this influence been positive?	**Bibliography:** Projects documents, SSI with resource-persons, Details about the project's timeline, objectives and activities.	
2. Local context	**What are the main geographical, agro-climatic,**		Bibliography	Agrarian diagnosis
	How evolved the local agriculture over the long term?		Bibliography, Historical timeline of technical change through SSI & FG	Synthetic historical timeline of technical change
	What are the main pressing issues for agriculture,		Bibliography SWOT matrix through SSI & FG.	SWOT matrix.
	How did the local context influence the Innovation Process?	Which factors of the local context influenced the Innovation process? Natural factors? (geography, topography, climate, property of Aloe…) Social factors? (social groups, gender issues, deviant behaviour?...) Institutions? Has the appropriation be facilitated by pre-existing norms, institutions, and beliefs? Historical factors? Have the changes in the local context influenced the Innovation Process?	Bibliography Direct observation, participant observation, SSI focusing on characteristics of the farming system relevant for innovation	
3. The case object in the context	**What are the main biological and ecological characteristics of the case object?**	What are the biological characteristics of A&P? What is their geographical repartition? What is the place of A&P into eco systems?	Bibliography Direct observation, participant observation	
	What are the social, economical, political and technical aspects linked with the case object?	What are the main types of Farming systems? What is the part of A&P in the agricultural GDP? Who are the main types of stakeholders that directly deal with A&P? Which part of the population does it represent? What is the place of A&P in their livelihood? What is the place of A&P into the farming system?	Bibliography, SSI, direct observation, participant observation Seasonal (and pluriannual) agricultural labour & expenses calendar, importance ranking of local crops through SSI & FG.	Farming system analysis, Synthetic seasonal & pluriannual agricultural labour calendar Synthetic importance ranking of local crops

Analytical issue	Research questions (RQ)	Research subquestions (SQ)	Methods & tools of data collection	Methods & tools of data analysis
Delimitate the Innovation System				
4. Nature of the Innovation	**What are the actual elementary innovations involved in the overall**	What are the various "novelties" from the beginning to the present moment?	Bibliography, SSI, direct observation, participant observation, historical timeline, innovation story through FG	
	Are wild Aloe exploitation, Aloe cultivation, and the making of Aloe-based products innovations?			
	What sequence of technical, technological and social, organizational or institutional innovations has emerged during the innovation process?	What transformation undergoes the Innovation through the innovation process? Was the initial innovation displaced, adapted, extended, or reversed? What factors contributed to a misdirection of the Innovation? Discovery of underlying principles? Habits? Norms? Institutions? How and why this mis-direction occurred? How many avatar results (or has resulted) from this process of misdirection? Has the innovation stabilized? If yes, when and how the innovation stabilized? Did the emergence of a final technical choice correspond to a stabilization of the network? To a compromise found between the stakeholders of the network?		
	How did the nature of innovation influence the Innovation Process?	What are the changes in practices and their link with the studied innovation? Has the nature of the innovation facilitated/made difficult its adoption?		
5. Stakeholders	**Who are the main stakeholders involved in the innovation Process?**	Who were the stakeholders, what were their roles and contributions? Who are the potentially concerned stakeholders?	Bibliography, SSI, participant observation	Typology and Institutional profile of stakeholders, Value chain analysis
	How evolved their respective role and contribution?			
	Were any stakeholders left out or isolated of the innovation process, why and with what consequences?	Who are the stakeholders integrated? Who are the one isolated? What can explain this disparity?		
6. Network	**How did the various stakeholders linked up around the innovation?**	How did /do the various stakeholders within the innovation system link up? Have these linkages been sufficient and/or strong enough to facilitate innovation? Is there an existing network created around the innovation? What is the degree of formalization of the network? Has there been formal partnerships/ alliances between some stakeholders during the IP? What role did they play?	Bibliography, SSI, participant observation Network mapping through SSI and FG. Ranking through SSI and FG. Conflict-partnership matrix through SSI and FG. Historical timeline through SSI &FG	Synthetic network mapping Synthetic conflict-partnership matrix.
	How has evolved the network?	Did the stakeholders in the innovation process, or their roles and contributions, change over time? If yes, why and with what impact? How is evolving the network throughout the innovation process? How is moving the gravity centre of the network throughout the innovation process?		
	How did those evolving linkages influenced the Innovation Process and the nature of the innovation?	How the stakeholder network has influenced the adoption and the diffusion of innovation? Are there existing organizational and institutional drivers and barriers that influence the Innovation Process? Is the adoption of the innovation more explained by the social characteristics of the stakeholders or by their position in the network (intensity of relationship)?		

Analytical issue	Research questions (RQ)	Research subquestions (SQ)	Methods & tools of data collection	Methods & tools of data analysis
Understand the Innovation Process				
7. Initiation & adoption	**How was the Innovation Process initiated?**	**Before the initiation** Is the innovation something totally new (at the world scale)? Is it a transposition/adaptation/copy of something already existing somewhere else? Can we identify the macro economical and macro sociological factors that led the innovation to reach Baringo? **Who** Who are the initiators (the stakeholders that come up with the innovation)? What are the sociological characteristics of the initiator? **How** How was the IP initiated? Has the Innovation been proposed or imposed to the stakeholders (dogmatic innovation)? What was the role of the initiator at the beginning? How evolved this role and why? Did the innovator actively tried to surround himself with a network? Why? Because he needed ally? Because the nature of the innovation committed de facto a lot of stakeholders? **Legitimation** Was the innovation legitimated by the highlighting of a particular problem? Which problem? Who legitimized the innovation (understand who emphasized the problem that is opening the way for the innovation)? Was this stakeholder the same than the one who initiated the innovation?	Bibliography, Timeline through FG & SSI Innovation story	TPB model (Theory of planned behaviour) Synthetic timeline
	How was the innovation adopted?	**Adoption** Was the innovation adopted at the district scale? How was it adopted? Is there a feeling of obviousness regarding the innovation. Do the people try to legitimate its use. **How** Who were the first users and why? Who has enlisted the stakeholders in the adoption of innovation? Which contingent decisions facilitated/made difficult the appropriation? When? by Whom? What was the degree of irreversibility of the decision?	Bibliography, Timeline through FG & SSI Innovation story	Synthetic timeline and innovation story
	What are the barriers and drivers to the adoption the innovation?	**Barriers** Is there barriers to enter in the IP? What kind of barriers are there? Are all groups equals in the capacity to overcome this barriers? Which external or internal factors facilitated/made difficult the adoption? **Diversity & drivers** Which diversity exists in the adoption of the innovation? Which driver can explain the diversity in the process of adoption? Has the process of adoption diverged from one place to another? From one group to another (tribe, genius, age)? From the centre to the periphery? Can we find failure experiences? If yes why did they fail? Are some farmers untouched, unable or perhaps even refusing to use the innovation? Why?	Bibliography, Exclusion-beneficiary matrix through FG & SSI,	Synthetic exclusion-beneficiary matrix

Analytical issue	Research questions (RQ)	Research subquestions (SQ)	Methods & tools of data collection	Methods & tools of data analysis
Understand the Innovation Process				
8. Scaling up and institutionalisation	**To what extent the innovation spread beyond its initial developers and users?**	To what extent the innovation spread beyond its initial developers and users? What scale has it reached until now?	Bibliography, Mapping through FG & SSI	Synthetic mapping
	How was it scaled up?	Which aspects of the innovation have spread? Who are these new users? Who among the stakeholders have played the role of innovation broker and during which phases? What has been their actual influence on the process? Has the innovation been spreading thanks to local leaders or cosmopolite ones (medias, information)? Or both? What specific factors and conditions have allowed given stakeholders to take active role in innovation development, or on the contrary, have prevented them from doing so?	Bibliography, Timeline through FG & SSI Innovation story FG & SSI	Synthetic timeline and innovation story
	How was institutionalised the innovation?	**Institutionalisation** Has the innovation changed the way of working of the stakeholders? Has the innovation led the stakeholder to new habits? To new social practice? Did those new social practice became norms? **Process of institutionalisation** Has the innovation destabilised the establishment, the institutions? What kind of interactions, controversies, contradictory debate, negotiations, was generated by the apparition of the innovation? On which arena, forum, and public space have the negotiations occurred? Have this arena/forum/public space played a specific role? Has the new practice, behaviour, habits, cooperation and conflicts generated by the innovation been regulated by new law, policy, rules or informal institution? If yes, has this regulation managed to re-establish a new establishment? If yes, did this intervention participated to a process of institutional learning? Of institutionalisation of the innovation?		

Analytical issue	Research questions (RQ)	Research subquestions (SQ)	Methods & tools of data collection	Methods & tools of data analysis
Understand the Innovation Process				
9. Turning points and drivers	**What were the main turning points of the innovation process?**	What are the key phases that can be identified in the IP? What was the nature of the innovation process? Was it governed or engineered and did it follow a planned course? Were there any critical events, which ones and why? Are there new Innovation Processes appearing through the different supply chains generated by the Aloe and Prosopis products? (Beams of innovation)	Bibliography Timeline through FG & SSI Identification of critical events through FG & SSI	Synthetic Timeline Synthetic Identification of critical events
	What triggers and drivers influenced the Innovation Process, from its initiation to its institutionalisation?	What were the main triggers and drivers of the Innovation Process? Which one were the most heavy?	Bibliography, Field force analysis through FG & SSI	Synthetic field force analysis
10. Knowledge	**How were the knowledge and skills being mobilized and spread in the innovation**		Bibliography (project documents) Direct observation, participant observation. Functional analysis through FG & SSI Survey of contribution through FG & SSI. Venn diagram to be filled through FG & SSI.	Synthetic functional analysis Synthetic matrix of knowledge contribution Synthetic Venn diagram
	What was the specific contribution of smallholders, brokers, and extension?	**Smallholders** How did smallholders participate in innovation development? What (existing) knowledge did producers contribute to the actual innovation(s)? What new knowledge did they develop during the process? Is there some kind of organized apprenticeship in order to transmit local knowledge about the studied innovation, and how does it work? **Intermediaries** Who has serve as knowledge broker(s) during the innovation process? How was knowledge brokerage done? How effective has it been for mobilizing and integrating the various sources of knowledge? What has been achieved Which information have public (and private) extension services or other intermediaries brought to farmers with respect to the innovation, and how?		
	What was the specific contribution of ARD actors and projects in the Innovation Process?	How did research interact with other stakeholders, and particularly farmers? What specific knowledge did research contribute? How relevant & useful has this knowledge been?		
	Did the latter mobilized local knowledge?	What has been the respective place of scientific / tacit/ local knowledge in this process? Has research identified and mobilized local knowledge in its propositions and activities, and how?		
	How did the knowledge influence the innovation process?	Have knowledge been an entry barrier to the Innovation? Have knowledge been circulating well? Is there a necessary quantity and quality of knowledge to have to be able to innovate?		

Analytical issue	Research questions (RQ)	Research subquestions (SQ)	Methods & tools of data collection	Methods & tools of data analysis
Understand the consequences of the innovation process and assess the prospect of development				
11. Activation of the Aloe resource	**Have wild Aloe exploitation, Aloe cultivation, and the making of Aloe-based products innovations contributed to transform Kenyan indigenous Aloe species into economical resources for ASAL?**			
12. Impact of the IP on ASAL communities	**Has the innovation process contributed to reduce poverty and marginalization among ASAL communities in Baringo?**	Has the income of the household increased thanks to the Adoption of the innovation? To which purpose the new income have been realocated? Was there underlying/hidden principles and practices coming with the appropriation of the innovation? What are the economical and social consequences of this underlying principle? Is there a positive dynamic existing around the innovation process? What have been the benefits of innovation for the local / regional / national economy? What is the economic output of the various value-chains affected by innovation (industrial, artisanal)?	Bibliography, SSI, FG	Yield analysis, labour use Value chain analysis, , cost-benefit analysis
	Have some innovators or innovation networks been empowered during the innovation process?	Have some innovators or innovation networks been able to improve their socio-political status through their participation in the innovation process, or to capture an innovation rent? In doing so, did they tend to have an inclusive or exclusive behaviour?	Bibliography, SSI, FG	
13. Impact of the IP on ASAL ecosystems	**Has the innovation process contributed to decrease pressure on wild Aloe resource?**		Bibliography, SSI, direct observation, participant observation	
	Has the innovation process contributed to improve management of natural resources in Baringo drylands?		Bibliography, SSI, direct observation, participant observation	Supply chain analysis, SSI & FG
14. Way forward	**Which way forward could be envisaged for the stakeholders and the Kenyan public policies involved in the process of activation of Aloe resource in Baringo?**			

Appendix 4

Semi structured Interview guide (Aloe Grower)

PART I. Profile the household

I.1) General	
Contact	- Name, location, contact
I.1.a) Household	- Composition of the family? Activities of the family members?
I.1.b) Livelihood	- What are the main sources of income for the family (e.g. *salary, selling crops, transfer, pensions*)? - What are the main sources of food (e.g. *agriculture, market, aid*)? - Do you or someone of your household own land? How much (surface)?
I.1.c) Agricultural activities	- What are the main crops cultivated by your family? Rank them according to the income generated? Estimate the surface occupied by each, as well a the trend
I.1.d) Livestock activities	- How many cattle, ship and goats, donkeys… do you own? - How are they kept (e.g. *home, grazing around*)?
I.2) Place of Aloe in the household	
I.2.a) Place of Aloe	- Are you or someone of your household growing or harvesting Aloe? Since when? Why? - Who is doing what in the household? (e.g. *cultivation, harvest, boiling, commercialisation*)?
I.2.b) Use of Aloe	- What use you and your family are making of Aloe products? (e.g. *Commercial, medical for human or livestock, ritual, fodder*) - Are those uses different according to domesticated and wild Aloe? What are the other possible uses of Aloe you know?
I.2.c) Economical importance of Aloe	- To what extent Aloe is contributing to the income of the household? Give a percentage. How has evolve this contribution over time? Why? - Is this contribution to the income of your household is different from the other people of your community? If yes explain in which way and why.
I.3) Aloe management	
I.3.1) Cultivation and harvest	- Describe the practices and the costs associated to cultivation of seedlings, transplantation of seedlings (e.g. *density*), weeding, input, fertilization, harvest, post harvest (transportation, storage conditions), boiling, processing. - If possible use a SEASONAL AGRICULTURAL LABOUR AND EXPENSES CALENDAR.
I.3.2) Where is Aloe cultivated	- Where is the Aloe better growing? Which kind of soil, water condition, slopes…? - Are your plots located in this kind of place?
I.3.3) Problems	- Have you met any problems concerning the cultivation of Aloe? If yes explain.
I.4) Harvest of wild Aloe	
I.4.a) What is harvested	- How many species/kind of Aloe do you know? Can you mention it? Are you harvesting all of them? For which specific purpose?
I.4.b) Where	- Where are you harvesting Aloe (e.g. *communal land, protected Areas, AMU*)? Why?
I.4.c) When	- When are you harvesting wild Aloe? At the same time or frequency than domesticated? Why?
I.4.d) How	- How are you harvesting wild Aloe? Is there any difference with domesticated

	one? How do you choose the plants to be harvested?
I.5) Production et allocation of Aloe products	
I.5.a) Production and allocation	- Estimate the quantity of sap harvested, sold, boiled, stored, and consumed - What about the other products (dry leaves, flowers…)
I.6) Projects & expectations	
I.7.a) Projects	- What are your personal projects as far as Aloe is concerned?
I.7.b) Expectations	- What are your expectations toward other stakeholders as far as Aloe is concerned?

