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► To cite this version:

Latifa Daadaoui, Loïc Sauvée. The design of knowledge governance for innovation: The case of biobased activities in the Industry and Agro Resources French competitiveness cluster. The XXth ISPIM: “The Future of Innovation”, ISPIM, Jun 2009, Vienna, Austria. hal-04287652

HAL Id: hal-04287652

<https://normandie-univ.hal.science/hal-04287652v1>

Submitted on 15 Nov 2023

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**The design of knowledge governance for innovation:
The case of biobased activities in the Industry and Agro Resources
French competitiveness cluster**

Latifa Daadaoui*

Université Paris-Dauphine, DRM, UMR CNRS 7088
and LaSalle Beauvais Polytechnic Institute, France

* Corresponding author: Email: latifa.daadaoui@lasalle-beauvais.fr

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Loïc Sauvée

LaSalle Beauvais Polytechnic Institute
and Université Paris-Dauphine, DRM, UMR CNRS 7088, France

Abstract

Launched in 2005, the French government’s call for the creation of competitiveness clusters has been a real success: 105 applications and 71 clusters¹ were created with 7 labelled out as ‘global competitiveness clusters’. Innovation is at the heart of this French version of clusters so popular in the strategic management literature. These ‘innovation networks’, such as the IAR (Industry and Agro Resources) cluster, devoted to the non food uses of agricultural products, connect various actors: researchers, firms, investors and policy makers, to create an ‘innovation ecosystem²’. The success in terms of innovations is then highly dependent upon the efficacy of knowledge creation and transfer between these heterogeneous actors. Complex relationships have to be governed. The question of the effective governance (Dyer & Singh, 1998) is relevant and somewhat often neglected in research (Foss, 2006). In studying the French IAR competitiveness cluster, we propose an analytical framework of knowledge governance in a context of radical innovations, where the questions of knowledge creation and sharing are crucial. Then we develop several propositions contextualized in this French cluster.

Keywords: governance, innovation, knowledge, inter-organizational relationships, cluster

¹ Official site of competitiveness clusters, 2007.

² Christian Le Blanc , « For an Innovation ecosystem », deputy of ‘Yvelines’ district in the French assembly

Introduction

Innovate or die is the challenge facing firms but also nations in this new area of Knowledge Based Economy (KBE). Drucker (1985) stressed that innovation is the mean allowing the value creation for the entrepreneur but the image of the isolated inventor in Schumpeterian tradition which inseminates the economy of an idea that is communicated by the sky is now fundamentally schematic and outdated. The process of innovation is not the same in Montpellier, Geneva or San Francisco, the appearance in France of the ‘competitiveness clusters’ attests that.

This model of a multiplicity of actors working together in the process of innovation highlights the relationship and interaction between users, providers and institutions and entities that are part of the innovation system. Inventors and innovators are in community, in a coalition based on shared trust and embedded in a dense network of interactions (Laursen & Salter, 2006).

Drucker (1993) points out that innovation is not different from the creation and application of new knowledge to make them productive. Then we believe in the same vein of ‘Innovation Based on Knowledge’ (Nonaka and Takeuchi, 1997; Johannessen et al., 1999; Leonard-Barton, 1995; Amidon, 2001) that innovation and knowledge are the two faces of the same coin.

The success of innovation depends on the governance mode (Teece, 1996) for the mainstream of the governance literature. The Williamson (1991, 1994, 1996) transactional framework does not consider knowledge: its nature, its dimensions and its process. So the need to develop a new scale of governance choice based on knowledge (as a base for innovation) is crucial to go in this new era of knowledge-based economy.

This issue is even more critical when it is about launching new activities like those of valorisation of agro resources. Bio fuel, agro-materials, bio molecules, bio-energy are the four activities that researchers, industrials, agricultural cooperatives and institutions wishing to emerge and for which the ‘pôle de compétitivité’ Agro-Industries and Resources (IAR) was created.

Our aim in this communication is: (1) to link these three concepts: governance, innovation and knowledge, which have been widely studied, but there were little (or no) attempts made in the direction of connecting the three, by (2) exploring this question in the particular context of the IAR French competitiveness cluster.

