Production contracts as a networking lever for system building. Some evidence from a comparative analysis of agrifood value-chains in Europe

Célia Cholez, Marie-Benoît Magrini

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Cholez Célia [1] and Magrini Marie-Benoit [1]

[1]INRAE (National Agronomic and Environmental Research Institute), UMR AGIR, France

Corresponding authors: celia.cholez@inrae.fr , marie-benoit.magrini@inrae.fr

Célia Cholez is a post-doctoral fellow in economics at INRAE. Her main research topic relates to inter-firm coordination issues applied to the agro-industrial sector in the context of sustainability transition. She is currently developing an original framework to analyze how contractual governance in value-chains helps enhancing collective knowledge creation and diffusion for changing productive practices (and what are the conditions for that). To do so, she draws on organizational theories more precisely transaction costs theory, supplemented by knowledge-based approaches in economics and management.

Marie-Benoît Magrini has a PhD in Economics. She is researcher at INRAE since 2007. She conducts analyses on the processes of lock-in and transition of agricultural and agro-food systems, with particular interest on both technical and organizational innovations. Her methodological approaches mobilize qualitative or quantitative analyses. She works in various national or European projects in a multidisciplinary approach. She has published over 30 articles in SCI journals, public reports and book chapters.

Abstract

Alternative technologies development in sustainability transition require stakeholders' joint-commitment for strategic system building, in order to reverse the lock-in prevailing in most sectors. Among the various strategic system building modes, this article focuses on the role of production contracts in value chains, as a networking lever for system building. If contracting has been studied in innovation economics, notably for R&D contracts or license contracts, there is a lack of evidence on how contracting for goods may also favor joint-knowledge development particularly for alternative goods in less technological intensive sectors. Based on a combination of Transaction Costs Economics, Relational-View of Strategic Management and Technological Innovation System literature, we propose an original analytical framework to disentangle the micro-mechanisms by which production contract governance (PCG) in value chains can be considered as strategic networking lever for system-building. We apply this framework to six case studies in European agricultural value-chains engaged in developing legumes, being alternative crops of high interest for both agricultural and food sustainability. Main results show that PCG between farmers, intermediary organizations and processors foster network structural and human resources that help alternative agricultural value-chain structuration. Those insights are particularly interesting for practitioners and policy makers to support PCG as a networking lever for alternative agri-food chains development; but they also offer new research agenda to analyze the role of PCG in other sectors in transition.

Key words: governance, network, knowledge, inter-organizational arrangement, grain-legume

Section 1. Introduction

Sustainability transition requires alternative technologies development to reverse the lock-in prevailing in most sectors. The way alternative technologies are developed is mainly analyzed throughout the technological innovation system (TIS), a set of actors that interact through a system of resources (Markard and Truffer, 2008; Smith et al., 2005, Farla et al., 2012). This literature highlighted that the creation and coordination of new business opportunities start "*if actors pre-commit to a new technological path, persuade others to follow, and set in motion a chain of joint commitments*."(Musiolik et al., 2018:3). Therefore, the network building strategies within the system building is of high interest to understand market creation. But network dynamics are still under analyzed in transition studies, particularly as regards formal strategic networks that are organized in an intentional way, although public policies could easily support them to foster alternative technologies/market development compared to more emergent systems that are, by definition, difficult to drive.

In that way, Musiolik et al. (2018, 2012) gave special attention to the role of *formal network* in their study on strategic system building modes; "formal network" being defined as "*organizational structure with clearly identifiable members where firms and other organizations come together to achieve common aims*" (Musiolik et al, 2012:1034). First, bridging stakeholders enables knowledge exchange and building, knowledge being a core resource for innovation. Second, formal networks foster other resources development such as financial resources, legibility, trust and common culture, etc. in a more efficient way. As underlined by Musiolik et al. (2012:1032): *"firms and other actors collaborate in formal networks not only to generate new knowledge but also to strategically create and shape supportive system resources".*

Nonetheless, those analyses remain quite unclear on the organizational arrangements supporting such networks, or in other terms, those works short fell in describing the governance structure of those formal networks. The "steering committee" or "working groups" as often mentioned in those works, are very general designations. Hence, one remaining question is to analyze the type of links on which those formal networks rely; or in more neo-institutional terms, which are the organizational arrangements that structure those formal networks, how they operate and how they contribute to system building; particularly in the early stages of development when performance of the alternative is low. That is to say, the challenge remains to formalize the micro-mechanisms by which the links structuring those formal networks result in resources development for system building.

To contribute to this agenda of research, we propose here to come back to the basic networks that shape the more frequent links between firms: the governance structure by which they exchange goods or services (i.e. transactions). The Transaction Costs Economics (TCE) initiated by Williamson (e.g. 1991) remains a fundamental framework for understanding those links of inter-firm exchange of goods (or services). This theory, strongly developed since the 1990s, revealed various organizational arrangements, mainly determined by the degree of specificity and uncertainty of inter-firm exchanges (Williamson, 2010). In particular, when dealing with the development of new goods requiring alternative technologies, the question of transaction specificity and uncertainty is rising; and from the TCE point of view, hybrid organizational arrangements based on formal contracts should prevail (Ménard, 2004). More precisely, the

specificity of assets/investments for alternative goods and the resulting hold-up risks will lead the firms to establish production contracts in order to secure their respective investments[1]; production contracts being defined as[2]:

> *formal agreements between two (or more) firms whose objective is to frame efficiently the production and the exchange of a good (or a service) under mutually agreed specifications on prices, quality, and production conditions.*

Because those contracts tackle "production conditions" they operate as strategic links between firms to develop alternative technologies, generating a formal network through their governance. But, those production contracts have been little studied in the literature on innovation and transition, while they are a core subject for social scientists in TCE (mainly to understand the reasons why various organizational arrangements prevail according to the characteristics of inter-firm transactions). More precisely, the question of how production contracts are also a lever for joint-knowledge development on technologies, and more broadly a lever to develop network and system resources, is marginalized in the literature. This is all the more surprising as inter-organizational arrangements are well known to be efficient in coordinating knowledge resources among productive stakeholders (Dyer and Singh, 1998; Mowery et al., 1996; Powell and Grodal, 2005); but the connections between contractualization in the value-chains, knowledge dynamics and more largely, TIS building, are still poorly established. Indeed, even if some authors suggest contractual arrangements could foster knowledge development (Brousseau and Glachant, 2002; Langlois and Foss, 1999; Gobbato, 2013), no analytical framework has been developed to consider those organizational arrangements through system building strategies. First attempts were done to highlight the role that production contracts could play in knowledge development on alternative technology in the agricultural sector (Cholez et al., 2019, 2020).

In fact, the question of knowledge development, through formal contracts, has been much more analyzed through R&D contracts or license contracts (Arena et al., 2012; Arora et al., 2004), while there is a lack of evidence on how contracting for goods may also favor knowledge creation and transfer (Gobbato, 2013). This last question is of particular importance because if R&D contracts or license contracts are frequently used in high-intensive technological sectors like energy and transports, they are less frequent in less technological intensive sectors, like the agricultural sector (Pavitt, 2005). Therefore, in less-technological sectors, the role of production contracts in developing network resources such as joint-knowledge, could become strategic for stakeholders, but it remains a puzzle question.

Considering that understanding production contracts as a networking strategy opens new avenues to analyze strategic system building for those sectors, the main objective of this article is to analyze how production contracts on alternative goods foster knowledge exchange and development for system building. A secondary objective is to explore how this networking strategy could also favor

[1] It is a strategy largely underlined by the TCT in various sectors of activity (Klein & Sykuta, 2010)

[2] If marketing contracts (concerning only price and delivery conditions not production specifications) are quite well defined by laws, there is no official or legal definition of production contracts in Europe. In practice, they could also be called "supply contracts" (UNIDROIT et al., 2015)

other resources building as shared expectations and legibility of the system shaped by the organizations linked with production contracts.

To analyze how production contract governance operates as a formal network supporting system building, we rely on an analytical framework in which we combined the Transaction Costs Economics (e.g. Williamson, 1991; Langlois and Foss, 1999), the Relational-View of Strategic Management (e.g. Dyer and Singh, 1998) and the TIS literature (e.g. Musiolik et al., 2018). This original analytical framework focuses on the micro-mechanisms of formal networks based on production contracts that foster both organizational resources (such as knowledge), network resources (such as joint-knowledge and trust), system resources (such as new standards of production).