PART II. General context

II.1) Policies	
II.1.a) National policies	- What are the national policies influencing your practices of cultivation, harvest, processing, and selling of Aloe products?
II.1.b) Local policies	- Same question with local policies
II.1.c) Informal rules or institutions	- Same question with informal rules
II.2) Market & supply chain	
II.2.a) Main markets	- What are the main final markets for Aloe products? What are the main enterprises involved in the Aloe sector?
II.2.b) Selling strategy	- What is sold? To whom? Where? Which frequency? What kind of selling relationship (transaction, contract..)? How is negotiated the price?
II.2.c) Illegal trade vs regulated trade	- Are you aware of the existence of illegal trade? Is it important compared to regular one? - Who are involved? How are they operating? Is it easier for smallholders to sell on the legal or illegal market? Why?
II.2.d) Perception of the Aloe sector	- Give your perception of the Aloe sector: Market trends, horizontal concurrency *(between Aloe growers or harvesters*), Vertical concurrency (*between stakeholders of the supply chain*), Prices (e.g. fluctuation, power of negotiations), Institutional support (e.g. *extension, information on price and quality, marketing infrastructure*)
II.2.e) Quality & reputation	- Are your buyers asking you to reach certain standards of quality? What are they? Are you paid according to the quality you propose? Are you trying to reach a better quality of your products? Are you aware about Baringo Aloe reputation?
II.2.f) Problems	- Have you experienced any problems linked with cultivation, harvest, selling, quality, getting inputs, problems linked with other stakeholders?
II.3) Local context	
II.3.a) Evolution of the local agriculture	- How has evolved the agriculture over the past 30 years in you village?
II.3.b) Pressing issues	- According to you, what are the main strengths, weakness, opportunity and threat your community is facing? *(SWOT Matrix)*

PART III. Innovation System

III.1) Innovation	
III.1.a) Elementary innovations	- What have been for you the various "novelties" linked with Aloe for the last 30 years to the present moment? (e.g. *cultivation, way of harvesting*, AMUs, boiling)
III.2) Stakeholders	
III.2.a) Stakeholders involved	- Who are the (type of) stakeholders you know involved in Aloe cultivation, harvest, selling, processing? What are they doing? How Evolved there role over the time?
III.2.b) Stakeholders left out or isolated	- Are there farmers for whom it's impossible to start cultivating Aloe? Why?
III.2.c) Ranking stakeholders	- Who are for you the most important stakeholders that deal with Aloe? (*Ranking*)
III.3) Network	
III.3.a) Groups	- Do you feel part of a group linked with Aloe? If yes, can you describe this group? - What is the place of this group toward pre existing groups (e.g. *tribe…*)?
III.3.b) Partnership	- Do you have partnership, contract, or arrangement with other Aloe grower or stakeholder (e.g. *assistance, input bulk buying, selling…)?* - If yes, can you describe them?
III.3.c) Collective action	- Are you or someone you know involved in any collective action linked with Aloe (e.g. *association, AMU, collective strategy for selling, purchasing input or equipment, storing, accessing land or information*)? - If yes describe it.
III.3.d) Conflicts	- Did the Aloe cultivation triggered conflict, or awaked pre existing conflicts? How did it happen?
III.3.e) Network mapping	- Can you map the links between the stakeholders you have described above (e.g. *Conflicts, partnership*…)? Map also the ones you may have forgotten. (The researcher should try to identify the gravity centre of the network)
III.3.g) Evolution of the network	- How the links you described above evolved in the time? (Use the previous map)
III.3.c) Influence of the network	- How those links have influenced your way of cultivating, harvesting, selling, or processing Aloe? - Have they helped you in the adoption of Aloe cultivation? In the improvement of you harvest practice?
III.4) Aloe Management Unit	
III.4.a) General	- Do you belong to an AMU? Why? Since when?
III.4.b) Implication	- What is your role in the AMU? Are you using a lot of time for it? Which frequency?
III.4.c) Organization of the AMU	- How is organised your AMU (members, rules, governance)? - Are you satisfied with the organization of your AMU?
III.4.d) Story of the AMU	- What is the story of your AMU?
III.5.e) Linkages	- Thanks to the AMU, did you create new relationship with people? What kind of relationship (e.g. Friendship, professional relationship…)?
III.5.f) Impact	- What impact had the AMU on your life? On the village? Through AMU did you notice that some people got more power or influence? Who were they?

Part IV: Innovation Process

IV.1) Initiation	
IV.1.a) Legitimating	- Who first came up with the idea of growing Aloe? Was it totally new in your family? In your village? How have this stakeholder justified the interest of growing Aloe (e.g. *highlighting problems*)? Was it relevant for you?
IV.1.b) Initiator	- Who have encouraged you/supported you to start growing Aloe? To participate to the AMU? How this stakeholder encouraged you? Why did he encourage you (e.g. *personal interest, needed ally*)?
IV.1.c) Evolution of the role of the initiator	- How evolved the role of the stakeholder who encouraged you (e.g. *Aloe grower*)?
IV.1.e) Project and initiation	- Were you encouraged by a project or an extension services? If yes by which organization exactly? In which way (e.g. training, provision of seedlings, credit, donation)?
IV.2) Adoption	
IV.2.a) Adoption (village scale)	- Who were the first to start growing Aloe in the village? In the district? In Kenya? - Did they have influence on your decision to start Aloe growing? In which way? - How fast the cultivation of Aloe started in the village?
IV.2.b) Adoption (farm scale)	- Explain how you have started growing Aloe: When, Why, progressively?
IV.2.b) Degree of irreversibility	- Once you have started to grow Aloe, is it expensive/easy to go back ? Why?
IV.2.c) Adoption and institutions	- Did the adoption of Aloe growing or the AMU damaged formal or informal rules, habits, or norms?
IV.2.d) Barriers to the adoption	- Has Aloe cultivation been easy to adopt? Why? - According to you anyone can easily adopt it? - Do you know some people who failed in the Aloe cultivation?
IV.2.e) Diversity in the adoption	- Do you know some household who where proposed and refused to grow Aloe? - According to you why did they refuse?
IV.3) Adaptation	
IV.3.a) Underlying principles	- When started to grow Aloe, did you discover something you didn't expect? - How did you cope with this unexpected principle?
IV.3.b) Adaptation	- Did you change or adapt the practices of harvest that was introduced to you at the beginning? Why (e.g. discovery of underlying principles, Habits, Norms, Institutions)? Explain how.
IV.3.c) Consequences of adaptation	- Is this change helping you in the Aloe growing? In which way? Could you grow Aloe without it?
IV.3.d) Diversity of adaptation	- Do you know other groups, villages, or tribes that cultivate Aloe differently? If yes, can you describe these differences?
IV.4) Up scaling	
IV.4.a) Perception of up scaling (farmers)	- How many farmers are growing Aloe in the village? Is this number tends to increase or decrease? Why?
IV.4.b) Perception of up scaling (villages)	- Is the number of village where Aloe is grown increasing? Explain I which way and why?
IV.4.c) New stakeholders	- Who are the stakeholders who started growing Aloe lately? Are they more women/men, young/old, poor/rich)?
IV.4.d) Innovation brokers	- Who encouraged the stakeholders who started growing Aloe lately? Were they the same that the ones who encouraged the first Aloe growers? - More generally, do you know some stakeholders who are actively promoting the cultivation of Aloe? Who are they? Why are they promoting it?
IV.4.e) Involvement in up scaling	- Are you used to speak about Aloe cultivation or AMU with your friends, family or tribe members? In which occasion (e.g. every day, markets, ceremonies…)? What are the main topics of discussion (e.g. advantages and disadvantages, cultivation techniques, Aloe market)?

PART V. Consequences and prospects of development

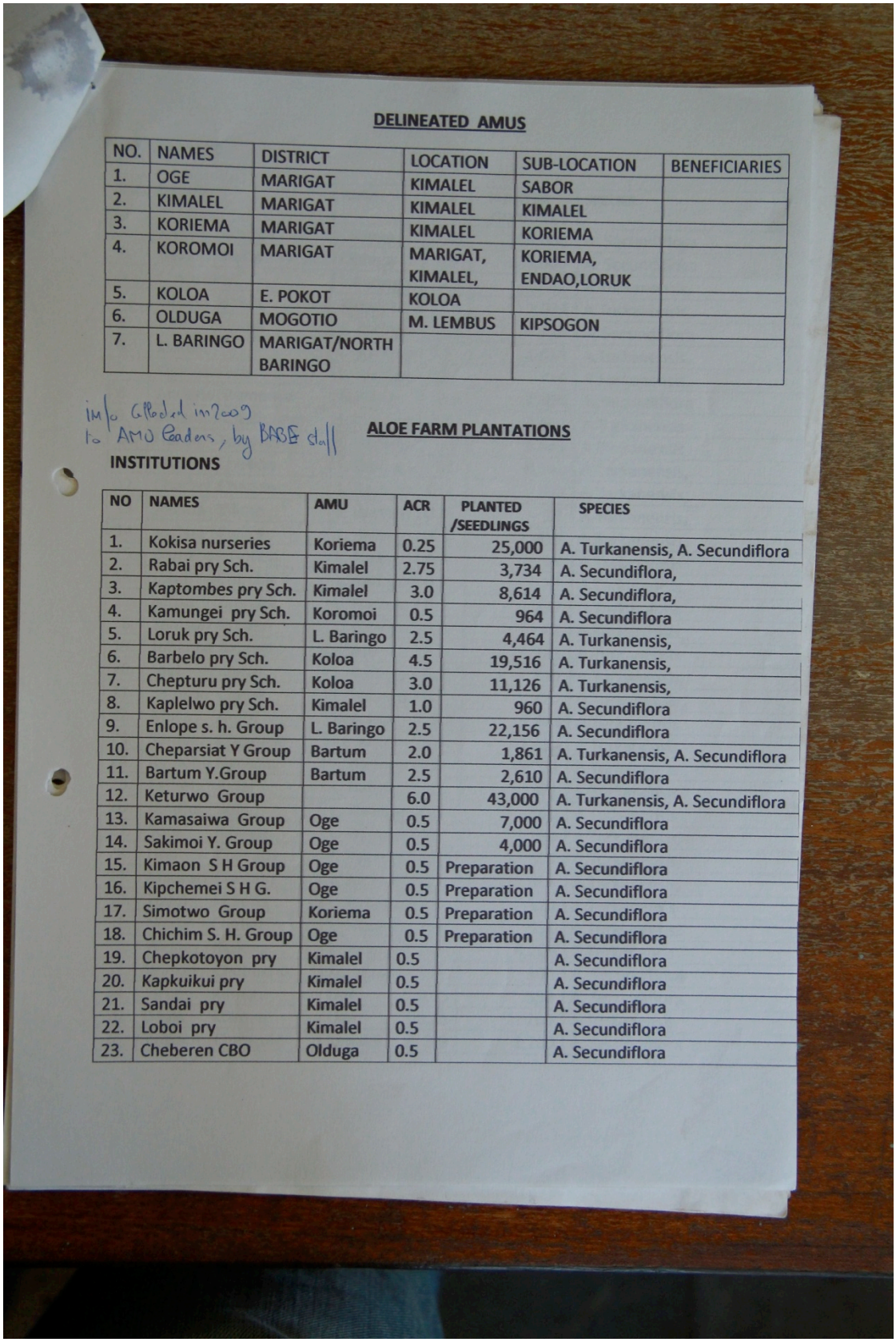
V.1) Economical consequences	
V.1.a) Perception of long term evolutions (economical)	What are the major social & economical changes that have occurred during the past 30 years? (household and village scale)
	- Did you notice a change in the quality of life during the past 30 years? (household and village scale) - If yes, describe this change and its causes?
	- Did you notice a change in your income during the past 30 years? (household and village scale) - If yes, describe this change and its cause.
	Can these changes be partly attributed to the Aloe growing? (If yes, explain?)
V.1.b) Economical & social consequences of Aloe growing.	Since Aloe have started to be grown what have changed in the village?
	Since Aloe have started to be grown what changed in your life (e.g. *income, farming system, labour organisation in the family, social status of someone of the family, political role of someone of the family*)?
	If new income, how did you allocated them? (e.g. *school, food, investment for Aloe, for other crops*)
V.2. Environmental consequences	
V.2.a) Perception of long term evolutions (environmental)	During the past 30 years did you notice (*for each question, precise what you noticed and give your own interpretation*): - A change in the communal lands (e.g. desertification..)? - An increase or a decrease of wild Aloe quantity in the village land? - A change in the wild Aloe quality in the village land (e.g. age, size, species)? - Do you think there is an existing link between theses changes and the domestication project? If yes, can you explain?
V.2.b) Change of practice	- How evolved the harvest of wild Aloe since the last 30 years – from both qualitative and quantitative – point of view and what triggered these evolutions? (e.g. *apparition of AMU, starting of growing, boiling…*)? What were the consequences? (TIMELINE)
V.3. Construction of territorial resources	
V.3.1) Perception of Aloe	What is for you Aloe? (e.g. natural resource, economical resource, patrimony, other, nothing…) Why? How evolved this perception over the time?
V.3.2) Sense of responsibility	Do you feel responsible for the wild Aloe? To what extent do you feel responsible? (only in your AMU? In the village? Outside the village? Why? Was it always the case?
V.3.3) Inventory of patrimony component	What would you like to transmit to the next generation? What is for you part of the patrimony? (fill the DIAGRAM OF TERRITORIAL COMPONENTS)

Appendix 5
Sampling rules

Sampling rule	Underlying assumption
Both men and women should be interviewed, even among the same household.	Gender is an important factor of diversity in the appropriation of the innovation, partly because of variable opportunity cost in the starting of any new activity.
Both leaders and non-leaders should be surveyed	The leaders are the easiest to meet, but are often hiding a part of the reality.
Both success and failure experiences should be surveyed	Success and failure stories can inform us about the success factors of the adoption and up-scaling of the innovation.
Similar or closed areas where innovations were respectively adopted and not adopted should both be surveyed.	The study of the diversity in the adoption of the innovation can inform us about the drivers of the innovation process.
Areas or stakeholders that have adopted the innovation from the beginning and late should be both surveyed.	
Areas or stakeholders that have adopted the innovation without the direct support of a project should be surveyed.	
All agro ecological zones should be surveyed	The consideration of agro ecological zones can help understanding the natural factors that facilitate or make difficult the adoption of the innovation.
Both proponent and opponent to the innovation should be surveyed	The contrast between the testimony of proponent and opponent is source of rich information.
Both freeriders and stakeholders who "play the game" should be interviewed	Freeriders are hampering the success of the Innovation adoption and up scaling. Understanding their behaviour could bring ideas for future development path.
All the livelihood systems should be surveyed	Poverty, livelihood, land ownership… are conditioning the adoption of the innovation (investment capacity, level of education…)
Representative of the different tribes should be interviewed	The knowledge and skills are different, as well as the informal institutions.