First, we will highlight the link between innovation and knowledge, then defining governance and the shortcomings of the literature. Secondly we will introduce the concept of “knowledge governance” (Foss, 2006) which means choosing governance structures (e.g. markets, hybrids, hierarchies) and coordination mechanisms (e.g., contracts, directives, reward schemes, incentives, trust, management styles, organizational culture, etc.), for the purpose of influencing processes of creating, transferring and sharing knowledge. Finally, the application to the case of emerging biobased activities is proposed.

1. The knowledge-based economy: knowledge and innovation

1.1. Knowledge and innovation: definition and dimensions

The innovation is the creation and implementation of new knowledge to make them productive (Penrose 1956, Drucker, 1993). So, to identify the innovation we need to understand knowledge. Winter (1987) was the first to propose a typology of knowledge (Foss, 2006, 2007) depending on whether this knowledge is tacit / explicit, non articulated/ articulated, observable / non-observable, complex / simple, element of a system / independent. Thus depending on its dimensions, knowledge is easily transferable or is difficult to transfer, its property rights are difficult to define or not and so on. In this cartographic perspective, Henderson and Clark (1990), Hall and Andriani (2003) offer interesting typologies of innovation. The former distinguish incremental, modular, architectural and radical innovations, depending whether knowledge is unchanged or changed and concepts are

reinforced or reversed. Hall and Andriani (2003) were more interested in the degree of incremental and radical innovations to distinguish minor and major degrees depending on the knowledge quantity and substitutability.

More global and dynamic, we find in the literature of innovation the difference between exploration and exploitation. Holland (1975) was the first to make this distinction, then used by March (1991). The exploitation concerns the extension and refinement of knowledge and technologies (March 1991) without changing the nature of activities with a limited uncertainty of the environment. Exploration is characterized by the break with what is being done to focus on the discovery of new technologies (March 1991). The exploration is not the efficiency of operations but is a process which concerns the uncertain search for new business opportunities based on new technologies. Knowledge creation is more important than diffusion for the exploration innovation.

1.2. Innovation as a process of transformation of knowledge

In the vein of the 'Knowledge Based Innovation' we support the idea that the innovation process is the process by which knowledge is transformed, combined and implemented. Nonaka (1991, 1994), Nonaka and Takeuchi (1997) are still the main contributions to the understanding of mechanisms of knowledge transformation. The model of the creation and capitalization of knowledge is based on the distinction between tacit and explicit knowledge. Tacit knowledge is rooted in the action, the routines in a specific context (which can increase personal productivity at the individual level and the competitive advantage at the enterprise level). The explicit knowledge is knowledge codified, transmitted in a formal and systematic language. In organization, the creation and accumulation of knowledge occurs at three levels: at the individual level, group level, organization level. It uses four modes of conversion: (1) Socialization, tacit knowledge to tacit knowledge (2) Exteriorisation of tacit knowledge to explicit knowledge (3) Combination of explicit knowledge (4) Internalization of explicit knowledge to tacit knowledge to a higher level.



Figure 1: Knowledge mode of conversion, Nonaka (1991)

Nonaka proposes the spiral of knowledge creation that explains the transition from tacit knowledge to explicit one and vice versa and between different levels.

Our purpose here is to explore this dynamic of creating knowledge for innovation in an interorganisational context from the governance perspective. Particularly, the objective is to understand the emergence of monitoring devices and governance mechanisms when question of knowledge creation and sharing are at stakes.

2. Governance and knowledge

2.1. Governance: the need for a new paradigm

The concept of governance has been extensively studied by theorists of organizations (Westphal and Zajac, 1995). Governance means the way of organizing transactions

(Williamson, 1994) and by extension the relationships. Its purpose is to achieve the correct order by public or private use of coordination mechanisms. The governance structure is the design of an institutional matrix in which the integrity of the transaction or set of transactions is decided (Williamson 1996, 2000, 2005) or an institutional model that governs trade in controlling opportunism (Dyer, 1997).

Williamson proposed a complete matrix of choice of governance but not very suitable for this special transaction of 'knowledge'. With his two books 'Markets and Hierarchies' and 'The Economic Institutions of Capitalism', Williamson built the theory of transaction costs where the analysis unit is the transaction. The choice of the appropriate structure is based on three criteria linked to the characteristics of transactions: the uncertainty that accompanies these transactions, the frequency and specificity of assets involved. Williamson argues that when the specific asset is idiosyncratic, integration can reduce transaction costs. It must be said that it is opportunism that worries Williamson. We will build the definition of governance in a functional approach based on dichotomist functions: disciplinary and cognitive, relational and contractual mechanisms (cf. figure 2).