We apply this framework to six case studies in European agrifood value chains developing legumes crops. Studying those value chains in the agricultural sector is challenging because stakeholders encounter difficulties in developing those alternative crops. Legumes crops are recognized as an important lever for the sustainability transition of agrifood system (e.g. Willett et al., 2019), but are still facing an important lock-in situation (Magrini et al., 2016); particularly in Europe where both their cultivation and consumption are very low (Weindl et al., 2020; European Commission, 2018[3]). Even if new outlets open opportunities for legume crops, deficit in the agrifood TIS for knowledge availability and distribution on alternatives farming practices hamper their development, as illustrated in various empirical works (Zimmer et al., 2015; Cholez et al., 2020). In addition, there is no consensus in the literature on AKIS (Agricultural Knowledge Innovation System) on the best ways to develop technical knowledge on crops throughtout agricultural supply chains; also given the fact that variety of extension services or other knowledge brokers across countries and regions makes the choice of policies difficult at the European level (Klerkx and Leeuwis, 2008). Hence, the agricultural sector being strongly concerned by network resources development issues for system building, we analyze how this contractual governance between farmers, intermediary organizations (storage organization or traders) and agrifood processors (ie. processing industry) based on production contracts for goods, fosters network resources development. The results concern the agricultural sector, but the analytical framework we developed could be applied to other sectors for comparisons, opening a research agenda that we discuss.

The paper is structured as follows. Section 2 presents the analytical framework and Section 3 the materials and methods based on a comparative analysis of 6 cases studies in Europe. In Section 4, we present the results and discuss a research agenda as regards the analysis of formal networks in strategic system building. Section 5 concludes.

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[3] *"Legumes have a large potential to increase protein production sustainably based on their high protein content and their ability to fix nitrogen. Demand for protein-rich crops in Europe is high, which is currently not covered by domestic production. In view of a changing climate and given the heterogeneous environmental conditions in Europe, cultivating a higher variety of better adapted legumes is required to increase protein self-sufficiency and contribute to healthy diets."* (Weindl et al., 2020: 4)

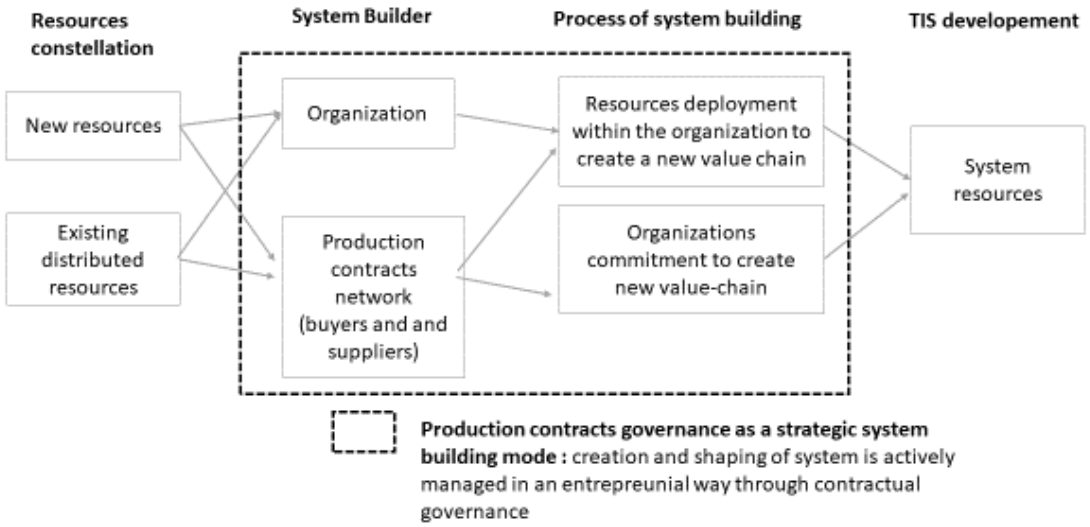
Section 2. The governance of production contracts as a networking lever for system building: an analytical framework

This framework aims at formalizing how production contracts contribute to network resources and especially knowledge development, which is a core resource in system building. First, we present production contracts as entrepreneurial actions constituting a strategic system building mode (2.1); after having recalled the basic concepts used (2.2), we disentangle the micro-mechanisms by which production contracts foster network human resources development (2.3) and other types of resources (2.4).

2.1. Production contracts governance as a strategic system building mode: delineation of the analytical framework

Figure 1 summarizes the delineation of production contracts governance as a strategic system building mode based on the framework of Musiolik et al. (2018). Production contracts in value chains are deliberately chosen by actors to coordinate the production in an explicit and strategic way. Then, the system builders (Hughes, 1979) under study correspond to a value-chain network, i.e. an organized community of buyers and suppliers. This coordination operates as a system building mode particularly for a new value chain concerning alternative goods development. Both existing resources are distributed (distributed agency) and new resources are needed (developing agency) (Musiolik et al., 2012). Production contracts linking firms and their governance (ie. contractual governance) could be analyzed as a strategic system-building mode under which (i) an organization (a firm) can deploy its own resources to create system structures, and (ii) the network of firms pre-commit to a new path, by setting in motion a chain of joint commitments.

Figure 1. Production contracts governance as a strategic system building, adapted from Musiolik et al. (2018)



2.2. Resources: basic concepts

Resources that constitute the resource constellation are both tangible and intangible assets of strategic value. According to strategic management literature, resources explain the competitive advantage of the firm and can be strategically developed both within firms, as highlighted by the Resource-based view (Barney, 1991) and at the inter-firm level, as highlighted by the Relational-based view (Dyer and Singh, 1988).

Among them, *human resources* play a major role. Human resources are all the immaterial assets linked with knowledge development both on the production practices and the expected characteristics of the goods exchanged. In productive value-chains, three main types of human/knowledge resources can be distinguished: (i) human capital developed by learning and training (referring to skills and know-how of employee) (iii) new knowledge provided by R&D activities (characterized by investment and/or patents) (iii) and by technical advisory services. The *human resources constellation* defines the global knowledge resources availability and distribution and the *human resources* developed within organization or within the network can allow knowledge deficit reduction in the TIS.

Other types of resources also exist. For instance, *tangible resources* such as equipment and financial assets, but also r*elational resources* such a*s* reputation, and lobbying power. Moreover, *structural resources* are also important to consider as they define the rules by which firms operate or interact, notably through the choice of a governance structure. In alliances or formal networks those rules define the meetings of firms, the type of access to other resources, etc.

Resources are distinguished with regard to who has access to them, referring to *organizational resources* when only the firm has access to it or *network resources*/club resources when only the members of the network have access to it. *System resources* are defined as the ones non-excludable (by the network) and that benefit to all the actors involved in the TIS.

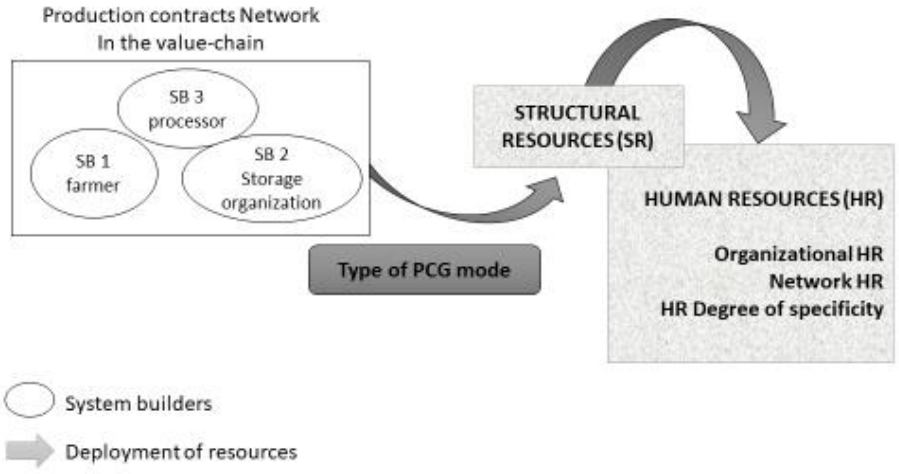
In the remainder of the paper, we focus on *organizational and network human resources* but we also give some attention to other resources.