Appendix 6

BABE raw data on Aloe growers used to estimate AC spread



DELINEATED AMUS

NO.	NAMES	DISTRICT	LOCATION	SUB-LOCATION	BENEFICIARIES
1.	OGE	MARIGAT	KIMALEL	SABOR	
2.	KIMALEL	MARIGAT	KIMALEL	KIMALEL	
3.	KORIEMA	MARIGAT	KIMALEL	KORIEMA	
4.	KOROMOI	MARIGAT	MARIGAT, KIMALEL,	KORIEMA, ENDAO,LORUK	
5.	KOLOA	E. POKOT	KOLOA		
6.	OLDUGA	MOGOTIO	M. LEMBUS	KIPSOGON	
7.	L. BARINGO	MARIGAT/NORTH BARINGO			

IM/o Gladed in 2009
to AMU Leaders, by BABE staff

ALOE FARM PLANTATIONS

INSTITUTIONS

NO	NAMES	AMU	ACR	PLANTED /SEEDLINGS	SPECIES
1.	Kokisa nurseries	Koriema	0.25	25,000	A. Turkanensis, A. Secundiflora
2.	Rabai pry Sch.	Kimalel	2.75	3,734	A. Secundiflora,
3.	Kaptombes pry Sch.	Kimalel	3.0	8,614	A. Secundiflora,
4.	Kamungei pry Sch.	Koromoi	0.5	964	A. Secundiflora
5.	Loruk pry Sch.	L. Baringo	2.5	4,464	A. Turkanensis,
6.	Barbelo pry Sch.	Koloa	4.5	19,516	A. Turkanensis,
7.	Chepturu pry Sch.	Koloa	3.0	11,126	A. Turkanensis,
8.	Kaplelwo pry Sch.	Kimalel	1.0	960	A. Secundiflora
9.	Enlope s. h. Group	L. Baringo	2.5	22,156	A. Secundiflora
10.	Cheparsiat Y Group	Bartum	2.0	1,861	A. Turkanensis, A. Secundiflora
11.	Bartum Y.Group	Bartum	2.5	2,610	A. Secundiflora
12.	Keturwo Group		6.0	43,000	A. Turkanensis, A. Secundiflora
13.	Kamasaiwa Group	Oge	0.5	7,000	A. Secundiflora
14.	Sakimoi Y. Group	Oge	0.5	4,000	A. Secundiflora
15.	Kimaon S H Group	Oge	0.5	Preparation	A. Secundiflora
16.	Kipchemei S H G.	Oge	0.5	Preparation	A. Secundiflora
17.	Simotwo Group	Koriema	0.5	Preparation	A. Secundiflora
18.	Chichim S. H. Group	Oge	0.5	Preparation	A. Secundiflora
19.	Chepkotoyon pry	Kimalel	0.5		A. Secundiflora
20.	Kapkuikui pry	Kimalel	0.5		A. Secundiflora
21.	Sandai pry	Kimalel	0.5		A. Secundiflora
22.	Loboi pry	Kimalel	0.5		A. Secundiflora
23.	Cheberen CBO	Olduga	0.5		A. Secundiflora

INDIVIDUALS

NO	NAMES	AMU	ACR	PLANTED /SEEDLINGS	SPECIES
1.	Mrs. Komen	Olduga	20	105,000	A. Secundiflora
2.	Equator Nature Farm	Olduga	25	125,000	A. Secundiflora
3.	Cheptokei	L.Baringo	0.5	962	A.Turkanensis,
4.	Bowen Isaiah	Kimalel	1.5	1,034	A.Turkanensis,
5.	John Kiptek	L. Baringo	1.5	713	A. Secundiflora
6.	Kiptikit	L. Baringo	0.5	1,034	A.Turkanensis,
7.	Kipkwarkwar	L. Baringo	0.25	783	A.Turkanensis,
8.	Anderw Rumenya	Koriema	0.5	2,000	A. Secundiflora
9.	Wilson Chebungei	L. Baringo	3.0	9,850	A.Turkanensis
10.	Harun Toroitich	L. Baringo	2.0	3,640	A.Turkanensis
11.	James Chebon	L. Baringo	3.0	8,240	A.Turkanensis,
12.	Charles Chebon	L. Baringo	0.5	200	A.Turkanensis,
13.	Joshua Kilimo	L. Baringo	0.5	17	A.Turkanensis,
14.	Joshua Kipkoti	L. Baringo	0.5	416	A.Turkanensis,
15.	Barnabas Tuitien	L. Baringo	0.5	67	A.Turkanensis
16.	John Chirchir	L. Baringo	0.5	22	A.Turkanensis,
17.	Musa Chirchir	L. Baringo	0.5	197	A.Turkanensis
18.	Samson Komen	L. Baringo	0.5	42	A.Turkanensis,
19.	Johanna Akipeta	Koloa	0.5	221	A.Turkanensis
20.	Joel Kiptui	L. Baringo	0.5	220	A.Turkanensis,
21.	Samson Chebii	L. Baringo	0.5	120	A.Turkanensis,
22.	Musa Argut	Koromoi	2.2	5,674	A.Turkanensis
23.	Samuel Chemase	Koromoi	3.0	1,124	A.Turkanensis
24.	Rymond Ngetuny	L. Baringo	2.0	1,231	A.Turkanensis
25.	Esther Kulei	L. Baringo	1.5	361	A.Turkanensis,
26.	Jeniffer Solit	L. Baringo	0.5	110	A.Turkanensis
27.	Sote Kimuge	L. Baringo	0.5	368	A.Turkanensis,
28.	Lina Chesang	L. Baringo	0.5	674	A.Turkanensis,
29.	Mauren Chesang	L. Baringo	1.5	863	A.Turkanensis,
30.	Toyoi Kiplong	L. Baringo	2.0	120	A.Turkanensis
31.	Maria Chebet	L. Baringo	1.0	551	A.Turkanensis,
32.	Wesley Kiplong	L. Baringo	2.0	4,200	A.Turkanensis
33.	Wilson Chebocho	Koriema	1.0	100	A. Secundiflora
34.	James Kimuge	Oge	0.25	530	A. Secundiflora
35.	David Kokoyo	Oge	0.25	200	A.Turkanensis
36.	William Changole	Kimalel	3.0	1,200	A. Secundiflora

37.	Richard Kibii	Oge	0.25	400	A. Secundiflora
38.	Daniel Kibet	Oge	0.1	200	A. Secundiflora
39.	Michael Kibet	Oge	0.2	122	A. Secundiflora
40.	Chesire Rutto	Oge	2.0	99	A.Turkanensis
41.	Joseph Boit	Kimalel	0.5	527	A.Turkanensis
42.	Amos Kigen	Oge	0.5	47	A. Secundiflora
43.	Joseph Ngetich	Koromoi	0.25	1,200	Aloe vera
44.	William Arusei	Koriema	0.25	81	A. Secundiflora
45.	Joseph Chebiliony	Koromoi	0.5	1,200	A. Secundiflora
46.	Musa Binott	Olduga	1.0	4,900	A. Secundiflora
47.	Kibichii Chebor	Olduga	1.25	3,700	A. Secundiflora
48.	Philip Bett	Olduga	1.00	1471	A. Secundiflora
49.	Job Chebet	Olduga	0.25	547	A. Secundiflora

AMUS	PROPAGATED ACRAGE	WILD ALOE ACRAGE	TOTAL PLANTATION
OGE	5.05	APPROX 50	12,798
KOROMOI	3.25	APPROX 30	6,025
L. BARINGO	15	APPROX 25	66,696
OLDUGA	49.5	APPROX 15	243,600
KIMALEL	14	APPROX 25	
BARTUM	5	APPROX 45	
KETURWO	5	APPROX 20	43,000
KORIEMA	2.75	APPROX 24	27,100

Appendix 7

Details of calculation of the estimation of AC spread

	Individuals		Smallholders groups (CBO and SHG)		Institutions (schools, projects, ranchs)		TOTAL	
	Number of stakeholders	Surface	Number of stakeholders	Surface	Number of stakeholders	Surface	Number of stakeholders	Surface
Oge	7	3,55	5	2,5	0	0	12	6,05
Koromoi	4	5,95	2	4,5	1	0,5	7	10,95
Lake Baringo	25	26,75	1	2,5	1	2,5	27	31,75
Olduga	4	3,5	1	0,5	2	45	7	49
Kimalel	3	5	0	0	7	8,75	10	13,75
Keturwo	0	0	1	6	0	0	1	6
Koriema	3	1,75	1	0,5	1	0,25	5	2,5
Kolowa	1	0,5	0	0	2	7,5	3	8
Total	47	47	11	16,5	14	64,5	72	128

Table : Surfaces cultivated with Aloe and stakeholders

AMU	**Individuals**	**Smallholder groups**	**Institutions**	**Total**	**Percentage**
Oge	3,55	2,5	0	6,05	5
Koromoi	5,95	4,5	0,5	10,95	9
Lake Baringo	26,75	2,5	2,5	31,75	25
Olduga	3,5	0,5	45	49	38
Kimalel	5	0	8,75	13,75	11
Keturwo	0	6	0	6	5
Koriema	1,75	0,5	0,25	2,5	2
Kolowa	0,5	0	7,5	8	6
Total	47	16,5	64,5	128	100
Percentage	37	13	50	100	

Table : Surfaces cultivated with Aloe per AMU

	Individuals	**Smallholder groups**	**Institutions**	**Total**	**Percentage**
Baringo Division	10	3	9	22	17
Baringo North Division	6	11	1	17	13
East Pokot Division	27	3	10	40	31
Koibatek Division	4	1	45	49	38
Total	47	16,5	64,5	128	100
Percentage	37	13	50	100	

Table : Surfaces with Aloe per Division

	Individuals	Smallholder groups	Institutions	Total	Percentage
Oge	7	5	0	12	17
Koromoi	4	2	1	7	10
Lake Baringo	25	1	1	27	38
Olduga	4	1	2	7	10
Kimalel	3	0	7	10	14
Keturwo	0	1	0	1	1
Koriema	3	1	1	5	7
Kolowa	1	0	2	3	4
Total	47	11	14	72	100
Percentage	65	15	19	100	

Table ; Number of stakeholder cultivating Aloe per AMU

	Individuals	Smallholder groups	Institutions
Baringo Division	48	22	30
Baringo North Division	50	38	13
East Pokot Division	87	3	10
Koibatek Division	57	14	29

Table : S**takeholders type per Division (%)**

	Individuals	Smallholder groups	Institutions	Total
Oge	0,5	0,5		0,5
Koromoi	1,5	2,3	0,5	1,6
Lake Baringo	1,1	2,5	2,5	1,2
Olduga	0,9	0,5	22,5	7,0
Kimalel	1,7		1,3	1,4
Keturwo		6,0		6,0
Koriema	0,6	0,5	0,3	0,5
Kolowa	0,5		3,8	2,7
Total	1,0	1,5	4,6	1,8

Table : Acrage per stakeholders

	Individuals	Smallholder groups	Institutions	Average
Baringo Division	1	1	1	1
Baringo North Division	1	4	1	2
East Pokot Division	1	3	3	1
Koibatek Division	1	1	23	7
Average	1	2	5	2

Table :**Acreage per stakeholder type per Division**

	Individuals	Smallholder groups	Institutions
Average	1,0	1,5	4,6

Table : **Average acreage per stakeholder type**

	Average acrage
Baringo Division	1
Baringo North Division	2
East Pokot Division	1
Koibatek Division	7

Table: Average acreage per Division

	Average acrage per Division (x10)	**Stakeholders per Division (%)**	**Surface per Division**
Baringo Division	8	38	17
Baringo North Division	21	11	13
East Pokot Division	13	42	31
Koibatek Division	70	10	38

Table: Acreage, stakeholders, and surfaces cultivated with Aloe for each region

	Percentage of total Aloe growers	Percentage of total land cultivated	Average acreage cultivated (X10)
Individuals Aloe growers	65	37	10,0
Smallholder groups (SHG, CBO)	15	13	15,0
Institutions (Schools, projects)	19	50	46

Table: Percentage of total Aloe growers, land cultivated, and acreage of Aloe of each stakeholder category

	Percentage of total land cultivated	Percentage of total Aloe growers	Average acreage (X10)
Baringo Division	17	38	8
Baringo North Division	13	11	21
East Pokot Division	31	42	13
Koibatek Division	38	10	70

Table: Percentage of total Aloe growers, land cultivated, and acreage of Aloe of administrative division

Appendix 8

Calculation of production costs of Aloe soap

Hyp: Production of 300 soap/day 6/7 days. Selling price of soap = 23 ksH.

Cost	Unit	Unit cost (KsH)	Turnover	Spent/day (KsH)	Spent/soap (KsH)	Percentage of total price
Palm oil	20 L barquet	1500	2 barquet/day	3000	10	43,5
Lye (NaOH)	25 kg bag	2500	4 kg/day	400	1,3	5,8
Aloe sap	20 L container	2000	100 mL/day	10	0,0	0,1
Packaging	Individual carton packaging	4,5	300 carton/day	1350	4,5	19,6
Firewood	A bundle of wood	200	1 bundle/6 days	33,3	0,1	0,5
Electricity	Monthly consumption of eletricity	1200	1/3 of totaldaily consumption of household	15,4	0,1	0,2
Extruder	1 Extruder	120000	1 extruder lasts 20 years	18,9	0,1	0,3
Transport	2 ways transport	500	4 transports/6 days	333,3	1,1	4,8
Salary	2 50% time and 2 40% time salary paid monthly	5000	26 days/month	346,2	1,2	5,0
Tax	Anual tax for 40% of enterprise activity	7800	317 days/year	9,8	0,0	0,1
Rent	Monthly rent for 40% of overall activity	3500	26 days/month	53,8	0,2	0,8
Total				5571	19	80,7

Appendix 9

Minute of the JOLISAA planning workshop

Compte rendu de l'atelier de planification
JOLISAA Kenya

Raphaël Belmin

Déroulement général

L'atelier s'est déroule du mercredi 23 au vendredi 25 au centre de Kari Thika. Deux participants étaient invites pour chacune des 6 études de cas (un institutionnel et un acteur). Tous ont répondu présents, et sont tous restes jusqu'a la fin de l'atelier. 2 ou 3 ont manque la première journée.