As several authors (Conner and Prahalad 1996, Kogut and Zander, 1996) we support the idea that the contextualization of governance by situations where knowledge is created raises the need for an extended theory. The innovation and dimensions of knowledge may explain the choice modes of coordination. More specifically, two directions need to be explored: the question of governance levels, and the complementarity of governance mechanisms at different levels.

Considering the first point, as Gomez highlights (2009), the actual theory of governance is inadequate to the study of new productive forms of action (for instance: clusters) in context of high uncertainty and complexity as those present in the phases of innovation for the emergence of new activities. This mismatch stems from the fact that:

- It is difficult to establish property rights on economic rent for the collaborative networks because the dominant theory on corporate governance in the capitalist system is based on a clear allocation of these rights.
- The stakeholders in a cluster have divergent interests on nature and time horizon and consensus can not be found in looking for a single collective benefit, as suggested by the theory of corporate governance.

Renewal or looking for a new paradigm is especially urgent as there is a multiplication of these forms throughout the world both in the developed countries and in developing countries. On the second point, the work by Poppo and Zenger (2002) shows an interesting complementarity between formal contract and relational governance (i. e. the "social processes that promotes norms of flexibility, solidarity and information exchange" (Poppo and Zenger (2002:710). For them, the reason of this complementarity is to be found in the fact that customized contracts narrow the domain around which parties can be opportunistic. "Customized contracts specify contingencies, adaptive processes and controls likely to mitigate opportunistic behaviour and thereby support relational governance" (Poppo and Zenger, 2002:721). Nevertheless several questions remain unsolved; for instance the question of mutuality between parties, of problem of conflicts, problems of measurement of costs and of benefits of the exchange.

These questions are particularly of interest in the situation of knowledge exchanges. As suggested by Antonelli (2005) the economics of knowledge has shifted from public goods then towards proprietary goods and finally towards localized technological knowledge. For Antonelli "at each point of time the topology of agents in the space of knowledge, hence their relative distance and structure of their relations and interactions, are key features of the system" (Antonelli, 2005:14).

In a general statement, the core question is, finally, whether or not this phenomenon of complementarity between governance mechanisms is to be observed in the context of knowledge creation and clusters.

On these points the so called knowledge governance approach (hereafter KGA) brings interesting insights. We will develop this approach and its interests in the following point.

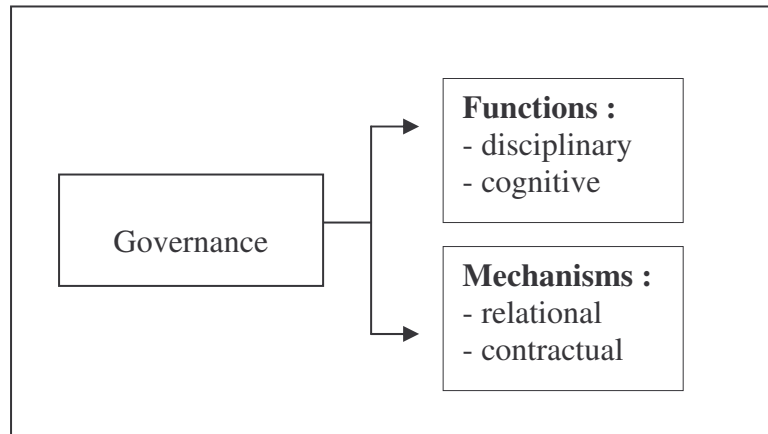


Figure 2: Governance components

2.2. The Knowledge Governance Approach (KGA):

According to Foss (2006, 2007), Grandori is the pioneer to have used the concept of ‘Knowledge Governance’, which he defines as: “Knowledge governance therefore means deploying governance mechanisms so as to maximize the net benefits from processes of transferring, sharing and creating knowledge. This is similar to the transaction cost minimizing logic of transaction cost economics.” He adds : “The approach may be briefly defined as a sustained attempt to uncover how knowledge transactions -which differ in their characteristics- and governance mechanisms -which differs with respect to how they handle transactional problems-, are matched, using economic efficiency as the explanatory principle.”