2.3. Micro-mechanisms by which production contracts governance foster organizational and network human resources

As mentioned in introduction, production contracts have been studied by several authors as regards incentives issues, but little attention has been paid specifically to knowledge development issues[4]. Starting from empirical exploratory findings of Cholez et al. (2020) suggesting production contracts could foster inter-firm knowledge development, our objective is to disentangle the micro-mechanisms by which this mode of system building *Production Contracts Governance* (we called PCG afterwards) constitutes *structural resources* (SR) that impact specifically the organizational and network *human resources* (HR) development (Figure 2).

[4] Indeed, the classical analysis of contracts remains the principal-agent perspective, examining how incentives (payment schemes and the length of contracts) affect producers' efforts. In this approach, contracts are a way to deal with asymmetric information while stating the contracting parties' abilities and preferences; but the knowledge dynamics surrounding the transaction is underestimated (Brousseau and Glachant, 2002).

Figure 2. Resources deployment through *Production Contracts Governance* strategic system building mode



Based on Transaction Costs Economics (TCE) (Williamson, 1991) and the Relational-View of strategic management (RV) (Dyer and Singh, 1998), we developed three main propositions linking PCG, structural resources and human resources.

First, considering the insights of TCE, the production contracts establish commonly agreed rules. Those rules are both formal agreements written in production contracts and informal joint commitment between stakeholders, the two one constituting the production contract governance (PCG). Based on various empirical studies on production contracts (e.g., Bogetoft and Olesen, 2002; UNIDROIT et al., 2015; Cholez et al. 2017) those commitments concern mainly the way the production is done and exchanged, for instance, the duration of the agreement, the quantity and quality of the good exchanged, the type of production practices to be implemented, the means by which stakeholders organize mutual controls, in addition to the price setting mechanisms. Those production contracts are usually signed before the production starts, and the PCG runs during all the production time. Those rules are defined bilaterally or collectively.

From a RV point of view, those commitments establish routines of interactions between the contracting parties, in that way PCG operates as structural resources.

> *Proposition 1: The production contracts governance (PCG) generates structural resources through the commonly agreed rules and the interactions implemented.*

Second, based on TCE, the rules of PCG allow the contracting parties to secure mutual investment by reducing the risk of opportunism (i.e. hold-up problem). This is particularly true for organizational human resources development in the context of alternative value chain development. And based on the RV, the interactions generated through the PCG, for instance the bilateral or

collective talks for the contract negotiation and other types of meetings to follow the execution of contracts or their adaptation (adjustment due to hazard events), contribute to share information and knowledge, that is to say, contribute to develop network human resources.

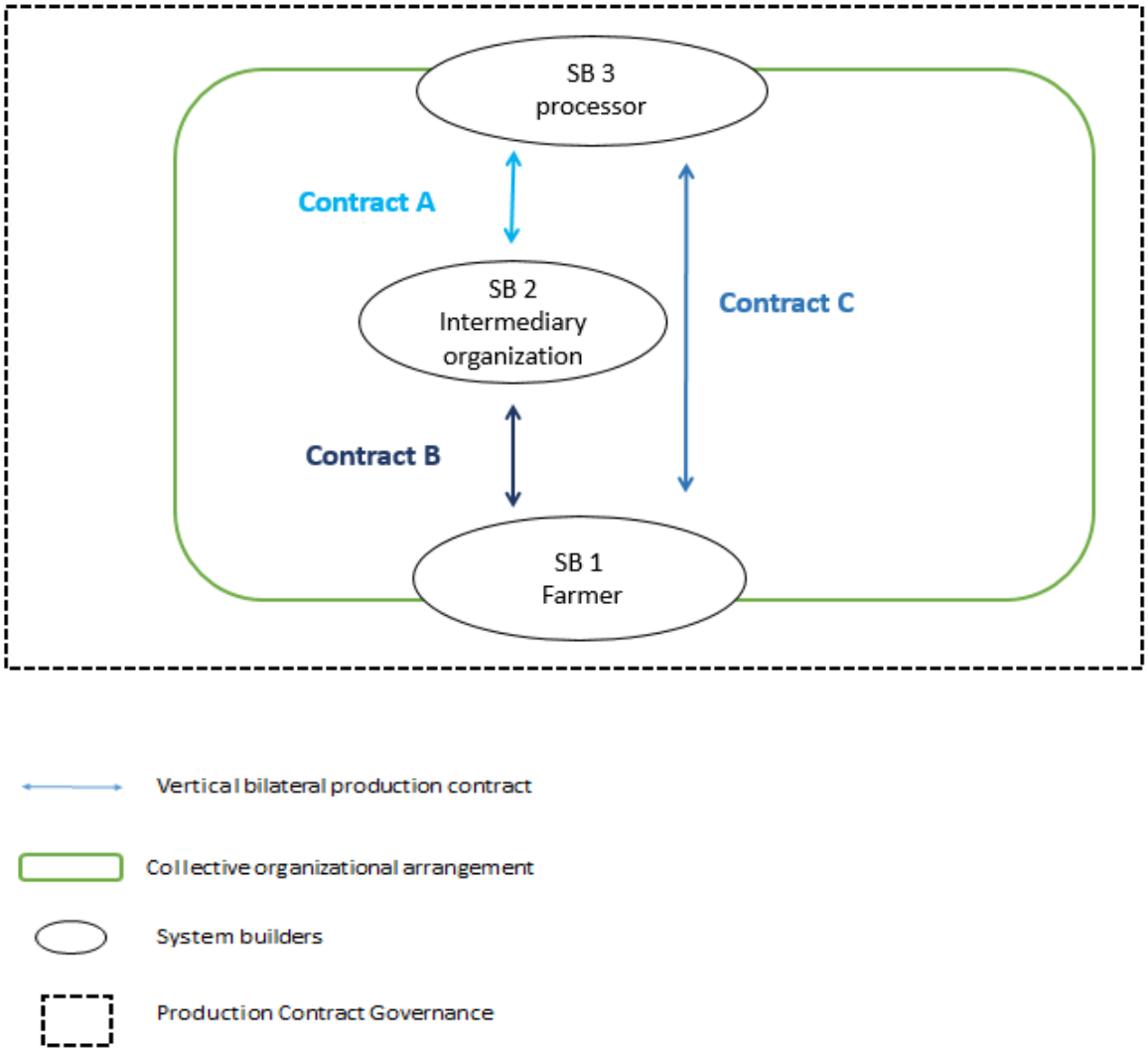
> *Proposition 2: The structural resources developed by production contracts governance protect and foster organizational human resources investment by reducing opportunism*
>
> *Proposition 3: The structural resources developed by production contracts governance foster network human resources development through the mutual interactions generated*

Notwithstanding, if joint-knowledge development (i.e. network human resource) emerges through the interplay of those cooperating actors in the value chain, the effect of production contracts may not be equal according to the contractual governance chosen by the stakeholders (Figure 3). Indeed, various schemes of production contracts can occur, according to the links between the three main types of system builders (SB) considered here (Cholez et al., 2017; UNIDROIT et al., 2015). Bilateral production contracts can be signed:

- between one (or several) intermediate organization (I) and a processor (P) : contract A
- and/or between an intermediate organization (I) and farmers (F) : contract B
- and/or between a processor (P) and farmers (F): contract C.

The intermediary organization is most often an organization in charge of storing and trading the crops harvested by the farmers; but sometimes only trading operations occur. The supply of a processor can be provided by one or several intermediary organizations (in that case a bilateral contract exists with each intermediary organization). In addition to the bilateral production contracts, collective arrangements (involving all the system builders, only part of them or even outside organizations) can contribute to the governance of those contracts.

Figure 3. Production Contracts Governance scheme



According to the contractual governance chosen (bilateral or collective), the human network resources building could be more or less important, and so accelerate more or less the learning curve of the stakeholders, particularly as regards the technical knowledge on the good under contract, that is the key-knowledge to develop for the system building of alternatives.