Activités réalises

Le tableau page 144 détaille et commente l'ensemble des activités implémentées durant l'atelier de planification.

Points forts

- Un bon équilibre entre présentations orales formelles activités participatives. Grâce au fort degré de participation, les membres de l'atelier ont gardé une aptitude proactive et se sont bien approprié la démarche CCA.
- L'approche «processus d'innovation » et les différents concepts semblent bien compris de la plupart des participants. Geoffrey a fait preuve d'une grande pédagogie à cet égard.
- Les différentes méthodes et outils à mobiliser ont été clairement établis
- Les équipes CCA ont été délimitées, et ont développé un calendrier de travail précis, et inscrit dans le temps (entre juin et novembre), ainsi qu'un budget de fonctionnement.
- Les plans de travail des différentes équipes CCA suivent tous les mêmes étapes (voir tableau ci dessous).
- Le double mandat des étudiants a été bien compris. Je participerai donc a l'ensemble du processus CCA, et je mènerai également mes enquêtes de mon coté, tout en essayant d'être les plus complémentaires possible bien sure.

Points faibles

- Les questions de recherche ne sont pas clairement établies, et une bonne moitie des participants fait peu de différence entre les questions de recherche et les questions à poser aux acteurs. Cela dit, les acteurs devraient recevoir une version finale des questions de recherche. Il suffira donc de la leur envoyer.
- Les questions de recherche locales n'ont pas été discutées.

Plan de travail des équipes CCA

Le **tableau** ci dessous montre le calendrier de travail CCA « type » qu'ont choisit les participants de l'atelier. Apres avoir définit ce dernier en séance plénière, chaque équipe

CCA a détaillé, daté, et budgétisé son calendrier de travail. Les dates inscrites ci dessous sont restées volontairement floues afin de rendre compte de la diversité des calendriers.

Mois	**activité**
Juin-juillet	Débriefing des autres membres de l'équipe CCA
	Réunion(s) de sensibilisation de acteurs
	Revue de la littérature
Juillet-aout	Développement et testage des guides d'entretiens et de FG
	Collecte des données (entre 3 et 6 jours selon les cas
Aout-septembre	Analyse des données Rédaction du rapport CCA version 1 Atelier multi acteur 1
Septembre octobre	Rédaction du compte rendu de l'atelier Collecte des donnes complémentaires Analyse des données Rédaction du rapport CCA version 2
Octobre novembre	Atelier multi acteur 2 Rédaction du compte rendu de l'atelier Rédaction du rapport CCA version finale
Décembre	Atelier national

Remarques concernant les études de cas Prosopis et Aloe

- Pour Prosopis et Aloe, les membres du Kefri et du Kari présents à l'atelier souhaitent faire partie des 2 CCA team. Par conséquent, les plannings des 2 CCA ont été conçus conjointement, de manière à ce que chacun des membres puissent réaliser les 2 études de cas. Du coup je me suis glissé dans les 2 équipes CCA.
- Je suis officiellement affilié à l'étude de cas Aloe, mais j'ai obtenu l'accord de Geoffrey et des équipes CCA de Baringo pour participer aux deux étude de cas.
- L'attitude des équipes CCA Prosopis et Aloe est plutôt positive a mon égard. Il semble que je sois bienvenue à Baringo !
- Je n'ai pas introduit mon pré projet pendant l'atelier : il m'a semblé plus important que les équipes s'approprient les outils et questions de recherche par elles même. De plus, le temps était très limité.

A priori le calendrier CCA ne me permet pas de participer à la seconde itération CCA.

Appendix 10

General Group Discussion Report

Reported by Raphael Belmin

18/07/2012

1. Introduction

3 General Group Discussion (GGD) were organized in the framework of the Aloe Collaborative Case Assessment, JOLISAA project: one for Koriema and Kimalel AMUs, one for Kolowa AMU, and one for Olduka AMU. The objectives of the GGD was to collect information about Aloe innovation system from groups of around 30 stakeholders coming from 4 AMUs chosen for their relevance and diversity.

Dates and locations:

- Koriema/Kimalel AMU: 05/07/2012, Koriema (in BABE factory)
- Olduka AMU: 06/07/2012, Radat
- Kolowa AMU: 12/07/2012, Kolowa

Participants:

- *CCA team members:* Chengole Mulindo (KARI Perquerra), Martin Welimo (director KEFRI Perquerat), Kimeto (Technician KARI), Raphael Belmin (CIRAD student), Julia Lekurle
- *Stakeholders:* See **Table 1** for comprehensive list of stakeholders.

Stakeholders	Koriema/Kimalel AMU	Olduka AMU	Kolowa AMU
Local leaders	4	1	1
BABE leaders	4	0	0
Smallhoders (from AMU or not)	5	28	16
AMU leaders	0	0	1
Herbalists	3	0	0
Self helped group members	3	0	0
Boilers or ex boilers	0	1	0
Sap trader	0	1	0
Gum traders	0	0	0
Total	**19**	**30**	**18**

Table 1. List of the stakeholders that attended to the GGD.

2. Material and Methods

During a previous sensitization meeting, Aloe stakeholders were identified and local leaders were asked to mobilize them (See Sensitization meeting report). The participants were sampled so as to embrace the whole diversity of stakeholders of the Aloe innovation system. **Appendix 2** details the sampling chosen by the CCA team. More specifically, smallholders were sampled in order to get a balance between the different villages, the gender, age. A SSI guide was designed (**Appendix 3**) in preparation of the GGD, and used as a background during the GGD. One facilitator was in charge to animate the discussion using a flipchart as a material support. The flipcharts pictures are given in **Appendix 4**. The other members of the CCA team were taking notes, asking complementary questions

General comments about the implementation of the GGD

- Although the General Group Discussion (GGD) were gathering 18 to 30 stakeholders, it was noticed in Koriema/Kimalel and Olduka GGDs that less than 10 stakeholders were actively participating. In Kolowa, the participation was more balanced.
- A problem of organization occurred in the Olduka GGD: the local leader responsible for community mobilization informed the CCA team one day before the planned day of GGD, that the invited stakeholders wouldn't be available because of an other meeting. The CCA team however decided to still conduct the GGD in Radat (instead of Mogotio), place where stakeholders were not supposed to attend to the other meeting. The result was that we couldn't catch the diversity of stakeholders initially planned.

- The noticeable absence of AMU leaders is an indicator of the weak organization of BABE.

- It was impossible to go through the whole SSI guide during the different GGD because of lack of time. Thus, it was decided to focus the GGD on the most relevant issues according to the local trends. For example in Koriema/Kimalel – place where the domestication project was initiated - we focused the discussion on the history and organization of BABE and AMUs although in Kolowa – place where the informal trade is dominant - we spent more time dealing with the informal supply chain organization.

3. Results

Livelihood Ranking

In Koriema/Kimalel and Olduka GGD, participants were asked to quote, and to rank in a second step the main livelihood sources. **Table 2** is summarizing the results of this ranking exercise.

Rank	Koriema/Kimalel AMU	Kolowa AMU	Olduka AMU
1	Goat rearing and butchery	Goat rearing	They are pastoralists, beekeepers and they run small scale business No livelihood ranking was done.
2	Beekeeping and hive making	**Aloe sap selling**	
3	General business 1. Maize floor 2. Sugar, tea leaves, salt 3. Vegetables 4. Beans 5. Aloe products and seedlings	Poultry production and selling	
4	Charcoal burning	Beekeeping	
5	Cattle rearing	??? (ask Martin)	
6	Poultry production	Farming (maize, cow peas, green grass, sorghum)	
7	Millet/sorghum, vegetables, peas, cultivation	Local hive making	
8	Local brew making	Ballast making	
9	Papaya cultivation	Firewood collection and selling	
10	Tree nursery	Sell of medicinal plants	
Other livelihood sources identified	Boda boda, herbal medecine, firewood collection and selling, pasture seeds, Jatropha,		

Table 2. Livelihood source ranking.

The livelihood ranking reveals the high degree of dependence of the Kolowa community toward Aloe sap selling. On the contrary, the Koriema Kimalel stakeholders didn't even quote Aloe as part of their livelihood sources. In this place, only one stakeholder who is running a

shop selling of Aloe seedlings. In Radat, the Livelihood ranking exercise was not done because of the lack of time but the discussions reveal that the people do not depend much on Aloe any more. In Olduka, livelihood systems have been deeply changing since the 60s because of the demarcation of land. In Radat, land has been demarcated in 1985. The community decided to do so to protect its and from "external grabbers".

Aloe main uses

The main uses made of Aloe quoted by the participants are given in **Table 3** (the quotation order has been respected). The Table show that in Olduka and Koriema/Kimalel AMU, stakeholders forgot to quote the selling of sap *(PR: probably because they have not been selling sap for a long time).* More specifically, the ethno pharmaceutical uses of Aloe quoted by the participants are given in **Table 4**.

Koriema/Kimalel AMU	**Kolowa AMU**	**Olduka AMU**
Herbs/medecine	Medicinal	Herbs/medicine
Bee forage	Anti "Satavi" ants (??)	Soap, cosmetic*
Seeds *(PR: selling?)*	Sell sap to boilers	Bee forage (golden colour honey)
Soap, lotion, hair	Control of soil erosion	Soil erosion
Animal feed	Traditional glue on arrow	"Landscape" *(PR:??)*
	Fodder for livestock during drought	

*It was quoted spontaneously, but they are not using it.

Table 3. Aloe uses

PR: Kolowa and Radat stakholders spoke about the use of Aloe as of way of controlling soil erosion. But it is unclear weather they really plant Aloe to control this problem or they just say it because they know it has this effect.

PR: It is the same for livestock fodder

	Preparation	Function
Koriema/kimalel	Fresh leaves burnet and grinded till it become a powder *PR : and then, how is this powder used ?*	Solve children teething problems
	Fresh leaves soaked into water to make syrup drunk by humans and animals	Solve stomach problems
	Roots boiled, liquid mixed with honey, soup, milk, or soda	
	Diluted sap poured	Antibiotic used on ticks bites, Anticoccidial used on poultry Anti CCPP (goat) Anti acid, anti malaria, typhoid, antivennon (humans)
Kolowa		Bile, wound, eye, medecine for goats, chicken
Olduka		Anti CCPP, Poultry Newcastle Disease, teething problems, wounds, diarrheal and stomach upsets, Malaria, pneumonia

Table 4. Ethno pharmaceutical uses of Aloe.

KOKISA/BABE

Koriema/Kimalel GGD

- The Koriema/Kimalel stakeholders know well KOKISA and BABE.
- According to them, there was an initial group before BABE called KOKISA. The management of Kokisa included representatives from LCHAMUS (1 person), NDOROIS-1 person, KOIBATEK (2 persons), and N.BARINGO (2 persons).
- In 2005, Landmawe agreed to contribute 2,5 millions of KsH. He started to invest with the buying of a boiler and a grinder, as well as the iron sheets of the roof. But later on, Landmawe changed his mind for an unknown reason, and stopped investing.
- In 2006, 8 Ugandan MPs came to visit BABE. This visit raised expectations, and contributed to change perception at the National level toward Aloe (Aloe=source of profit). In 2008, 3 members of Kokisa came at the national level to discuss the establishment of the National strategy for conservation and management of wild Aloe.
- According to the Koriema/Kimalel stakeholders, BABE management is structured as below: Chairman, vice chairman, secretary, treasurer, vice treasurer. At the AMU

level, each AMU includes a chairman, vice chairman, secretary, and treasurer. The last meeting was done in 18/9/2011. No meeting had been done for the last 2 years.

Olduka and Kolowa

Interviewed stakeholders only know BABE as a buyer that gives a better price that the Somali traders. They also don't know AMU (only the AMU responsible said knowing what an AMU is).

PR: The calendar of meetings is still unclear.

PR: it is not clear weather only the members of Kokisa could supply the sap to BABE, or anyone.

PR: The transition/articulation between KOKISA and BABE remains unclear.

Domestication process

Koriema/Kimalel

- In Koriema Kimalel, the domestication process started in 2005, and ended in 2007. After 2007, farmers stopped establishing Aloe farms or to pick out Aloe shrubs in the wild to their farm.
- Every body tried to get new Aloe shrubs (mainly from the wild) and to maintain their Aloe pool, but only very few farmers established Aloe Farm (3 to 5 in Koriema Kimalel). Some SHG and schools developed their own nursery and farm, and started selling seedlings.
- Under Kokisa, 3 nurseries were created (among them the one which is near the factory). But these nurseries progressively collapsed (because of the lack of buyers according to the participants). Firstly, 2 of them were closed and the seedlings were transferred to the central one (near the factory). Finally, the last nursery is not ran anymore (it is there, but nobody to take care of it).
- At the beginning of the domestication project, a lot of stakeholders didn't go to buy seedlings because their "farm" was already full of wild Aloe. The result of it was a deceiving domestication. Some stakeholders explain this situation by the high initial investment required to start domesticating. Thus when the time of harvest came, participants estimate that 95% of the Aloe sap supplied came from the wild.
- Kefri taught how to remove the suckers, but few people did it (although 1 Aloe plant can produce 10 suckers/year).

PR: It is not clear that there is a lack of buyers for the seedlings. Kefri nursery is producing and selling Aloe seedlings on regular basis. The existence of a shop in Koriema is also an evidence of the presence of buyers for such seedlings.

PR: The reluctance to establishment of Aloe farm in Koriema/Kimalel is not general. In Loruk, the simple fact to know the existence of BABE led some private stakeholders to plant several hectares (Informal group discussion)

Olduka

In Olduka, aloe is mostly in the wild as the community has not not domesticated it.

Kolowa

In 2009-2010, Kolowa stakeholders started cultivating Aloe in their farm (or garden?) spontaneously because they "feared that the wild Aloe disappears". During the meeting, 9 participants said having Aloe in their farm, but they couldn't estimated the total number of stakeholder cultivating Aloe. They have been starting this cultivation by transferring wild Aloe to their farm. The average size of their Aloe plantation is unknown. Barpello high school project, and Kefri in a second step (spacement) have brought the knowledge of cultivation. Barpello high school project has been encouraging domestication in several farms.

In Kolowa, there is a project of demarcation of land that contributed to initiate a change of perception toward Aloe. People started to identify pieces of land that they expect to own, and to take care of the natural resources on it.

PR: this "fear" is contradictory with their previous statement (Aloe population and size of shrubs increasing). Probably because the latter was a lie.

Harvest and Market

Koriema/Kimalel

In Koriema/Kimalel, each time when BABE made order of sap from Koriema/Kimalel, stakeholders couldn't supply as much as it was expected. *PR: The reason is probably because the opportunity cost of harvesting (even in the wild) is low for the price proposed by BABE.* Koriema/Kimalel participants said that it take a lot of time to harvest Aloe, not because of the cutting of leaves, but because they are only using one basin. Thus, they have to wait one basin to be full to go back home, empty it, and fill it another time etc… They are not weeding, although they know the production would increase if they did. The last time the Koriema farmers sold their harvest to BABE was in 2010. The stakeholders didn't know why BABE didn't buy to them anymore.