The KGA starts from the hypothesis that knowledge processes (i.e., the creation, retention, and sharing of knowledge; Argote, 1999) can be influenced and directed through the deployment of governance mechanisms, in particular the formal aspects of organization that can be manipulated by management, such as organization structure, job design, reward systems, information systems, standard operating procedures, accounting systems, and other coordination mechanisms (cf. Grandori, 2001). The KGA asserts that such governance mechanisms should be seen as critical antecedents of knowledge processes.

More specifically, Foss identifies the causes of the research gaps, mainly the missing micro analytic foundations (at the level of individuals) and the neglected role of organizational antecedents, as well as of the formal organization. On the contrary, Foss suggests that the governance approach, i.e. the specific combination of governance structures (market, hybrid, hierarchy) inside organizational forms will influence the knowledge process (sharing, integration and creation). Similarly he suggests that this is necessary to identify knowledge-based hazards, and “how does the deployment of governance mechanisms remedy such hazards” (Foss, 2007:42).

An interesting development of the KGA literature is also the question of unit(s) of analysis. For Foss, the most applicable unit is the “knowledge transaction”, that is to say “the transfer of an identifiable ‘piece’ of knowledge from one actor to another one” (Foss, 2007:44).

Nevertheless, the innovation does not appear in the KGA. Teece (1986) proposes an interesting framework combining knowledge (in-house, outside or to be created), innovation (autonomous or systemic) and mode of governance (S = flexible structure, V = Virtual, M =

Multiproduct integrated, A = alliance). Teece attests that the reality is better represented by the existence of mixed modes (Richardson, 1972) where firms adopt simultaneously or alternatively the two modes of governance. For Teece, innovation is not monolithic, and it is imperative to understand the kind of innovation that is used (see figure 3). In the continuation of this work, Gopalakrishnan et al. (1999) propose to combine innovation and knowledge, based of the three knowledge dimensions: tacit conditions, autonomy and complexity.

	<u>Type of Innovation</u>	
	autonomous	systemic
Capabilities Exist Inhouse	S	M
Capabilities Exist Outside	V	A
Capabilities Must be Created	A,S	S

Figure 3: Innovation, knowledge and governance, Teece 1996

3. ‘Les pôles de compétitivité’ : A french version of clusters

3.1. Methodology

The literature had extensive discussions on the issue of governance, but left in the shadow of the descriptive and explanatory framework, concrete structures and governance mechanisms (Ehlinger et al. 2007). The aim of understanding and exploration suggests a qualitative exploratory approach involving a case study. Indeed the novelty of the research on governance in special context, where it is about an emergent activity (Möller and Svahn, 2003) aiming to develop new technologies and non-food applications for agricultural products that provide interesting analysis, that is a breakthrough innovation with great complexity and uncertainty.

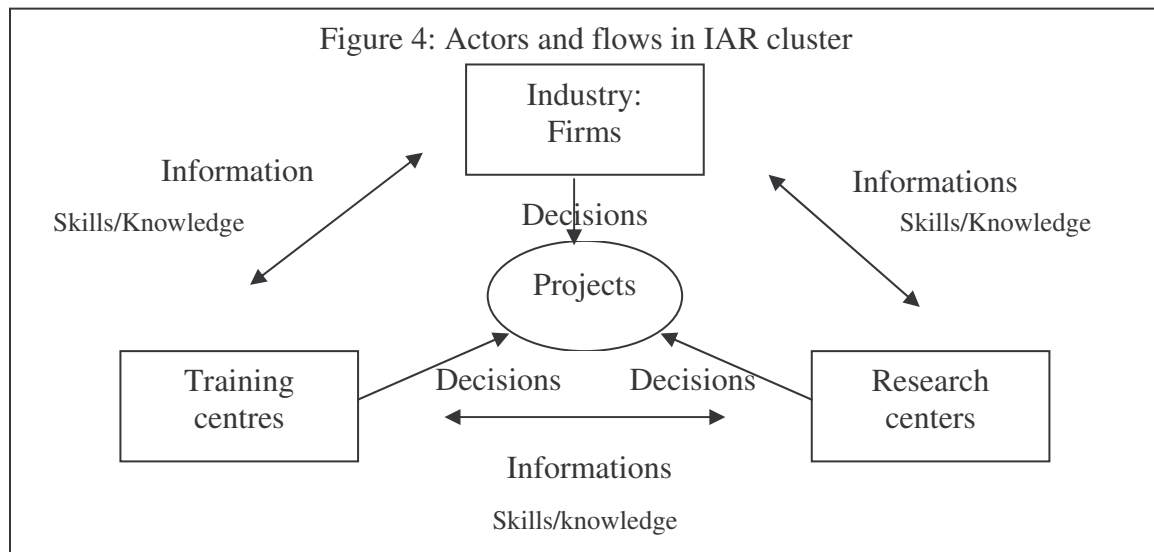
The application of this method is favourable in terms of feasibility and the research design, which can be explained by the following quote from Yin (1994:6) "In general, the case studies are preferred when the issues of" how "or" why "questions are asked, and when we focus on a contemporary phenomenon in the context of life." According to Glaser and Strauss (1967), the objective of the research case study is to "discover" a theory by comparing the different cases.