Those three main propositions call for empirical analysis in order to understand how those mechanisms operate and how PCG impact the development of resources.

Section 3. Method: Case studies comparative analysis of grain-legume value chains in Europe

TIS on grain-legume crops, in the European agrifood sector, represent a relevant case study to highlight Production Contract Governance (PCG) system building mode. We selected this empirical field for several reasons. First, the TIS on grain-legumes is caracterized by deficit in (i) market formation (ii) knowledge production and (iii) legibility issues. This deficit results from a lock-in situation analyzed in previous works: during the previous decades, agrofood system essentially developed around some major crops, creating a lock-in situation particularly difficult to reverse for developing alternative crops supporting a greater diversification of agricultural systems (see Magrini et al., 2016, 2019 for insights on lock-in mechanisms in agrofood system). Second, the TIS on garin-legumes can be considered as an ecological innovation which is not only radical regarding new production practices, but also relies on more complexity involving different knowledge between upstream and downstream stakeholders for developing coupled innovations (Meynard et al., 2017). Hence, the challenge to favor system building on alternative crops, is to commit the stakeholders to investing on them through all the value chain. The last reason is that we could draw on previous study on production contracts in grain-legume value chains, which help us to understand what were the contracting issues in a context of innovation and changes, and how technical knowledge development was considered as a main issue by stakeholders from those value chains (Cholez et al., 2019; 2020).

We choose to use a case study approach because it fits very well with the nature of the research question that is quite new and with the study of a contemporary phenomenon in the making (Eisenhardt, 1989; Yin, 1994). Also, a pragmatic reason is that no dataset exists to analyze the organizational dimension of those value chains: data on production contracts remain private and must be collected by researchers (Sykuta and James, 2004).

Cases selection was made in order that we can make comparisons across the cases. By a case, we consider here, one grain-legume value-chain represented by the succession of transactions from the crop production by a farmer (i.e. a farm) until the transformation of the crop by an industry (i.e. a processor) and in which production contracts were used following the various schemes presented in Section 2. Notably, those operations could also require the action of an intermediary organization (for storage and/or trade operations) or not. In that way, the delineation of each case study was based, first, on the identification of a processor, and then, on the identification of its suppliers: among them, only one intermediary organization supplying the processor was taken into account in each case study; and only one farmer supplying this intermediary organization was considered as a representative of the farmers supplying the intermediate organization. With the support of professional organizations involved in an European research project (H2020 LEGVALUE), we selected 6 grain-legume value chains across four European countries: France, Latvia, Portugal, United Kingdom. The grain-legume crop considered could be one of the following crops: soya, pea, fababean, and chickpea. The mode of production could be organic or conventional, and could concern food or feed outlets. Table 1 presents the case studies. The very low share in agricultural land area of the legume crop assesses for the minor status of it.

Table 1: Case studies description (**Data calculated from Eurostat data)*

Case study name	*Chickpea VC in France*	*Chickpea VC in Portugal*	*Fababean VC in France*	*Pea VC in Latvia*	*Pea VC in France*	*Soya VC in France*
Case study acronym	**CFr**	**CP**	**FFr**	**PL**	**PFr**	**SFr**
Country	France	Portugal	France	Latvia	France	France
Grain-legume crop	chickpea	chickpea	fababean	pea	pea	soya
% of the grain-legume crop in the arable land of the country in 2007*	n.a.(confidential area)	0,2	0,3	1	0,9	0,2
% of the grain-legume crop in the arable land of the country in 2017*	0,1	0,1	0,4	12	1,1	0,8
Outlet	food	food	feed	food	food	feed
Agricultural mode of production	conventional	conventional	conventional	organic	conventional	conventional
Label	no	no	no	organic	no	no

We collected the data by combining a semi-qualitative survey we addressed to each of the 3 main stakeholders structuring the value chain under study (a farmer-F; an intermediary organization-I; a processor-P) and additional sources of information.

The survey was implemented on-line and filled by the respondent with our assistance by phone or skype. This assistance helped us to check the good understanding of the questions and to collect additional information. The survey was based on 72 open or closed questions distributed across different sections about: general information on the respondents, the tangible resources deployed like investment in equipment and facilities, the human resources (knowledge), the production contractual governance (PCG), and one synthesis section. The questions were formulated in English and based on common terms (avoiding theoretical terms) in order to be easily understandable by the respondents. The grid-survey is available on open repository and the information collected allows us to inform the propositions established in Section 2, through various variables we linked to the analytical concepts (presented in Section 2) synthetized in Table 2.

Table 2: Analytical concepts and variables addressed in the survey

Analytical Concepts	**Concept delineation within the case studies** *A case study is a grain-legume value chain.*	**Variables concerning the crop in the VC under study; addressed by each organization** *farm-F, intermediary organization-I, processor-P*
Human Resources constellation	The human resources constellation is defined by: -the initial knowledge availability on the crop and the transformation of knowledge base over time -the distribution of knowledge on the crop across the stakeholders of the VC and the transformation of knowledge base over time	-Perception of the level of technical knowledge on the crop (i.e. all the knowledge required for producing, storing, transporting, and transforming the crop) for each organization at the launching of the value chain and nowadays * -Gap/difference in the level of technical knowledge perception across the stakeholders
Human resources deployment	The human resources deployment relates to all the investment made for developing the technical knowledge on the crop	- R&D activities - Patents - New workforce allocation /reallocation - Technical advice through various devices - Training - Data collection on the production processes along the value-chain
Network Human Resources	Human resources above mentioned are organizational (exclusive to the organization) or network resources (club-resources) according to the type of access i.e. excludability or not for the stakeholders (farm, intermediary organization, processor).	- Type of access to R&D outputs - Type of access to technical advice or training - Type of access to data collected on the production processes along the value-chain
Specificity of human resources	The specificity of human resources relates to the inability to reuse them for other purposes (other use or other client) without additional costs	-Specificity** of R&D outputs -Specificity** of technical advice outputs
Structural resources	Structural resources are the rules by which firms operate or interact. Among them, we distinguish the ones provided by the bilateral production contracts between the stakeholders and/or the one provided by other collective interactions linked to those contracts.	- Interactions between the stakeholders of the value-chain: reasons (linked to the PCG or for other purposes), frequency, and type (bilateral or collective) - Contractual rules or clauses

*the level of technical knowledge was asked for ten items (varieties choice, soil tillage, seedling, harvest, crop rotation, ecosystem services, collect, storage, technological processing) according to a Likert scale from 1 to 4 : 1 no knowledge at all, 2 some knowledge but not reliable for the VC, 3: reliable knowledge to be strengthened, 4 reliable knowledge very well adapted. An average score was calculated for the nine first items relative to crop production and technological processing item is considered separately, and n.a. means not available: the respondent did not know how to answer.

** the specificity of R&D outputs or technical advices outputs is qualified with declarative statements, according to a scale on additional cost forecasting: the output can be reused for other purposes without any costs; with few costs for adaptation; with important costs for adaptation; the output cannot be reused at all.

Additional sources of information for triangulation included: preliminary interviews with one agricultural professional organization that is engaged in the H2020 LEGVALUE project (n=6) and follow the value-chain under study; post interviews with these same professional organizations to

get additional information in case of inconsistency in the data collected by the survey (n=2); firm reports; press release; publicly available documents; and participatory workshops conducted during the LEGVALUE project (2017-2021).

The survey responses were organized in an excel data set. Data analysis allowed us to identify regularities among the different cases concerning the different modes of contracting in the value-chains and their impact on organizational and network human resources.

Section 4. Results and Discussion

Main findings show that production contracts governance (PCG) is deliberately chosen by stakeholders according to initial resources availability and distribution in the TIS; and that PCG functions as a system-building mode, particularly as regards structural resources defining collective rules and enhancing interactions for shared expectations and joint-knowledge development.

4.1. The knowledge deficit perception in the TIS

The system builders/organizations (farmers-F, intermediary organizations-I and processors-P) identified systemic problems in the grain-legume sector when they launched their value-chains. One main problem was the knowledge deficit in the grain-legume TIS. Their perception of the initial knowledge availability on the crop and of its evolution over time, presented in Table 3, shows most often a progress of the knowledge base on the crop with the development of their respective value chain.