Olduka

They started to harvest in 2000, when Somali traders started to buy sap to them. Nobody taught them how to harvest. One family is able to harvest 5-10 L/day (half day harvest), using 2 basins. Men do not harvest. Children harvest during week end. During intensive period of harvest, the Radat collector received 100 L/Day. The harvest stopped in 2009, when the Somali Traders stopped buying here. Between 2004 and 2006, there was no buyers. *PR: Those Somali traders can go anywhere according to their mood. They represent an insecure market for them. Why do those Somali traders go and leave like this?* The buying price in Radat was 20 KsH/L. BABE bought 35 KsH/L. When BABE made an order to Olduka AMU, smallholders harvested but the process was slowdown by 2 limiting factors:

- The limited storage capacity of the collector
- The lack of storage facility at the family level

In Olduka, we could also collect some estimations concerning the boilers' strategy and volumes of activity.

- They boil 200 L of sap in a baril, which give them 80 kg of gum (=1 bag)

- They have a storage capacity of 4 tones
- There volume of activity is around 40 bags in 3-4 month, which means 3200 kg (store hardly full) → In one year they can get 9,6 to 12,8 tones
- One Somali has stayed during 4 years (2000-2004), and another has stayed 4 years (2006-2010).

PR: There is a confusion among stakeholders in the status of the boilers.

PR: Why do they stay 4 years and go. 4 year is enough for them to collect 38 to 51 tones of Gum. Is this number is a minimal trigger point to access certain market? And then they go to another market.

Kolowa

Kolowa stakeholders started harvesting in 2000, when the Somali boilers started to buy sap. Before this, stakeholders say that there was no commercial harvest of Aloe. It was preexisting in West Pokot. At the beginning they were harvesting all the plant, but they quickly change their practices, leaving uncut the top ring (2 to 5 leaves). From an agronomical point of view, they said it was good to leave them uncut because it increased yield, it avoid the drying of the shrub. Moreover they said it is useless to cut those leaves because they do not contain sap. They explain that they changed their practice because the elders started complaining in 2001, and decided to regulate the harvest of sap thanks to a pre existing organization in charged of regulating natural resource management. This organization is active at the location level (Kolowa), and supervised by the Chief. In each village, a comitee supervise the wild harvest, and can suppress the right to harvest Aloe to someone who is suspected to have harvested in the bad way.

Women (and children during weekends) use to harvest at a distance comprised between 9 and 12 km from their house. They leave their home around 8 and walk till 10 to a place from where they start harvesting till 5 PM. They get 3 L/day. When they go harvesting, they are doing this activity only. On their way back to home, they collect natural vegetables for the dinner. There is no cost linked with the harvest. Secundiflora produce more sap than turkanensis. When it is hot they harvest more. When it is wet, they do not harvest. They stop harvesting during rainy periods. They can wait one month before harvesting after a period of rain.

Stakeholders say that since the harvest started, the Aloe population increased and the size of the shrubs as well.

PR: Are they lying to avoid enforcement of law? If not, this statement need further agronomical research to understand the stimulating effect of harvest. If yes, it's an information in itself: it means they know this business is illegal.

PR: This is a good example of institutionalization of an innovation. Have to dig it.

Kefri trainings

Olduka

3 stakholders have been participating by trainings organized by KEFRI. They said they have leart soap making (but they didn't adopt the innovation for they were not ready to invest).

Innovation

Koriema/Kimalel

In Koriema/Kimalel, after this exercise of inventory of ethno pharmaceutical uses of Aloe, participants were asked weather there was any innovation on the basis of these practices. Participants responded that some people started to use gum instead of sap, leading the drugs to become more effective, and facilitating storage (*PR: and access as well?*). The participants also considered the cultivation of Aloe seedlings as an innovation.

PR: This innovation (replacement of sap with gum), if it's found to be really an innovation, might probably emerge within the community thanks to the access to gum. Also, several stakeholders spoke about small pieces of Aloe gum sold in market or by mobile fish-merchants. To be dug

Knowledge source

Koriema/Kimalel

In Koriema (where Aloe domestication took place through KOKISA and BABE), stakeholder were asked which knowledge were brought by the "factory". They responded it has provided them with knowledge on how to exploit aloe more effectively, and that they were taught how to boil in order to preserve the sap through the production of gum. *PR: They assimilate factory with the whole domestication project.*

Olduka

The participants were asked to identify their knowledge about Aloe, as well as the source of those knowledge. **Table 5** provides results of this exercise.

Knowledge	Knowledge source
Boiling	Somalis traders' middlemen
Quality test	Somalis traders' middlemen
Cooling	Somalis traders' middlemen
Cooling using bags	Somalis traders' middlemen
Gum utilization	Somalis traders' middlemen + Community
Harvesting time	Community
Selection of leaves during harvest	Somalis traders' middlemen (1) + Community (2) + Kefri/MOA (3)
Processing	Kefri
Harvesting seeds	Kefri
Market opportunity	Somali traders' middlemen (1) + BABE (2) + Urban herbalists (3)

Table 5. Knowledge and knowledge source identified by Olduka AMU Stakeholders

Consequences of the Aloe innovation process

Table 5 summarizes the positive and negatives consequences or problems perceived by the stakeholders of the different AMUs.

	Positive consequences	Negative consequences/problems
Koriema & Kimalel	- Provision of income in time of hunger (*PR: 2010 was a time of hunger??*) - Knowledge on Aloe nursery - Unity of purpose - Capacity to generate income and sustain themselves with Aloe products (soaps) - Soil conservation improvement - Employment initially - Knowledge on Aloe propagation - Aesthetic value - International promotion of Aloe domestication and commercialization (for Ugandan President sent 8 MPs to see how Kenya did.	- High capital outlay (it takes around 100 000 KsH to plant one hectare). *(PR: it is not a negative consequence, but a statement).* - Lost money in domestication since the factory stopped buying from the farmers
Kolowa	-	
Olduka	- The harvest of Wild Aloe increased the population of Aloe as well as the size of the shrubs.	- Low yield (would like something to press Aloe leaves) - Lack of market for sap - Lack of harvesting skills - Transport problem

Table 5. Positive consequences and negatives consequences or problems perceived

Stakeholder analysis

Stakeholder identification

Participants of the different GGD were asked to identify the stakeholders linked with Aloe. **Table 6** provides the result of this exercise of identification in the quotation order.

Koriema/Kimalel	Kolowa	Olduka
- Community - Kefri, - Landmawe, - KWS, - KFS, - Provincial administration, - Donors (EU, SNV), - AMUs, - Self helped Groups (Among them Kamasaiwa, Sakimoi), - Schools, - Local leaders, - BABE, - Herbalists, - Traders, - Boilers - Middlemen & brokers, - Consumer.	- Somalis (buyers and boilers) - AMU/BABE (buyer and boilers) - KEFRI (harvesting knowledge brokers) - Leaders - Community (Aloe farmers, wild harvester, both) - Barpello catholic mission	- BABE - KEFRI - MOA - Middlemen (BABE) - Middlemen (Traders) - Traders - Community - Urban herbalists - Consumers

Table 6. Stakeholders identification.

In Koriema/Kimalel, participants had difficulties to identify BABE as a stakeholder: "BABE, it's us, it's the community". We see that the community comes first in Koriema/Kimalel although it comes last in Olduka. Moreover, the number of types of stakeholders identified is probably reavealing something about the implication in Aloe projects.

Network mapping in Koriema/Kimalel

After having identified the stakeholders linked with Aloe, Koriema/Kimalel stakeholders were asked to link them together through a network mapping exercise (**Figure 1**). The Network Mapping led the stakeholders to tackle a certain number of issues:

- The mysterious non respect of the MOU by Landmawe,
- The opportunity to find other markets for the gum, and the influence of this MOU on the lack of motivation of the BABE management in the process of looking for other markets;

- The internal management problem in BABE, and the lack of credibility of the chairman
- The lack of capital of BABE betraying it to buy to the farmers even if there is an order
- The weak and variable links between the BABE executive authority and the AMUs;
- The key role of local leaders in the support of AMUs organization and to prevent informal trade;
- The duality in the Aloe trends according to the location;
- The price given to smallholders was to sufficient to make them go harvest;
- The existence of a conflict of interest in the BABE management (*PR: to be dug*);
- The non-renew of the interim executive authority of BABE for unknown reason. To solve this problems, the Kimalel/Koriema stakeholders suggested the creation of a "working committee".

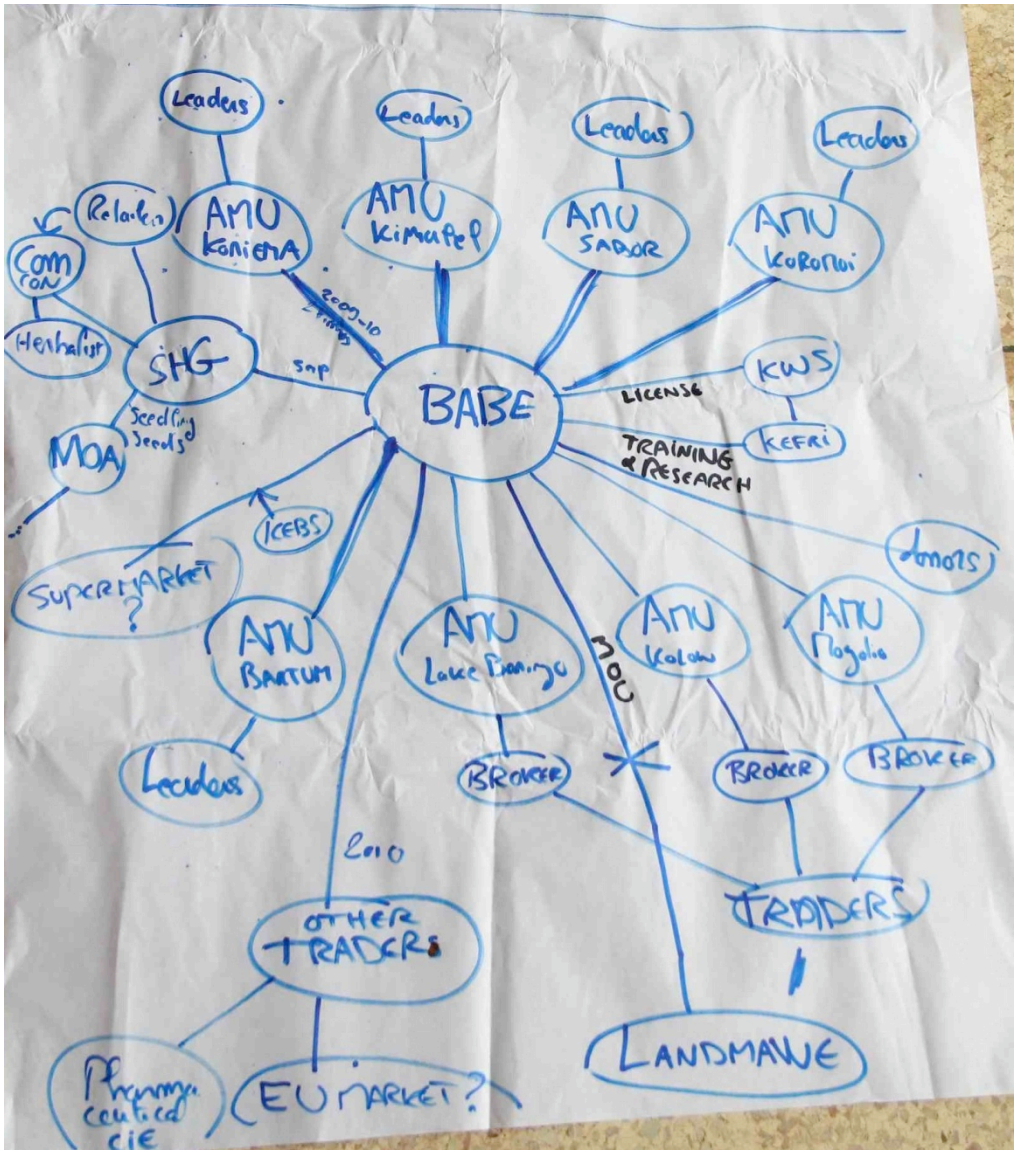


Figure 1. Result of the Network Mapping exercise in Koriema/Kimalel

Olduka

After having identified the stakeholders linked with Aloe, Olduka stakeholders were asked to link them together through a Supply chain mapping exercise (**Figure 1**), that led the stakeholders to tackle a certain number of issues:

- Identification of the a recently established “sous-filière”, made of so called urban “herbalists” and “soap makers”, that buy sap to local small scale traders belonging to the community. Their products are sold in markets by hawkers, in the street by fly fish merchants, and even in supermarkets.
- Estimation of the number of stakeholders of each “type”
- Estimation of the buying price proposed by each kind of buyers
- Transport costs not taken into account in the BABE purchasing policy