Table 3: Level of Technical Knowledge (TKN) perception for each organization in the six case studies

Case study acronym	CFr			CP			FFr			PL		PFr			SFr		
Organization acronym	CFr_F	CFr_I	CFr_P	CP_F	CP_I	CP_P	FFr_F	FFr_I	FFr_P	PL_F	PL_P	PFr-F	PFr_IO	PFr_P	SFr_F	SFr_IO	SFr_P
Initial																	
TKN CROP PRODUCTION	2,1	2,7	1,1	2,9	3,0	1,0	2,1	2,9	1,4	4,0	2,3	n.a.	1,9	1,3	2,3	2,6	2,6
TKN COLLECT STORAGE	3,0	2,0	2,0	4,0	2,5	1,0	4,0	3,0	1,0	n.a.	3,5	n.a.	2,0	2,0	2,0	3,0	3,0
TKN TECHNOLOGICAL PROCES	1,0	2,0	3,0	n.a.	4,0	4,0	1,0	2,0	2,0	n.a.	2,0	n.a.	1,0	2,0	2,0	1,0	1,0
Today																	
TKN CROP PRODUCTION	3,7	3,0	1,4	4,0	4,0	1,0	3,7	3,0	3,4	4,0	3,6	n.a.	2,7	2,6	4,0	4,0	4,0
TKN COLLECT STORAGE	4,0	4,0	2,5	4,0	4,0	1,0	4,0	3,0	3,0	n.a.	4,0	n.a.	3,5	3,0	3,0	4,0	4,0
TKN TECHNOLOGICAL PROCESSI	2,0	3,0	4,0	n.a.	n.a.	n.a.	1,0	3,0	4,0	n.a.	4,0	n.a.	3,0	4,0	3,0	4,0	4,0
Learning																	
TKN CROP PRODUCTION	1,6	0,3	0,3	1,1	1,0	0,0	1,6	0,1	2,0	0,0	1,3	n.a.	0,9	1,3	1,7	1,4	1,4
TKN COLLECT STORAGE	1,0	2,0	0,5	0,0	1,5	0,0	0,0	0,0	2,0	n.a.	0,5	n.a.	1,5	1,0	1,0	1,0	1,0
TKN TECHNOLOGICAL PROCESSI	1,0	1,0	1,0	n.a.	n.a.	n.a.	0,0	1,0	2,0	n.a.	2,0	n.a.	2,0	2,0	1,0	3,0	3,0

Lecture: The level of technical knowledge was asked for ten items considered as crucial in agricultural sector (varieties choice, soil tillage, seedling, harvest, crop rotation, ecosystem services, collect, storage, technological processing) according to a Likert scale from 1 to 4 : 1 no knowledge at all; 2 some knowledge but not reliable for the value chain; 3: reliable knowledge to be strengthened; 4 reliable knowledge very well adapted. An average score was calculated for the eight first items relative to crop production, one for the collect and storage items and another one for technological processing item considered separately. n.a means not available: the respondent did not know how to answer (ie. no clear opinion). The perception of the knowledge availability on the items was addressed for each one organization (F-Farmer; I-Intermediate Organization; P-Processor) at the launching step of the value chain ("Initial" lines) and today (ie. in 2020 when addressing them the survey). Then the score difference was calculated for each ones ("Learning" lines)

At the launching step of the value chain (VC), for all the system builders (SB) (F-Farmer; I-Intermediate Organization; P-Processor) their perception of knowledge level on crop production was less than 3, meaning they had either no knowledge at all when they started or some knowledge but not reliable for the outlet of the VC or the production region. No major differences appear across the different species (soya, chickpea, fababean or pea) concerning this TIS deficit in knowledge. Two exceptions are: (i) the farmer in the pea value-chain in Latvia, that declared to have already reliable knowledge which is consistent because this VC started in 2018 and the farmer has some previous experience; (ii) the intermediary organization in the chickpea value chain in Portugal who declared to have also strong previous experience. Those results are consistent with previous study showing grain-legume TIS suffer from technological lock-in (Magrini et al., 2016). Note that those results could be also commented as regards the distribution of knowledge. For instance, in the two chickpea value chains in France and Portugal, the knowledge appears to be more distributed than in the other value-chains with a stronger score difference between the intermediary organization and the processors, compared to the other value-chains.

To sum up, the initial resources constellation at the launching of the grain-legume value-chain was characterized by a need for coordinating distributed resources between farmers, intermediary organizations and processors, but most of all by the need to create new resources to reduce the initial deficit. The calculated learning scores (difference between today level of perception -year 2020- and the initial one) are mostly positive. Learning by doing over time can explain a part of this learning, but the learning also resulted from deliberately implemented activities toward deficit reduction by the system builders in the value-chain. In particular, next results show how the production contract governance implemented by the system builders in the value-chains, helped structural resources and human resources deployment at the organizational and network levels, contributing to initial knowledge deficit reduction.

4.2. Structural resources deployment through the production contract governance

Table 4 presents the production contract governance chosen by the SBs. The chickpea VC in France, the chickpea value-chain in Portugal, the fababean value-chain in France and the pea value-chain in France rely on what is called “a chain of production contracts”: a production contract A between the processor and the intermediary organization, and a production contract B between the intermediary organization and the farmer. In the pea VC in Latvia, no intermediary organization exists, so the processor directly contracts with farmers. In the case of the soya value-chain, the intermediary organization contracts with farmers, and has a part of the capital owned by the processor. Therefore, no formal production contract exists between the processor and the intermediary organization, but agreement on production planning and sale is made before the sowing of the crop. In addition to that, the SBs studied could participate in other collective arrangements, as is the case for three of this value-chain: chickpea value-chain in Portugal, fababean and soya value-chains in France. This point is of importance because it questions the diffusion of the resources built, but also the way those network contribute to develop resources that could be used by the value chain under study.

Table 4: Production contracts governance types

Case study name	*Chickpea VC in France*	*Chickpea VC in Portugal*	*Fababean VC in France*	*Pea VC in Latvia*	*Pea VC in France*	*Soya VC in France*
Case study acronym	**CFr**	**CP**	**FFr**	**PL**	**PFr**	**SFr**
Contractual scheme	A, B	A,B	A,B,C*	C	A, B	B
Launching of the contractual scheme by the I	2008	2015	2014	2018	2007	2016
% of the crop supply under contract for the I	95	70	80	not concerned	50	95
% of the crop supply under contract for the P	40	100	40	100	private information	not concerned
Other Collective Arrangements	no	The intermediary organization is member of CERSUL (Agrupamento de produtores de cereais do sul, S.A.) being a group of several intermediary organizations	The intermediary organization and the processor are members of GTO (Graines Tradition Ouest) being an association gathering several intermediary organizations, the processor, and a seed producer	no	no	The intermediary organization is member of the SICA Exstrusel, being a society gathering several intermediary organizations and feed manufacturers

*In the fababean VC, the processor also make direct contract with farmers for 10% of its supply

All those Production Contract Governance types resulted in structural resources deployment as summarized in Table 5.

Table 5: Structural resources portfolio linked to the PCGs

Case study name	*Chickpea VC in France*	*Chickpea VC in Portugal*	*Fababean VC in France*	*Pea VC in Latvia*	*Pea VC in France*	*Soya VC in France*
Case study acronym	**CFr**	**CP**	**FFr**	**PL**	**PFr**	**SFr**
Type of interactions for contract A	3 bilateral talks	at least 5 bilateral and collective talks*	4 both bilateral and collective talks	not concerned	3 to 4 bilateral talks	at least 4 bilateral talks*
Type of interactions for contract t B	1 bilateral talk	4 to 7 bilateral and collective talks	1 bilateral talk	not concerned	1 to 2 bilateral talks	1 bilateral talk
Types of interactions for contract C	not concerned	not concerned	both bilateral and collective talks	bilateral talks	not concerned	not concerned
Interactions between I and P for other crops	no	no	yes for linseed	yes for potatoes	yes for wheat, maize	yes for rapeseed

*for the soya case in France, we observed no contract A but quasi-integration between the intermediary organization and the processor, and several interactions are done between them to define agreements on crop production and transaction

First, the PCG allows for defining common agreed rules of behavior between the stakeholders through the various meetings required to achieve such agreement. All the contracts A, B, C are one-year contract and signed before the sowing of the grain-legume crop. They define clauses on price formation, clauses on production practices (very often restriction on varieties choice and sometimes constraints on pest management, etc.), and clauses on the quantity and quality of the final product that will be bought, etc. Those rules reflect common expectations regarding production and exchange conditions on the grain-legumes. Common expectations require various talks, whose frequency depends on each value chain. Indeed the PCG enhances the number of interactions between the stakeholders (compared to simple market relation) in order to negotiate the contract, to monitor the production process and adapt the formal contract if non-anticipated events occur (Table 5). Therefore, the PCG implements a combination of commonly agreed rules in the formal contract and routinized interactions to manage and adapt the rules over time if necessary. So, our results confirm the Proposition 1 that *The production contracts governance (PCG), through the interactions and the commonly agreed rules implemented, generates network structural resources between the stakeholders.* But, there is no uniformity in the way to organize this governance: for instance, collective talks are not systematically used and do not appear correlated to the spatial proximity of the actors.

Afterwards, we present another type of resources implemented by the system builders, which are key to reduce the TIS knowledge deficit: the human resources.

4.3 Human resources portfolios and their deployment through PCG

For each case, Table 6 presents human resources portfolios. The human resources, used or created by the system builders to develop their grain-legume value-chains, refer to R&D activities, data collection during the production, technical advice. We observed a differentiation of human resources across the cases. Indeed, some resources are mainly organizational, that is to say created within the organization and kept in house; whereas some resources are more network resources. Network resources include (i) R&D outputs when common/coupled R&D projects exist across the value chain (ii) mandatory data collection shared between the stakeholders of the VC *(those resources are underlined in Table 6*), and (iii) all the technical advice resources that are not accessible to everyone in the TIS but only to the stakeholders of the production network that are under contract *(those resources are underlined in Table 6*).

Table 6: Human resources portfolio in the VC

Case study name	*Chickpea VC in France*	*Chickpea VC in Portugal*	*Fababean VC in France*	*Pea in Latvia*	*Pea in France*	*Soya in France*
RESEARCH & DEVELOPMENT						
R&D made on crop production	yes, about variety selection,pest management, N management; seedling	no	yes by the farmer an processor: variety trial, seedling density and grain quality	yes on variety, soil tillage, grain quality	yes on variety trial and grain quality, by the intermediary organization and the processor	yes on variety, seedling, pest management (weedling), grain quality (F,I)
R&D made on crop processing	yes	no	yes by the processor	yes by the farmer on primary processing, and the processor on dry processing and protein values	yes by the intermediary organization and the processor	yes on extrusion and trituration process (I, P)
Patent filing	no	no	yes by the processor	no	yes by the processor	no
Common/coupled R&D project across stakeholders under study	yes	no	yes	yes	no	yes
Genericity of R&D outputs	the kn is specific to the region and outlets (F, I) and sometimes reliable for other region like weedling (F,I); but reliable for other outlets according to the processor (P)	none	kn is reliable for other type of fababean outlet and other production region	the knowledge is reliable only for the pea cultivated in the region and for the current VC outlet	for the intermediary,the knowledge is reliable only for the pea cultivated in the region and for the current VC outlet (I)BUT for the processor knowledge is also available for other production regions (P)	the knowledge is reliable for other types of outlets (I) or region (F,I, P)
Specificity of R&D outputs (cost of reusing the R&D outputs for other suppliers or clients)	reusable without cost (F), not reusable (I) and reusable with few costs(P)	none	reusable without costs (F) or few costs(P)	reusable without any costs(F) or few costs(P)	resusable with few costs (I) or important costs (P)	reusable without any costs (F,I) or few costs (P)
DATA COLLECTION *data underligned is shared across the stakeholders in the VC						
Mandatory data collection by the I and/or P	no mandatory collection on agronomic items; P collects data on technological processing and grain quality, internally	I collects data on 6 agronomic items, on collect, storage, technological processing and grain quality; and P collects data on storage technological processing and grain quality, internally	I and P collects data on 6 agronomic items and grain quality	P collects data on 1 agronomic item (harvest) and storage	I collects data on 7 agronomic items, collect, storage and grain quality; and the P collects data on 2 agronomic items (variety, pest management) , technological processing and grain quality	I collects data on 6 agronomic items, P collects data on collect, storage and technological processing and grain quality
Volontary data collection on by the I or P	I collects data on collect and storage internally and grain quality*	I collects data on 2 agronomic items	I and P collects data on agroenvironmental services	P collects data on 3 agronomics items		
Data managed as a common good at the level of the VC	no	yes	yes	no	no	no
TECHNICAL ADVICE						
Type of devices * type of technical advice that is underligned means acces is limited to the stakeholders under production contracts	technical newsletters, phone assistance, on-site bilateral advice	technical newsletters, phone assistance, web plateform; on-site bilateral advice	on-site bilateral advice	on-site bilateral advice and web plateform	technical newsletter, phone assistance, bilateral advice	technical newsletters, phone assistance web plateform, bilateral advice
Collective on-site events involving farmers , the intermediary organization and the processor (i.e. demonstrations, visits, meetings, either on the farm, at the intermediary organization or at the manufactory sites)	yes, 2 to 3 times a year; access to some events is limited to the stakeholders under production contracts	yes , 4 to 20 times a year	yes, 1 to 2 times; only for stakeholders under production contracts	yes	yes, one time a year for stakeholders under production contracts	yes, 3 times a year
Genericity of the knowledge exchanged trough these devices (according to the intermediary organization and the processor): reliability for other production regions than the current one/reliability for other outlets than the current one	For both I and P, the knowledge is not reliable for other production region, According to P , the knowledge is reliable for other chickpea outlets	The I thinks that the knowledge is reliable only for the current production region and outlet, whereas the P thinks that the knowledge is reliable for other production regions and chickpea outlets	The I and the P both think that the knowledge is reliable for other production regions,and other fababean outlets; for the processor the knowledge is even reliable for other crop outlets	The P think the knowledge is reliable for other production regions	The I thinks that the knowledge is reliable only for the current production region and pea outlet, whereas the P thinks that some knowledge is reliable for other production regions	The I the knowledge is reliable for other production regions and other fababean outlet, whereas the P think it is reliable for other production regions but not other soyabean outlet
PARTICIPATION TO OTHER NETWORK providing knowledge on the crop	for all: regional agricultural extension services and seed producers	for the intermediary: national agricultural research institute	for the farmer: farmer network group, animated by national agricultural extension services	national agricultural research institute	for the processor: agricultural research institute, seed producers, in France and Canada	For all: Artemis network gathering national extension services, technical and research institutes and several intermediary organizations

First, research & development activities are implemented in all the VC, except in the chickpea VC in Portugal. In all the VC, it concerns both the crop production dimensions like variety selection, pest management seedling and the crop technological processing like trituration process or process adaptation to increase protein value of a product. For four value-chains, we observed coupled R&D projects between the three system builders (farmer, intermediary organization and processor) and we thus consider the outputs of those projects as network resources. But the results do not reveal regularities concerning the genericity of the knowledge developed: when some knowledge is reliable only for the VC outlets and the production regions concerned, others declared the knowledge is also reliable for other VC but still concerning the same crop. This point is of importance as, in this last case, the knowledge developed is a starting point for larger system building concerning the development of a minor crop (notably to reach a status of major crop in the future).

The results showed that most often the output of R&D is not specific for the farmer, that is to say the farmer could reuse it without new costs for other clients. However, for the intermediary organizations and the processor, the outputs of R&D would be reusable but with few or important costs for adaptation. This reveals that these R&D investments are not highly specific to the stakeholders of the VC but still are moderately specific. Thus, in this context, even if the hold-up risk linked with opportunism is moderate, the proposition 2 is confirmed. And this last observation could explain that contracts are rather short term (one year) even though collective arrangements that came in addition to the formal contract can be longer.

This could explain also why in less intensive technological sectors production contracts are a sufficient way to develop links between stakeholders to sustain investment without using direct R&D contracts more frequently observed in high-intensive sectors.