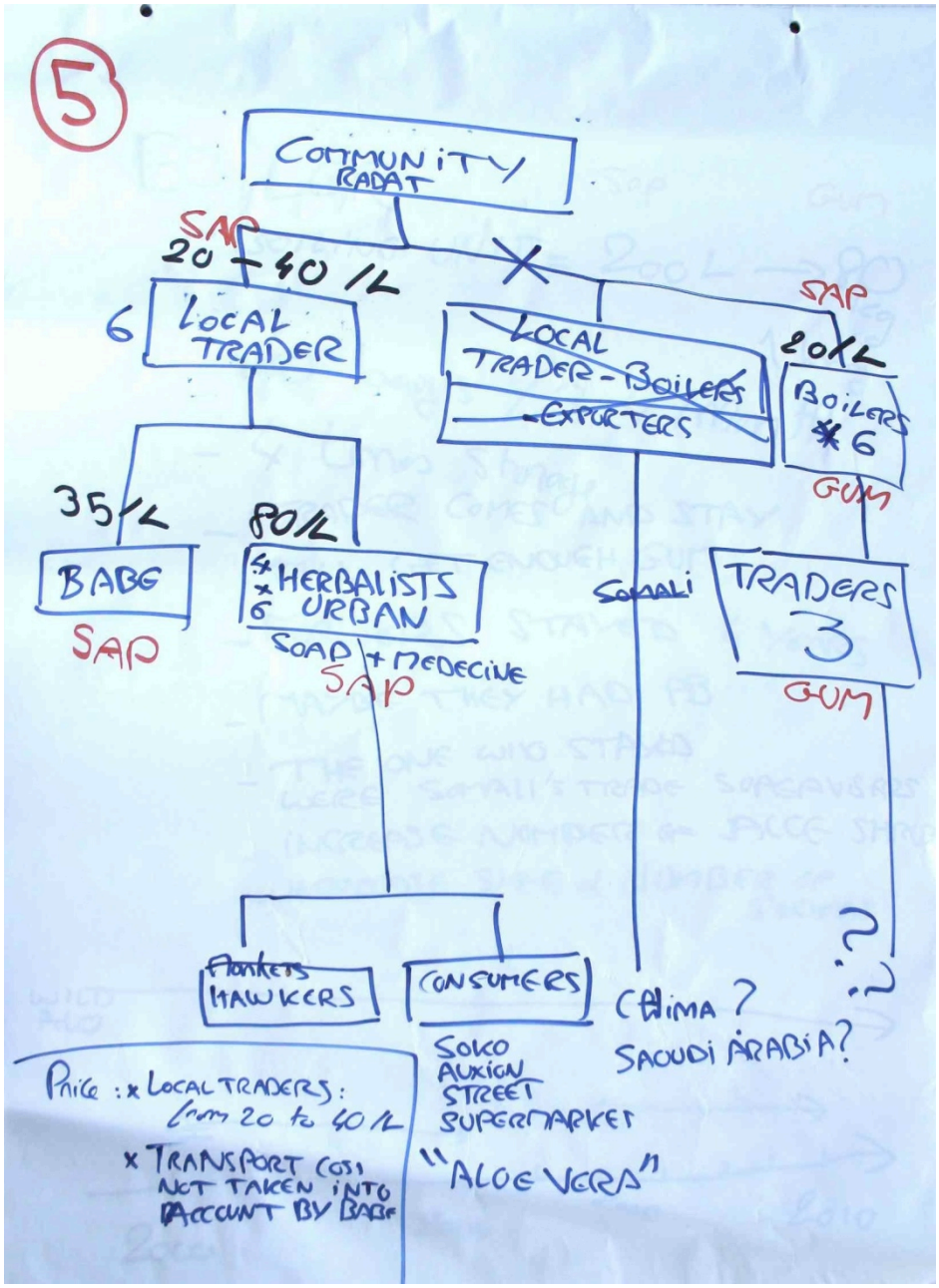


Figure 1. Result of the Supply chain Mapping exercise in Olduka

Perception change

Olduka

According to Olduka stakeholders, there is no law governing the use and exploitation of aloe. Nevertheless, when they heard about the potential commercialisation of wild Aloe, people started to actively protect Aloe on their own land. This process was facilitated by land ownership.

Expectations

Koriema/Kimalel

Koriema/Kimalel Stakeholders were asked to quote and rank their expectations toward the « factory » at the beginning of the project (order of quotation respected).

- Employment in factory
- Increased income through the selling of sap to the factory, as well as the selling of seedlings
- Increased aloe domestication → success
- Increased bee forage/honey → success
- Give value addition to Indigenous knowledge (traditional medicine, herbal products)
- Reduced illegal activities (charcoal burning and illegal brew) thanks to the employment
- Increased knowledge in aloe exploitation → success

Appendix 11
Multi stakeholder Workshop report

BARINGO ALOE COLLABORATIVE CASE ASSESSMENT

JOLISAA SCHEME

MULTI STAKEHOLDER WORKSHOP REPORT

KARI Perkerra, 08/08/2012

Photo: Opening session of the Baringo Aloe Consultative Case Assessment workshop

Reported by Chengole Mulindo & Raphael Belmin
Marigat, Kenya
18/08/2012

Executive summary

A Multi Stakeholder workshop gathering the Baringo Aloe stakeholders was organized on the 8th of August at KARI Perkerra, in the framework of the Collaborative Case Assessment (CCA) of the Baringo Aloe innovation system, JOLISAA project. The objectives of the event were to introduce the initial results of the aloe case by the CCA team to the Aloe stakeholders, to validate it, to fill existing gaps in the Aloe innovation story, and finally to come up with way forward for Aloe production and marketing. This report describes and critically assesses the preparatory work for the workshop and the actual conducting of the different sessions of the workshop. It also draws lessons dedicated to the other JOLISAA CCA teams, and establishes a way forward for the Aloe CCA. Although criticisms may be made about the way the workshop was prepared and implemented, all the objectives were reached. Oral presentations showed a thorough overall analysis of the Baringo Aloe innovation process, although it was regrettable that inequalities of hindsight into the results among the CCA team were visible, and that the materials & methods used by the CCA team were not introduced aprior to the oral presentations. Validation and focus group discussions confirmed the major findings and uncovered new evidence, but were vague and not fully exploited due to unclear identification of the grey areas that required some clarification, as well as the use of inappropriate methods putting at the same level questions of a different sort. The last session of the workshop led the participants to formulate their expectations as well as ideas on the way forward for the Baringo Aloe case. However, the debate was relatively unstructured, and most of the ideas were not discussed in much detail. Hindsight gaps into the results, unclear identification of grey areas, and inappropriate methods were inter-linked, and were the result of insufficient time taken by the CCA team before the workshop to consolidate data and share interpretation of results. Such problem could have been avoided by allowing some time for debriefing after each fieldwork, and by organizing regular CCA team meeting dedicated to the joint analyses of findings. Nevertheless the support of the national/international JOLISAA team that came a few days to the workshop played a key role, by helping the site team in structuring objective of the workshop.

Layout

Introduction

1) Workshop preparation

a. **Logistics**
b. **Choice of stakeholders**

2) Workshop implementation

a. **General overview and critics**
b. **Oral presentation**
c. **Validation session**
d. **Focus group discussion**
e. **Way forward**

3) Lessons drawn from the Multi Stakeholder workshop

4) Way forward for the CCA team

Conclusion

Appendix 1: Detailed workshop program
Appendix 2: PPT used for oral presentations
Appendix 3: Flipcharts fell during the focus group discussions

Introduction

After an engagement with the Aloe stakeholders through general group discussions, one-on-one interviews and observations made by the Collaborative Case Assessment (CCA) team, a multi-stakeholder workshop to discuss findings and elicit stakeholders' views on specific issues about the Aloe innovation story was held on 8th of August 2012 at KARI-Perkerra in Baringo County. The objectives of the workshop were three-fold: First, it was to introduce and validate the findings of the CCA team study about the aloe case and two, to gain more knowledge to fill existing gaps in the aloe innovation story, and finally to come up with way forward for Aloe production and marketing. This report describes and critically assesses the preparatory work for the workshop and the actual conducting of the different sessions of the workshop. It also draws lessons dedicated to the other JOLISAA CCA teams, and establishes a way forward for the Aloe CCA.

1) Workshop preparation

a. Logistics

The Baringo Aloe Multi stakeholder workshop was prepared by the Aloe site team (C. Mulindo, M. Welimo, R. Belmin), with a substantial support from B. Triomphe (JOLISAA coordinator) and T. Ng'ang'a (National JOLISAA coordination team).

A few days before the workshop, the site team met with the agenda of selecting the participants of the workshop and determining the number and contents of the presentations to be made. It was decided that C. Mulindo would make invitations for the participants while M. Welimo & R. Belmin would prepare the oral PowerPoint presentations. The selected participants were invited by letter and follow-up made by phone for confirmation. Despite all these, some AMU chairmen picked other people outside the invited circle. Others increased the number of attendants from the AMUs.

On the eve of the workshop, the CCA team was joined by B. Triomphe and T. Ng'ang'a in a preparatory planning meeting. On this occasion, workshop objectives were crafted, proposed programme was revised, oral presentations were refined and grey areas were identified. Responsibilities for the workshop were also allocated. Identification of grey areas resulted into selection of topics for discussion during the workshop.

b. Choice of invited stakeholders

The participants were selected on the basis of relevant institutions, the framework of the Aloe Management Units (AMUs) and other special groups. The institutions where representatives were selected for invitation were: the Ministry of Agriculture (represented by the District Agricultural Office), the Kenya Forest Service

(represented by the District Forest Office), the Kenya Wildlife Service (represented by the District Warden's Office), the Kenya Forestry Research Institute (represented by KEFRI Marigat Centre), Kenya Agricultural Research Institute (represented by KARI-Perkerra) and Baringo Aloe Bio-enterprise [represented by the factory manager]. The AMUs representatives were selected with the aim of getting as much variety as possible from the group members. Kolowa AMU being the furthest had the least representation while the closer AMUs [Mogotio, Koriema, Kimalel, Bartum and Sabor] had the most representation. Table 1 provides more details about the stakeholders that were invited to the Baringo Aloe Multistakeholder Workshop, coming from the various AMUs.

Name of AMU	**Type and number of stakeholder**
Koriema [6]	Self Help group: 2 Herberlists:1 AMU official: 1 Aloe farmers: 1 Wild aloe harvesters: 1
Sabor [6]	Self Help group: 2 Herberlists:1 AMU official: 1 Aloe farmers: 1 Wild aloe harvesters: 1
Kimalel [6]	Self Help group: 2 Herberlists:1 AMU official: 1 Aloe farmers: 1 Wild aloe harvesters: 1
Bartum [3]	AMU official: 1 Aloe farmers: 1 Wild aloe harvesters: 1
Mogotio [6]	Self Help group: 2 Herberlists:1 AMU official: 1 Aloe farmers: 1 Wild aloe harvesters: 1
Loruk [4]	Aloe boiler: 1 AMU official: 1 Aloe farmers: 1 Wild aloe harvesters: 1
Kolowa [2]	AMU officials: 1 Boiler/trader: 1

Table 1. AMU stakeholders invited to the Baringo Aloe Multistakeholder Workshop.

2) Workshop implementation

a. Logistics

Aside from the one involved in the preparation of the workshop, the implementation and debriefing of the workshop was facilitated by the institutional support of Dr. G. Kamau (Coordinator JOLISAA Kenya) and T. Moi (Centre Director KARI-Perkerra) as well as by the logistical support of Kimeto (KARI-Perkerra), Veronica (KARI-Perkerra) and J. Lekurle (Prosopis CCA team), and other KARI-Perkerra staff.

The language used during the workshop was English and Kiswahili. During the opening session, Dr. B. Triomphe's words were translated from English to Kiswahili by C. Mulindo. On the other hand, R. Belmin's oral presentation, made in English, was not translated considering it would have taken too long and that most of the participants could understand English. Mr. M Welimo's presentation was done in Kiswahili with some English undertones. The plenary discussions were mainly in Kiswahili, and informally translated to the participants that couldn't understand this language.

b. General overview of the workshop

The objectives of the workshop were to introduce the preliminary results found by the CCA team to the Aloe stakeholders, to validate them, to fill existing gaps in the Aloe innovation story, and finally to come up with way forward for Aloe production and marketing.

There were 4 distinct workshop sessions: After an opening session including opening remarks (T. Moi), introduction of JOLISAA scheme (B. Triomphe) and workshop objectives (G. Kamau), two 20-minute oral presentations were made by M. Welimo and R. Belmin, each followed by a validation session facilitated by T. Ng'ang'a. This was followed by a focus group discussions session and eventually a session designed to capture the way forward for the Aloe innovation process. The detailed workshop programme is given in **Appendix 1**.

Although the workshop programme was slated for 8.30 AM, the event did not start until after 10.00AM as most participants arrived late (some were arriving as late as 11.00 AM). Participants were coming from their homes that morning and being household bread winners they had to sort out family issues in the morning before coming. If they had slept over, time would have been saved. However, financial resources could not allow an overnight stay for all participants, except for two from Kolowa.

c. Oral presentation

Two oral presentations were made, by use of PPT. Conducted by M. Welimo, the first presentation went through the traditional uses of Aloe in Baringo, the story of the Baringo Aloe Innovation process and the main triggers and drivers. The presentation demonstrated the existence of 4 main periods in the innovation process:

- 1950s-1986: Environmental threat.
- 1986-2004: Increasing attention on Aloe.
- 2004-2007: Infrastructure and organizational development.
- 2007-2009: Dormant period and confidence crisis
- 2009-2012: Supplying, marketing, and management challenges

The second oral presentation, conducted by R. Belmin, provided an in-depth analysis of the stakeholders and innovations. The presentation first identified and characterized groups of smallholders that successively appeared into the innovation process. Then, it went through the various elementary innovations and related knowledge brokers identified in the Aloe innovation system, to emphasize the key role of traders, KEFRI, and KWS a knowledge brokers.

The two oral presentations showed a thorough overall analysis of the Baringo Aloe innovation process, although it was regrettable that inequalities of hindsight into the results among the CCA team were visible, and that the materials & methods used by the CCA team were not introduced. The PPT used by M. Welimo and R. Belmin are given in **Appendix 2**.

d. Validation session

Each oral presentation was followed by a plenary discussion facilitated by T. Ng'ang'a, and was designed to validate the findings introduced by the CCA team.

Validation sessions confirmed the main findings and uncovered new evidences, but were vague and not fully exploited due to unclear identification of the grey areas that required some clarification, as well as the use of inappropriate methods putting at the same level questions of different sort. Moreover, there was no systematized parking notes for later attention. Finally, there was no clear validation frame focusing the attention of participants on specific issues. The participants only agreed on the overall package presented by the CCA team. Validation sessions were held by means of plenary discussions where participants addressed various topics:

- **The barriers to Aloe cultivation** such as high investment costs linked with the buying of seedlings and the fencing of plots

- **The Aloe sap yield** is respectively higher for wild Aloe and *Aloe turkanensis* than for cultivated Aloe and *Aloe secundiflora*. This perception of the

participants might not be taken for granted, as other factors might determine the sap yield (e.g. climate, soil, age of shrubs, cultivation methods)

- **Aloe soap making is made difficult** due to in the high price of some key inputs (e.g. Coconut oil).

- **The producer price for Aloe sap** is not uniform across the livelihood zones. In Loruk and Kolowa, limited livelihood options lead women to harvest wild Aloe and sell it at less than K.Shs 30 /litre. In Koriema, Kimalel and Sabor, harvesters find it hard to sell aloe sap at K.Shs 40/litre to BABE because of availability of multiple livelihood sources. However, most of the participants agreed that a fair selling price for sap would be K.Shs 60 /litre.

- **Sustainable harvest practice** This technical innovation that spares the top growing leaves while harvesting had not been adopted at the same time and varied by place. In Tangulbei, after their coming in 1984, traders inducted smallholders in sustainable harvesting by use of provincial administration meetings as training fora. In Loruk, traders didn't sensitize smallholders on sustainable harvest leading to a rapid decline of wild Aloe population.

- **BABE internal management should be revived.** During the plenary discussion, many stakeholders raised the issue of BABE internal management, emphasizing lack of transparency and capacity to operate.

e. Focus group discussion

After the session of finding introduction and validation, 4 focus group discussions were organized. Their main objectives were to collect some information about grey issues pre-identified by the CCA team. The 4 focus group discussions dealt with the following grey areas:

- **Group 1:** Boiler numbers, volume of activity, and catchment area size
- **Group 2:** Diversity and characterization of markets for Aloe gum, and sap yields estimates, variability, and drivers
- **Group 3:** Cultivation vs wild harvest practice; characterization and drivers
- **Group 4:** Estimation of Aloe farm numbers and acreages and reasons for Land Mawe stepping down .