Second, data collection during the production process can be made either voluntary or mandatory if the contract rules say so. Our results show that data collection is mandatory in all the cases, but only four cases (chickpea in Portugal, fababean in France, pea in Latvia, and pea in France) use this data collection as a way to exchange knowledge between the intermediary organization and the processor of the VC on the crop production practices. Among those cases, the fababean in France is singular because the processor collects up to 6 agronomic items on crop production. In the fababean and the chickpea VC, the organizations mentioned the data is managed as a common good at the level of the VC. Therefore, it constitutes a network human resource. In the other cases, where data is shared it appears that the data remains private, or the respondent does not know about the data protection.

Third, technical advice on the crop is used in all the cases. The technical advice comes on newsletters, phone assistance, web platform, bilateral advice, collective events allowing for social interactions between peers or stakeholders across the VC. The access to those devices can be limited to the stakeholders under contracts (being in that case a network resource) but not necessarily. For instance, some collective events can also be open to everyone, in order to diffuse the knowledge outside the network and to motivate new stakeholders to come in.

4.4. The PCG as a starting point for system building

To sum up, PCG enables human resources deployment in the VC. Some of them are organizational resources while others more network resources. Both of them can allow learning to occur in the VC. In addition to the knowledge dynamics, the PCG can also foster relational resources that could improve the reputation and visibility of the VC. Table 7 presents the perception of the system builders according to the various effects of PCG on both knowledge dynamics (i.e. human resources), legibility and visibility of the VC. The disagreement of farmers in the fababean VC and regarding the effect of PCG on knowledge questions the way the farmers are represented in this PCG; and the disagreement of the processor in the pea Latvia could be assigned to the very recent launching of the value-chain. For all the other statements, the system builders agree with the fact that PCG in the VC had a positive effect on knowledge dynamics. But according to the statements of the system builders, no clear difference arises between the VC that rely on other collective agreements for the PCG (chickpea in Portugal, fababean and soya in France) and the VC shaped only by bilateral contracts.

Table 7: Effect of PCG on knowledge dynamic, legibility, and visibility in the six value chains

Case study name	*Chickpea VC in France*			*Chickpea VC in Portugal*			*Fababean VC in France*			*Pea VC in Latvia*		*Pea VC in France*			*Soya VC in France*		
Case study acronym	CFr			CP			FFr			PL		PFr			SFr		
Organization acronym	CFr_F	CFr_I	CFr_P	CP_F	CP_I	CP_P	FFr_F	FFr_I	FFr_P	PL_F	PL_P	PFr-F	PFr_I	PFr_P	SFr_F	SFr_I	SFr_P
Foster investment for technical knowledge development specific to the VC	4	3	4	n.a.	3	3	3	2	4	n.a.	3	n.a.	4	3	4	4	n.a.
Engage the VC stakeholders on a medium term collaboration by increasing common legibility	2	4	4	n.a.	3	3	3	3	4	n.a.	3	n.a.	4	4	4	3	n.a.
Engage the VC stakeholders in a progress curve (i.e. a learning curve)	3	4	4	3	3	4	3	3	4	n.a.	3	n.a.	4	4	4	3	n.a.
Foster knowledge exchange on the grain-legume between the stakeholders of the VC	4	4	4	3	3	3	2	3	4	n.a.	2	n.a.	4	4	4	4	n.a.
Increase the recognition of the VC for political purpose, consumers, etc.	3	3	4	4	3	4	1	3	3	n.a.	2	n.a.	1	4	3	3	n.a.

** Lecture: The level of agreement to the statement was asked to the responding based on the following Lickert scale: 4 means strongly agree, 3 means somewhat agree, 2 means somewhat disagree, 1 means strongly disagree, n.a. means the respondent does not answer this question. Each SB (Farmer-F, Intermediate organization-I, Processor-P) answers those questions.*

4.5. The PCG as a network resources builder to the PCG as a system building mode: discussion and new research agenda

This analysis was a first attempt to capture the effects of the production contractual governance, considered as a formal network within a value chain, for starting a system building with the development of, first, human resources. If theoretically, thanks to the insights of the TCT and RV approaches, micro-mechanisms could explain such effects, empirics were required to assess how the stakeholders perceived those effects, according to the way the PCG is organized. The empirical demonstration was not easy as no data is directly available to measure those phenomena, and a long-time perspective is required to assess them. Notwithstanding, the first results we get suggest that this PCG could play an important role in structuring the take-off of a TIS, thus contributing to sustainability transition in the agricultural sector (Ingram,2015) . Therefore, this research opens a new research agenda in order to expand this analysis in a long-term perspective, particularly for the most recent value chains analyzed here, and also to enlarge it towards other sectors, particularly for low-technology intensive ones for which such production contracts could operate as a way to foster R&D dynamics and collective learning curve.

Moreover, in order to understand how this PCG could favor system building, deeper analysis is required to describe how other types of actors are involved in this system fostering knowledge development. For instance, extension services (Labarthe and Laurent, 2013) could use the

knowledge developed by the value-chain formal network to transfer it to other value chains. The survey conducted did not reveal the existence of such intermediaries who could accelerate knowledge development, acting as knowledge brokers (Klerkx, and Leeuwis, 2008; 2009; Kivimaa et al., 2019). In that way, research should pay more attention to the governance around those production contracts as regards its intermediation role in knowledge brokering (Grin et al., 2010).

Last, results also question the way property rights on the knowledge developed could be defined in order to protect the competitive advantage that the system builders had acquired. Indeed, the question of knowledge development to foster alternative technologies remains challenging because on the one hand, closed delineated network through strategic organizational arrangements (such as production contracts) could foster network knowledge resources thanks to specific investment protection and repeated interactions, but on the other hand, the knowledge should become a resource for other actors in order to enhance the alternative technology adoption and diffusion in the socio-technical regimes (Fuensfschilling et al., 2014). Therefore, long-time perspective of those case studies remain necessary to observe how the knowledge base developed within the formal network was or not the prerequisite for larger development, or in other words the starting point for a system building strategy by one or several of the system builders of the formal network. If the processor is often the most willing to start such a phenomenon, observing the development of the formal network of its suppliers could be a way to observe how the system is building over time.

Section 5. Conclusion

Understanding strategic system building processes is crucial to define sound policies fostering it for developing alternative technologies. System building underlies networks of actors and not all types of networks have the same efficiency in developing resources building. Notwithstanding, the analysis of those networks remain often unclear. The objective of the paper was to disentangle the micro-mechanisms by which a specific kind of formal network - the production contract governance in value-chain - foster human resources deployment at organizational and network levels, and thus constitute a network resources building mode which, in fine, could be the starting step for a system building mode.

By building bridges between organizational theories (especially Transactions Costs Economics, and the Relational-View of Strategic Management) and literature on Technological Innovation System literature, we showed that production contract governance (PCG) in value chains is deliberately chosen by stakeholders, according to initial human resources availability and distribution in the TIS. PCG foster resource system building particularly as regards structural resources defining collective rules and enhancing interactions between stakeholders. Those structural resources foster human resources deployment and particularly, shared expectations and joint-knowledge about the production process over time. Further research adopting a long-term perspective in the analysis of those case studies have to be done to assess how this PCG, used as a strategic network resources building mode, could be the starting point for system building development, notably according to the way the developed knowledge is spread to other actors than the first system builders. The way more and more actors could join the business model developed will be an indicator of the TIS development.

Hence, this study opens a research agenda to analyze how contracting for goods brings the stakeholders into a collective progress curve favoring system building particularly for less intensive technological sectors. Our results are particularly interesting for practitioners and policy makers in agricultural sector, as EU wants to develop a new strategy to foster the development of legumes, observing the previous failure in developing them (so far, Europe granted millions of subsidies to increase legume cultivation but their acreage is still only 2%) (Magrini et al., 2016; 2019). By supporting this PCG strategic system building mode, policy makers could create a great lever effect on agricultural subsidies. The analytical framework built for the agricultural sector could be easily adapted to analyze the micro-mechanisms of resources and system building in other sectors, particularly for less-technological intensive ones where R&D contracts for knowledge development on alternative technologies do not prevail.

REFERENCES

Arena, R., Festre, A., Lazaric, N. (2012). *Handbook of knowledge economics*. Edward Elgar.