The flipchart materials produced during the focus group discussions are given in **Appendix 3**. Detailed information collected during those focus group discussions are contained in another report.

Although focus group discussions allowed the CCA team to collect significant amount of data, the accuracy and relevance of those data sets were uncertain because of rushed identification of grey areas and inadequate stakeholders sampling. Some of the focus group discussions were dominated by few stakeholders.

f. Way forward

- There is need to find a sustainable and more-paying market for the Aloe gum
- Critical need to revolutionalize the management of the Baringo Aloe Bio Enterprise (BABE) was noted
- The project and government should employ a more inclusive approach toward stakeholders involved in informal aloe trade.

Much of the debate was relatively unstructured, and most of the ideas were not discussed in detail. Moreover, the discussions were mostly focused on the way forward for BABE, which is a stakeholder among others. Finally, it was unclear weather it was to the participants, to the CCA team, or both, to come up with way forward as no specific times were allotted. In conclusion, as well as for the validation session, those problems are due to the absence of clear framework to lead the discussion.

Another problem was lack of scientific objectivity. and some controversies that led to accusations and counter-accusations during the workshop.

3) Lessons drawn from the Multi Stakeholder workshop

The day after the workshop, the site team together with the national and International team held a debriefing meeting on the workshop. This was the occasion to critically assess both preparatory work and implementation of the workshop. This section of the report follows:.

It was found that although all the objectives of the workshop were reached, critics might be made about the way the event was prepared and implemented. In a nutshell, the different sessions of the workshop were vague, incomplete, and not fully exploited due to:

- Insufficient quality of oral presentations;
- Absence of clear framework to lead the validation and way forward session;
- Rushed identification of grey areas that required some clarification during the focus group discussions;
- Relatively unstructured debates, and ideas not deeply discussed during the way forward session;
- Lack of scientific objectivity

Those problems are inter-linked, and have been caused by a hindsight gap into the results, a lack of preparation work for the workshop itself, and a lack of clear objectives as far as the multi stakeholder workshop is concerned. During the workshop preparatory meeting, the CCA team understood too late there were gaps

of understanding of the Innovation process within the CCA team as well as an overall lack of hindsight. These gaps and lack of hindsight led the CCA team to spend the time that should have been dedicated to the preparation of the workshop's technical aspects by refining oral presentations, consolidating field data, and share interpretation of CCA results. This overall lack of preparatory work of the workshop explains the different problems evocated above.

Such problem could have been avoided by allowing some time for debriefing after each fieldwork, and by organizing regular CCA team meeting dedicated to the joint analyses of findings (consolidation of data and share interpretation of results). Nevertheless the support of the national/international JOLISAA team that came a few days to the workshop played a key role, by helping the site team in the structuring of objectives. A constant monitoring of the other CCA teams by the JOLISAA national team could encourage them to work on a more regular basis.

4) Way forward for the CCA team

After the debriefing meeting, the site team together with the national and International team held another meeting designed to propose a way forward for the Baringo Aloe CCA team (as well as for the Baringo Prosopis CCA, but this report does not tackle it).

Given the short remaining time available to the Aloe CCA process and the constraint linked with the necessity of dealing with the Prosopis case, it was proposed that the Aloe CCA team focus its attention on:

- Writing the workshop report;
- Completing the field work by interviewing smallholders (both farmers and wild harvesters), Land Mawe LTD representative, Kavaka Mukonyi, District Crop Officer of Marigat, Kenya Wildlife Service Officer in Kabarnet, Urban soap maker in Nakuru or Eldoret, and Self Help groups on Aloe;
- Completing the collection of secondary data;
- Writing a first draft of the Aloe CCA report (dead line on the 12th of September).

Conclusion

Although criticisms may be made about the way the workshop was prepared and implemented, all the objectives were reached. Greater success of the Baringo Aloe Multi stakeholder workshop could have been achieved if more time had been invested for debriefing after each fieldwork and by organizing regular CCA team meeting dedicated to the joint analyses of findings. A constant monitoring of the other CCA team by the JOLISAA national team could encourage them to work on a more regular basis.

Photo: Participants of the Aloe workshop

11.30-12.00 PM	2nd presentation **Aloe innovation story** (Innovation history story barriers, drivers, impacts)	Welimo
12.00-1.00PM	Reactions [plenary]	Chengole
1.00-2.00PM	Lunch	
2.00-3.00PM	Way forward	Teresiah

Appendix 12

Data source used in the estimation of Aloe sap harvesters income and Aloe trade volume

Type of data	Figure	Source
Demographical data		
Number of habitants in Baringo County	555 561	Baringo County, Kenya County Factsheet, Commission on Revenue Allocation
Number of household in Baringo County	110 649	Baringo County, Kenya County Factsheet, Commission on Revenue Allocation
Number of individual per household in Bairngo County	5,02	Calculation
Number of inhabitant in East Pokot	78968 hab	Arid land resource management project, 2006-2007 annual report
Number of households in East Pokot	15 730	Calculation
Data on Aloe exploitation		
Number of individual per household involved in wild Aloe exploitation	1	GGD Kolowa
Quantity of sap harvested from one Aloe shrub	80-100 mL	NAREDA, 2002
Sap quantity produced by one smallholder	3-5 L	GGD and interview Kolowa
Number of months per year when the Aoe sap is harvested	6	GGD and interview Kolowa
Number of days per month when the Aoe sap is harvested (Sundays removed, and rainy days)	20-25 days	GGD and interview Kolowa
Number of days per year when the Aoe sap is harvested	120-150	Calculation
Data on Aloe trade		
Number of sap processors in activity in 2008	9	Interview traders, GGD and interview Kolowa
Annual gum production of one Aloe sap processor	9000-15 000 kg	Traders, boilers
Conversion coefficient between sap and gum	0,4 kg/L	GGD Koriema
Buying price of 1L of Aloe sap	28 KsH	GGD and interview Kolowa
Monthly salary of an unskilled Kenyan employee	4258	Agricultural Industry (amendment) Order June 2012

Appendix 13

Organizations involved in the Aloe regulatory device and their role

Organization	Expected role played in the regulation of Aloe exploitation and trade
Kenya Wildlife Service (KWS)	Kenya Wildlife Service is the CITES Management Authority for the Kenya government, and thus ensures that all trade and transactions of wildlife out and into Kenya are within the provisions of the national legislations and in compliance with CITES provisions. Thus KWS coordinate, should administer and regulate all trade and transactions of Aloe species or derivatives on behalf of the government in consultation with other lead agencies.
National Museum of Kenya (NMK)	The expected role of the NMK is to advise KWS so that the removal of Aloe species from their habitat does not affect its survival in the wild. KWS and NMK have worked closely together to ensure that the national obligations with regard to CITES are enforced. By hosting the East African Herbarium, NMK is also involved in ex-situ Aloe conservation.
Kenya Forestry Research Institute (KEFRI)	KEFRI undertake forestry research and technological development and provide extension services on sustainable utilization and management of forests and their products, with special emphasis on socio-economic empowerment of communities to create wealth. It has a wide scope, which includes, dry land forestry, plantation forestry, and non-timber products (the latter included Aloe species).
Kenya Forest Service (KFS)	KFS' role is to enhance protection, conservation, development and management of all forest resources in the country, with special emphasis on development of commercial plantations and protection of indigenous species. KFS shall include Aloe exploitation in the scope of its activities related to community mobilization in integrated forest management.
Department of Resource Survey and Remote Sensing (DRSRS)	DRSRS plays a critical role in species monitoring, by being skilled in the study of population dynamics, abundance, threats, mapping. DRSRS should therefore play a major role in aloe assessments, monitoring and mapping.
Customs	The Customs is an enforcement agency with the mandate of verification of accompanying documents and clearance for exports and imports. Customs shall play a critical role in verifying quantities of aloe products exported from and imported into the country against the accompanying permits and certificates.
Kenya Plants Health Inspectorate Services (KEPHIS)	KEPHIS plays a role of vigilance on movement of plant materials in addition of the role of national Customs. The role of KEPHIS in Aloe regulation is therefore in the issuance of phytosanitary certificates in case of exports of whole plants and or specimens of Aloes.
Ministry of Agriculture (MOA)	The Ministry of Agriculture has identified and classified aloes as an emerging crop and therefore supplement and complement the activities of the lead institutions with regard to commercialization of aloe plants. The ministry through its structures shall provide extension services to Aloe farmers.
National Environmental Management Authority (NEMA)	The mandate of NEMA is to supervise and coordinate all matters related to environment in Kenya. In conjunction with relevant lead agencies, NEMA prescribes measures for conservation of biological resources. Aloe utilization, conservation and management will be subject to rules and regulations within the provisions of EMCA Act, 1999.
Monitoring and Evaluation System	A monitoring and evaluation system will be set up to fast track the implementation of the Wildlife (Conservation and Management) (Aloe species) Regulations, 2007. More precisely, a monitoring program on the impact of harvesting on aloe populations shall be periodically undertaken.

Appendix 14

Public interventions that were undertaken in Baringo

Year	Name of the intervention	Budget (KsH)	Donor	Goal	Specific objectives
2004-2005 (13 months)	The Baringo Aloe Bio-Enterprise Development project	11,730,000	- CDTF-BCO (78%) - KEFRI (12%) - KWS (5%) - Land Mawe LTD (4%) - KOKISA CBO (1%)	Set up a sustainable Aloe supply chain in Koriema, Kimalel, and Sabor relying on AC, and encourage the establishment of a national legislation and regulatory mechanism for Aloe exploitation and trade; observing the CITES recommendations.	- Build on and Aloe bio-enterprise managed by a multi-actor partnership between a community (KOKISA CBO), a private investor (Land Mawe LTD), and GoK (through KEFRI and KWS) - Build an Aloe processing factory; - Promote AC among Koriema, Kimalel, and Sabor actors by promising future market for Aloe sap; - Facilitate adoption of AC in Koriema, Kimalel, and Sabor by training actors on cultivation techniques and by providing access to Aloe seedlings through Aloe nurseries; - Fund the development of a national legislation and regulatory mechanism for Aloe exploitation and trade; - Collect the information needed to regulate harvest of wild Aloe - Establishment of Koriema and Oge AMUs.
2005-2006 (6 months)	Develop capacity within KOKISA CBO	1 560 000	SNV (97%), KOKISA CBO (3%)	Build the capacity of the project backer organization (KOKISA CBO/KOKISA Cooperative) Project Implementation Committee	- Organise workshops and training on organisational development, business skills, financial management, business planning
2007	2007 KEFRI budget to BABE project	250 000	KEFRI (100%)	Create new AMUs and strengthen the existing ones so that KOKISA Could get a KWS license to exploit Aloe.	- Establish 3 new AMUs (Kolowa, Oge, Koromoi) (90 000 KsH/AMU) - Monitor existing Aloe plantations and nurseries and continue to promote AC - Establish demonstration plots in Koriema, Endao and Loruk - Operationalization of the prior-existing AMUs
2008-2010 (17 months)	The Baringo Aloe Bio-Enterprise Development and Capacity Building Project	3,027,200	- CDTF-CEF (79%) - KEFRI/KWS/Land Mawe (8%) - KOKISA (13%)	Strengthen the governance and management capacity of KOKISA/BABE LTD, and link it to the various AMUs. - Support the infrastructure development of the factory	- Strengthen the organisational capacity of KOKISA CBO, KOKISA Cooperative, and later BABE LTD. - Strengthen the link between BABE and the various AMUs - Employ a management team for the factory - Delineate processing lines in the factory - Develop of a business plan for the future Aloe bio-enterprise - Continue to promote AC in all selected AMUs
2010	2010 KEFRI budget to BABE project	501 000	KEFRI (100%)	Support BABE LTD in the marketing of high quality Aloe gum and Aloe-based cosmetic products.	- Branding of BABE products - Training on quality control - Laboratory tests for sap and gum chemical content and microbial activity analysis

Appendix 15

Press articles on key events of the Baringo Aloe innovation process

President Moi presents degree certificates at Moi University College, Eldoret, yesterday.

Medicinal plant given Presidential protection

By PIUS NYAMORA

President Moi yesterday delcared presidential protection for a medicinal plant known as *aloe* to save it from extinction.

Presiding over the second graduation ceremony of Eldoret's Moi University, where he awarded 24 graduands with bacheior of science degrees in forestry, the President said:

"Here in Kenya, we have in some cases reached a stage where the direct exploitation of certain plant species has resulted in threatening the biological diversity of our eco-system.

"I am most concerned in this regard about reports I have been receiving on the indiscriminate exploitation of the *aloe* plant."

The President said that for many years, the *aloe* plant had been used traditionally to cure many diseases.

"This limited use has, in most cases, been moderate and has not posed any threat to the regeneration of the *aloe*," he said.

"In recent years, however," he went on, "there has been an increase in the cutting of the *aloe* for commercial purposes. The commercial exploitation of this plant has resulted in its being totally destroyed in some parts of the country."

In addition to the direct threat to the plant itself, the President said, its excessive exploitation had had other negative environmental effects.

The *aloe* grows mostly in clusters in the drier areas of Kenya. It tends to thrive in desert or semi-desert lands, for instance in Namibia's Kalahari Desert.

(There are at least 275 species of the *aloe* and more species are still being discovered in Africa and South and Central America. The plants have various medicinal values which include being used as a purgative to ease or cure constipation, **explains *Nation* Science Writer, Otula Owuor.**

In many communities the extract is taken in the evening to clear the stomach in the morning. The plants generally have colour-

BACK PAGE — Col. 3

FROM PAGE 1

ful red or yellow flowers. The leaves are thick or fleshy and tend to have spines. Some species of the *aloe* are used as sources of various skin cosmetics).

The plant also helps hold the soil together and encourages the growth of other vegetation in its surroundings. President Moi said its destruction would result in the elimination of other vegetation.

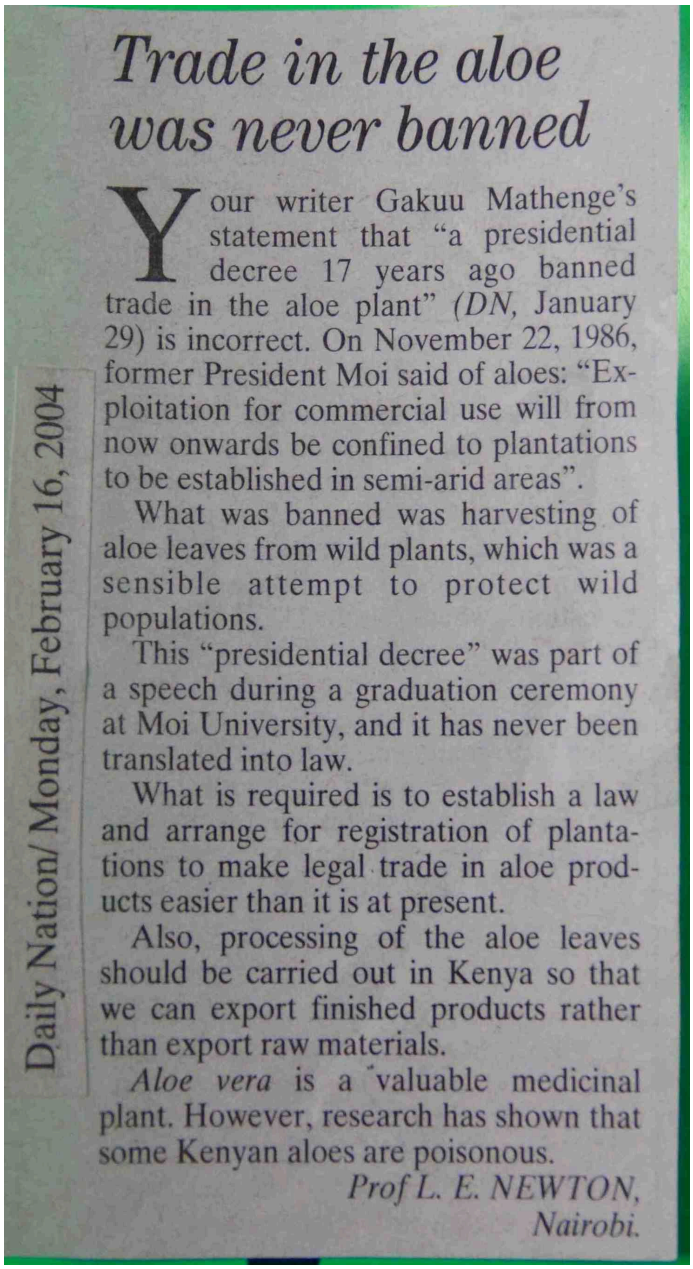
"Further, it is often necessary for those who cut the plant so as to gather fuel-wood from nearby bushes in order to boil the plant and obtain the medicinal extract," the President said.

"We, obviously cannot afford to sit back and watch this plunder continue. I, therefore, declare the *aloe* to be an endangered species which will henceforth be protected from unauthorised harvesting.

"Exploitation for commercial use will from now onwards be confined to plantations which will be established in semi-arid areas."

DAILY NATION, SATURDAY, NOVEMBER 23, 1986

No. 8075, p. 1, 24.



Trade in the aloe was never banned

Your writer Gakuu Mathenge's statement that "a presidential decree 17 years ago banned trade in the aloe plant" *(DN,* January 29) is incorrect. On November 22, 1986, former President Moi said of aloes: "Exploitation for commercial use will from now onwards be confined to plantations to be established in semi-arid areas".

What was banned was harvesting of aloe leaves from wild plants, which was a sensible attempt to protect wild populations.

This "presidential decree" was part of a speech during a graduation ceremony at Moi University, and it has never been translated into law.

What is required is to establish a law and arrange for registration of plantations to make legal trade in aloe products easier than it is at present.

Also, processing of the aloe leaves should be carried out in Kenya so that we can export finished products rather than export raw materials.

Aloe vera is a valuable medicinal plant. However, research has shown that some Kenyan aloes are poisonous.

Prof L. E. NEWTON,
Nairobi.

Daily Nation/ Monday, February 16, 2004

Ban endangers healer plant species

Commercial potential of global money-spinner, aloe vera, is suppressed in local market

By GAKUU MATHENGE

A presidential decree 17 years ago banned trade in the aloe plant in the country, reinforcing an international convention meant to protect the plant.

But, ironically, the might have only managed to further endanger the plant while suppressing the commercial potential of what could be a multi-million dollar industry.

The aloe plant grows wild in many parts of Kenya, but as long as trade is banned, farmers who have it on their land would rather just cut it down and replace it with crops that are more useful.

Valued the world over for its healing natural healing properties, as a food supplement and in the cosmetics industry, especially with the trend towards natural and herbal remedies, the plant's species, Aloe Vera being the best known, is already a global money spinner.

Some 57 species of aloe, known locally variously as *ihukuroi* (Gikuyu), *sukuroi* (Maasai), *subri* (Somali), among others, grow naturally in Kenya, most of it in the semi-arid areas. Some of the species have been found to possess similar chemical composition with aloe vera — the most successfully commercialised of the species.

A stakeholders meeting in Nanyuki last week called for serious scrutiny of restrictions imposed by international lobbies and conventions on our natural resources before adopting them wholesale.

'The regulated farming and export of aloe vera could boost our GDP'

Aloe is listed under the Convention on International Trade in Endangered Species (Cites) for international protection.

"At this age of globalisation when the world is rapidly getting inter-connected, it is imperative that we domesticate international treaties that we have ratified, to boost our national interests," said a paper prepared by State counsels Anne Kaiga Mutindu and Martha Maina from the AG's chambers.

"Kenya, being an agricultural-based economy, the regulated farming and export of aloe vera could go a long way in boosting our GDP. The challenge is how to balance the exploitation of the plant without making it extinct."

The 1985 presidential decree banning the exploitation of the aloe drove the thriving trade underground. It has been blamed for hindering investment in commercial production and processing at a time the global demand for aloe products has been on an upward trend.

From fermentation of the popular Gikuyu traditional brew, *muratina*, to releasing mosquito repelling smoke by the Samburu, the aloe has a myriad local uses. But it is in large scale exploitation that local farmers can play their role in supplying the pharmaceutical industry with a ready cure for the poultry disease, coccidiosis, to a wide range of

Photos/Joan Pereruan

Mr William Wambugu of the National Museums' Nairobi botanical garden, shows the aloe secundiflora, yesterday. Inset, the aloe lateritia, one of the 57 known species of aloe.

products used by the multi-billion dollar cosmetics industry and food supplements.

A casual visit to any pharmacy, cosmetics store and supermarket in Nairobi will reveal a large number of pricy, imported products boasting aloe as a primary ingredient.

It has, indeed, become the new goddess of beauty and health, but how much of the raw material comes from Kenya is impossible to determine because of the underground nature of the export trade.

Mr Powse

'The absence of plant material provisions means even if we got anybody with aloe products, we can only seize them since we have no laws to charge anybody'

Mr Jama

The Queen of Sheba and the fabled Wise Men from the East (the Maggi) are reported to have carried expensive gifts, among them aloe, in their exalted Biblical safaris.

All food supplement products — the varieties globally sold by Swissgarde, Forever Living Products and other modern "herbalists" — commend aloe vera for rejuvenating weary nerves and cells, cleansing impurities generated by body metabolism, buttressing the immune system against a wide array of diseases.

As for cosmetics, there is no skin condition — from insect bites, sunburn, texture, acne, boils and fungal attacks, to rejuvenating the skin and slowing (even reversing) skin aging — that is not listed under the Aloe. Penetration: reputed to have have the ability to penetrate the skin deep into the dermis, taking its healing powers to the damaged areas.

- Stimulation: it stimulates the renewal and growth of new tissues at the cellular level and accelerates the healing process.
- Settles/Calms nerves: has a calming effect on the nervous system.
- Detoxification: Cleanses and detoxifies the digestive system, boosting the body's own immune system and self-healing abilities.
- Anti-inflammatory: natural treatment for swellings and tissue injuries.
- Nutrition: contains a wide variety of vitamins and minerals that are vital to various functions of the body systems.

One could go one and on.

Kenya is a substantial supplier of the the global aloe trade but little is understood about the extent of the country's contribution and value.

As global demand rose, suppliers of the raw materials scoured the length and breath of African wilderness, Kenya included, harvesting the naturally growing aloe and shipping it to Europe, America and Asia.

The fear of overexploitation prompted Cites to list aloe in its appendix (II), which means that all signatories needed to develop production and licensing procedures for international trade to be considered ethical.

In Kenya, this was followed by a presidential decree, which was never gazetted, simply banning exploitation and trade in aloe.

There were no attempts to develop production and licensing procedures so that the trade could carry on with the approval of Cites.

The consequences of the ban meant that even privately cultivated aloe cannot be exported because Kenya Wildlife Service — the custodian of Cites protocol in Kenya — will not grant export permits.

In the absence of a regulatory framework, those involved in the trade simply went underground.

"The trade has been a a fall-back position in times of drought, with over 46 per cent of households deriving part of their livelihoods from aloe business in recent years with an average annual income of Sh46,000," says a market survey commissioned by the Laikipia Wildlife Forum (LWF) last year.

"There are people out there who have expressed interest in funding plantation farming of aloe but always shied off because of the grey legal environmental. Once it is sorted out, am sure investment will come in," says LWF chairman Gilfrid Powse.

KWS chief licensing officer Ali Jama confesses that though the organisation issues export permits, it has no provisions for plant materials, which he adds are only now being formulated.

Boiled bitters

"The absence of these provisions also meant that even if we got anybody with these aloe products — usually exported as boiled bitters or crystals — the best we could do was to confiscate them since we have no laws to charge anybody," he added.

Trade in the extract was banned 17 years ago but 300 tonnes are exported illegally annually

Profits turn green as new factory taps aloe plant, the wonder cure

BY OLIVIA OWUOR

Until two weeks ago, residents of Baringo district watched in dismal as the waters of River Perkerra receded. It is their lifeline, and a number of the 50,000-plus locals resorted to illegal charcoal burning since the area is semi-arid.

Then a saviour came in the form of a local herb — the aloe. The European Union and other donors gave residents a new lease of life by opening a commercial plant in the area.

Residents had feared that their only source of livelihood would be lost, with the eminent collapse of an irrigation scheme. They would lose about Sh150 million annually from cash crops grown in the scheme. Only charcoal burning would save them, some thought, says Mrs Jane Chepkonga, a resident.

The European Union, the main sponsor of the aloe processing plant at Marigat in Baringo district, officially commissioned it on September 14. The factory is the first of its kind in Kenya. It will reduce cattle rustling, which is prone in the area, by offering an alternative way of earning a living, says Mr Hassan Farah. Farmers can export up to 1,000 tonnes of aloe products annually to the European Union.

Mrs Chepkonga, chairlady of the 30-member Equator Nature Conservation project, said: "Our district is very dry. We have been relying heavily on the irri-

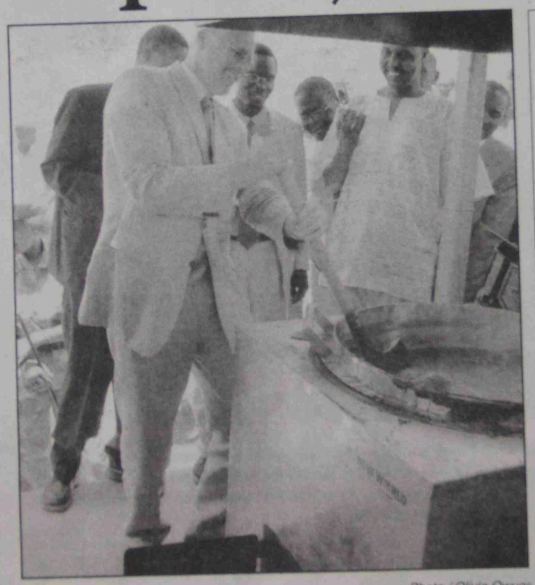


Photo / Olivia Owuor

Mr Eric Van der Linden of the European Union stirs aloe sap at the new processing factory in Koriema, Baringo district.

EXPORT

Kenyan sap among the best in the world

BY GATONYE GATHURA and GAKUU MATHENGE

The opening of a commercial aloe processing factory in Baringo this month removes the trade from just a few well-connected people to hundreds of local farmers.

Trade in aloe was banned through a presidential decree and listing on appendix (II) of CITES 17 years ago. But an estimated 300 tonnes of the plant extract are still exported illegally from the country every year.

"This ends up in South Africa where it is re-packaged and re-exported to Europe, Asia and North America," says Kenya Forestry Research Institute's head of the Biospecting and Intellectual Property Coordinator, Dr Kavaka Watai.

The black market — a thriving multi-million shilling trade — has been going on for decades, complete with its own chain of producers, middlemen, transporters and exporters, but who disguise their products as

plant can be harvested several times over a long period.

The idea, says Mr Fred Kibara, chairman of the Kenya Aloe Working Group, is to have a thriving market selling local aloes as a brand name to compete with exotic ones like *Aloe Vera*, *Aloe Barbadensis* and *Aloe Ferox*.

Some 57 species of aloe, known locally as *thukurui* (Gikuyu), *sukuroi* (Maasai), *subri* (Somali), among others, grow naturally in Kenya, mostly in semi-arid areas. Some of the species (specifically *Aloe Turkanensis and Aloe Secundiflora*) have been found to possess similar chemical composition to *Aloe Vera* — the most successfully commercialised species.

Although *Aloe Vera*-based gums have traditionally been sold as having a higher content of the active ingredient, aloin, studies have since shown the Kenyan species (*Aloe Secundiflora and Aloe Turkanensis*) have comparable aloin content. Indeed, the Kenyan gums have higher contents of other ingredients — aloe resin, aloesin and aloenin — used in cosmet-

Executive summary

Joint Learning in Innovation Systems in African Agriculture (JOLISAA) is a European project that aims to increase understanding of agricultural innovation systems and to produce lessons and Agenda for further research, practice, and policies, by cross analyzing experiences of agricultural/rural multi stakeholder innovations in 3 African Countries (Kenya, South Africa, Benin). This internship has occurred in the framework of the Collaborative Case Assessment (CCA) phase of JOLISAA, which consists in the in-depth joint analysis of innovations cases selected out of a large inventory. We took part of a Kenyan CCA team in charged of the assessment of an innovation process linked with the activation of a natural resource in Baringo (Kenya): *Aloe secundiflora* and *Aloe turkanensis*.

Baringo County is dominated by arid and semi arid lands (ASAL), where populations' livelihoods are weakened by hostile marketing systems, environmental degradation, and inappropriate or insufficiently funded past development policies. Kenyan indigenous Aloe species have been described as particularly interesting livelihood diversification options for ASAL communities due to adaptation to dry conditions and commercial value of the sap.

The Baringo Aloe case is a 30 years innovation process characterized by 3 periods of time during which 3 innovations - Wild Aloe exploitation (WAE), Aloe Cultivation (AC), and the Making of Aloe-based Products (MAP) – have been adopted, up-scaled, and institutionalized.

The 3 innovations of WAE, AC and MAP represent 3 successive forms of Aloe resource activation. However, the process of transformation of the Kenyan indigenous Aloe species into a sustainable economical resource for Baringo ASAL has not yet reached a point where it is achieved. Moreover, our study suggests that the process of activation of the Aloe resource in Baringo has reproduced the past dynamics of marginalization and natural resource degradation of ASALs. Nonetheless, the various public interventions implemented so far led to the construction of organisational, institutional, biological, and knowledge resources, which are still immature but usable as a strong basis for further projects.

Key words: Innovation system, natural resource, Aloe, Kenya, Baringo.