Arora A., Andrea F., Gambardella A. (2004). *Markets for technology: the economics of innovation and corporate strategy*, MIT Press.

Barney J.(1991). Firm resources and sustained competitive advantage. *Journal of management*, 17, 1, 99-120.

Bogetoft, P., & Olesen, H. (2002). Ten rules of thumb in contract design: lessons from Danish agriculture. *European Review of Agricultural Economics, 29*(2), 185-204.

Brousseau, E., & Glachant, J.-M. (2002).*The economics of contracts: Theories and applications*. Cambridge: Cambridge University Press.

Cholez, C., Magrini, M.-B., Galliano, D. (2017). Les contrats de production en grandes cultures: coordination et incitations par les coopératives. *Economie Rurale*, 60,65-83.

Cholez C., 2019. Structures de gouvernance des transactions et dynamique des connaissances inter-firmes dans la création de filières. Application aux contrats de production dans le secteur des grandes cultures en France. Thèse de doctorat de l'Université de Toulouse, http://www.theses.fr/s216810

Cholez C., Magrini M-B., Galliano D., (2020). Exploring inter-firm knowledge through contractual governance: a case study of production contracts for faba-bean procurement in France. *Journal of Rural Studies.* doi.org/10.1016/j.jrurstud.2019.10.040

Dyer, J.H. and Singh, H., (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of management review*, 23(4), pp.660-679.

Eisenhardt, K.M., (1989). Building theories from case study research. *Academic Management. Review*, 14, 532–550.

European Commission (2018). Report from the Commission to the Council and the European Parliament on the Development of Plant Proteins in the European Union, COM 757. Brussels. Available online: https://ec.europa.eu/info/sites/info/files/food-farming fisheries/plants_and_plant_products/documents/report-plant-proteins-com2018-757-final_en.pdf

Farla, J.; Markard, J.; Raven, R.; Coenen, L. (2012). Sustainability transitions in the making. A closer look at actors, strategies and resources. *Technological Forecasting and Social Change* 79 (6), 991–998, DOI: 10.1016/j.techfore.2012.02.001.

Fuenfschilling, L.; Truffer, B.(2014): The structuration of socio-technical regimes-Conceptual foundations from institutional theory. *Research Policy* 43 (4), 772–791. DOI: 10.1016/j.respol.2013.10.010.

Grin, J., (2010): The Governance of Transitions. An agency perspective. In John Grin, Jan Rotmans, J. W.Schot (Eds.): *Transitions to sustainable development. New directions in the study of long term transformative change.* New York: Routledge (Routledge studies in sustainability transitions), 265–284.

Gobbato, M., (2013). Long-Term Relationships, Networks and Exchange of Knowledge in *Production and Distribution Contracts.* Aldershot, Ashgate Publishing Ltd

Hughes, T.P., (1979). The electrification of America: the system builders. *Technology and Culture*, 20,124–161.

Ingram, J.; (2015): Framing niche-regime linkage as adaptation. An analysis of learning and innovation networks for sustainable agriculture across Europe. *Journal of Rural Studies*, 40, 59–75. DOI:10.1016/j.jrurstud.2015.06.003.

Kivimaa, P., Boon, W., Hyysalo, S., Klerkx, L. (2019). Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. *Research Policy*, 48, 4.

Klein, P., & Sykuta, M. (2010). *The Elgar companion to transaction cost economics*. Cheltenham, UK Edward Elgar.

Klerkx, L., Leeuwis, C., (2009). The emergence and embedding of innovation brokers at different innovation system levels: insights from the Dutch agricultural sector. *Forecasting And Social Change* 76, 849–860.

Klerkx, L., Leeuwis, C., (2008). Balancing multiple interests: Embedding innovation intermediation in the agricultural knowledge infrastructure. *Technovation*, 28, 364–378. https://doi.org/10.1016/j.technovation.2007.05.005

Labarthe, P. and Laurent C. (2013). Privatization of agricultural extension services in the EU: Towards a lack of adequate knowledge for small-scale farms? *Food Policy*, 38, 240-252.

Langlois, R. N. and Foss, N. (1999). Capabilities and Governance: The Rebirth of Production in the Theory of Economic Organization. *Kyklos,* 52(2), 201-2018.

Magrini M-B., Befort N., Nieddu M., (2019). Technological Lock-In and Pathways for Crop Diversification in the Bio-Economy. In Agroecosystem Diversity: Reconciling Contemporary Agriculture and Environment Quality. Lemaire, Recous, Kronberg, and Carvalho (eds). Elsevier.

Magrini, M.-B., Anton, M., Cholez C., Corre-Hellou, G., Duc, G., Jeuffroy, M.-H., Meynard, J. M., Pelzer, E., Voisin, A.-S., Walrand, S., (2016). Why are grain-legumes rarely present in cropping systems despite their environmental and nutritional benefits? Analyzing lock-in in the French agrifood system, *Ecological Economics*, 12, 152-162.

Markard J., Truffer B., (2008). Technological innovation systems and the multi-level perspective: Towards a integrative framework, *Research Policy*, 37:596-615.

Ménard, C. (2004). The economics of hybrid organizations. *Journal of Institutional and Theoretical Economics, 62*(3), 1-32.

Meynard JM., Jeuffroy MH., Le Bail M., Lefèvre A., Magrini M-B., Michon C., (2016). Designing coupled innovations for the sustainability transition of agrifood systems. *Agricultural Systems*.

Mowery, D.C., Oxley J.E. and Silverman, B.S. (1996). Strategic alliances and inter-firm knowledge transfer. *Strategic Management Journal*, 17, 77-91

Musiolik, J.; Markard, J.; Hekkert, M., (2012). Networks and network resources in technological innovation systems. Towards a conceptual framework for system building. *Technological Forecasting and Social Change*, 79 (6), 1032–1048. DOI: 10.1016/j.techfore.2012.01.003.

Musiolik, J., Markard, J., Hekkert, M., Furrer, B., (2018). Creating innovation systems: How resource constellations affect the strategies of system builders. *Technological Forecasting and Social Change*. DOI: 10.1016/j.techfore.2018.02.002.

Pavitt, K. (2005). Innovation processes In: Fagerberg et al.,2005. *The Oxford handbook of innovation*.

Powell W.and Grodal S. (2005). Networks of innovators. In: Fagerberg et al.,2005. *The Oxford handbook of innovation*, 56-86.

Smith, A., Stirling, A. and Berkhout, F., (2005). The governance of sustainable socio-technical transitions. *Research policy*, 34(10), 1491-1510.

Šumane, S., et al. (2018). Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies*, 59, 232-241.

Sykuta M., and James, H., (2004).Organizational economics research in the U.S. agricultural sector and the contracting and organizations research institute. *American Journal of Agricultural Economics*, 86, 3, 756-761.

UNIDROIT, FAO and IFAD, (2015). Legal Guide on Contract Farming. Rome

Weindl, I., Ost, M., Wiedmer, P., Schreiner, M., Neugart, S., Klopsch, R., Kühnhold, H., Kloas, W., Henkel, I.M., Schlüter, O. and Bußler, S., (2020). Sustainable food protein supply reconciling human and ecosystem health: A Leibniz Position. *Global Food Security*, 25, p.100367.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., Afshin, A., Chaudhary, A., Herrero, M., Agustina, R., Branca, F., Lartey, A., Fan, S., Crona, B., Fox, E., Bignet, V., Troell, M., Lindahl,T., Singh, S., Cornell, S. E., Srinath Reddy, K., Narain, S., Nishtar, S. and Murray, C. J. L. (2019). Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Lancet, 393(10170), 447-492. doi: 10.1016/S0140-6736(18)31788-4

Williamson, O. (1991). Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. *Administrative Science Quarterly*, 36(2), 269-296. doi: 10.2307/2393356

Williamson, O. (2010). Transaction Cost Economics: The Natural Progression. *American Economic Review*, 100(3), 673-690.

Yin, R.K. (2014). *Case study research: design and methods*. SAGE Publications.

Zimmer, S., Liebe, U., Didier, J-P., Heß, J. (2016). Luxembourgish farmers' lack of information about grain legume cultivation. *Agronomy for Sustainable Development*, 36(2).