The chosen field of investigation is the ‘pôle de compétitivité’, this French version of cluster launched to enhance competitiveness and innovativeness of French industries. The data was collected by interviews with different actors: academics, industries, policymakers.

3.2. Industries Agroressources IAR cluster: growing in green

Our empirical focus is on the emerging biobased industry where innovation has many facets. On the one hand, the origin of products for which it will give birth, 100% derived from renewable agricultural, functionality to the extent that they will produce no nuisance to the natural environment (biodegradability..), the technology that will be used to produce these products, which is still unknown in large part. But more important is the framework which has been created in 2005 for governing innovation by launching the French model of clusters

called ‘Pôles de Compétitivité’. The development of this process follows a model of encouraging open innovation industry-research-training relationships. The relationship in this context is tripartite between industry, research centers and training centers exchanging different streams of information and skills (cf. figure 4).



This new net (different actors detaining resources and capabilities and designing new activities) proposes to break with the existent technology and to bring a radical change that will lead to the creation of a new value system, with ideas still fuzzy, exogenous uncertainty related to the project concerning the process, and the output, as well as a high endogenous uncertainty associated to the difficulty of assessing performance. The net is also characterized by a significant level of complexity relating to the subject of the relationship (biobased activities), the diversity of partners which belong to different organizational environment (Plewa et al, 2004), a complexity that induces a specificity of human, physical (Heide, 1994) and relational (network, other relations) assets. Thus the governance of relationships will be different, needing a special framework.

We are here in a systemic innovation situation: for instance to go further in bio fuel activity we need the results of bio fuels of 1st generation to pass to the second one. This innovation needs more tacit, complex and systemic knowledge.

	Innovation	Knowledge			
		Tacit	Explicit	Complex	simple
Innovation in IAR cluster for biobased activities	Systemic	+++	+	+++	+

Möller and Rajala (2007) suggest that these nets with weak ties require: self-coordination, informal leadership, and cannot be managed by one actor alone. The ambiguity suggests an environmental scanning, bringing new ideas of products, markets or business concepts and the uncertainty suggests the important of sense making role.

In the definition of the IAR cluster (Jacquet & Darmon, 2005), each actor has a specific role, clearly defined and identified: the private sector is responsible for the cluster and the government represented by the ‘public collective bodies’ accompanying the device and

participating in coordinating committees and funding. It is important to know the role of each one in terms of governance functions and mechanisms.

The IAR is an associative configuration based on the membership to a solidarity community between pairs (no subordination link) on developing a community hub. It allows maintaining equilibrium between research and industry, and also the 'representativity' of the two regions (Picardie and Champagne-Ardenne). Its main challenge is to identify, accompany and help regional R&D projects in the field of agro resources (www.iar-pole.com). The local bodies (regional council, DRIRE, CCI, CRA) help forming and maintaining the economic actors without participating directly in the cluster governance (Figure 4) via the 'Institutional partners committee'. The institutional frame plays a crucial role in governing the links between actors (Brousseau, 2000). The association is organized around a steering committee that selects the projects with a view of their labelling by the pole based on an independent audit by a scientific committee. The labelling allows projects to be oriented, to be submitted to the committee for funding, and to the possibility of different funding related to its content (figure 5). To execute the plan of actions defined by the association, several working groups, the 'COS or Comités d'Orientation Stratégique' (Strategic Orientation Committees) have been established. They are spaces to meet, to think, to animate the network, to break boundaries and particularly project ideas incubation.

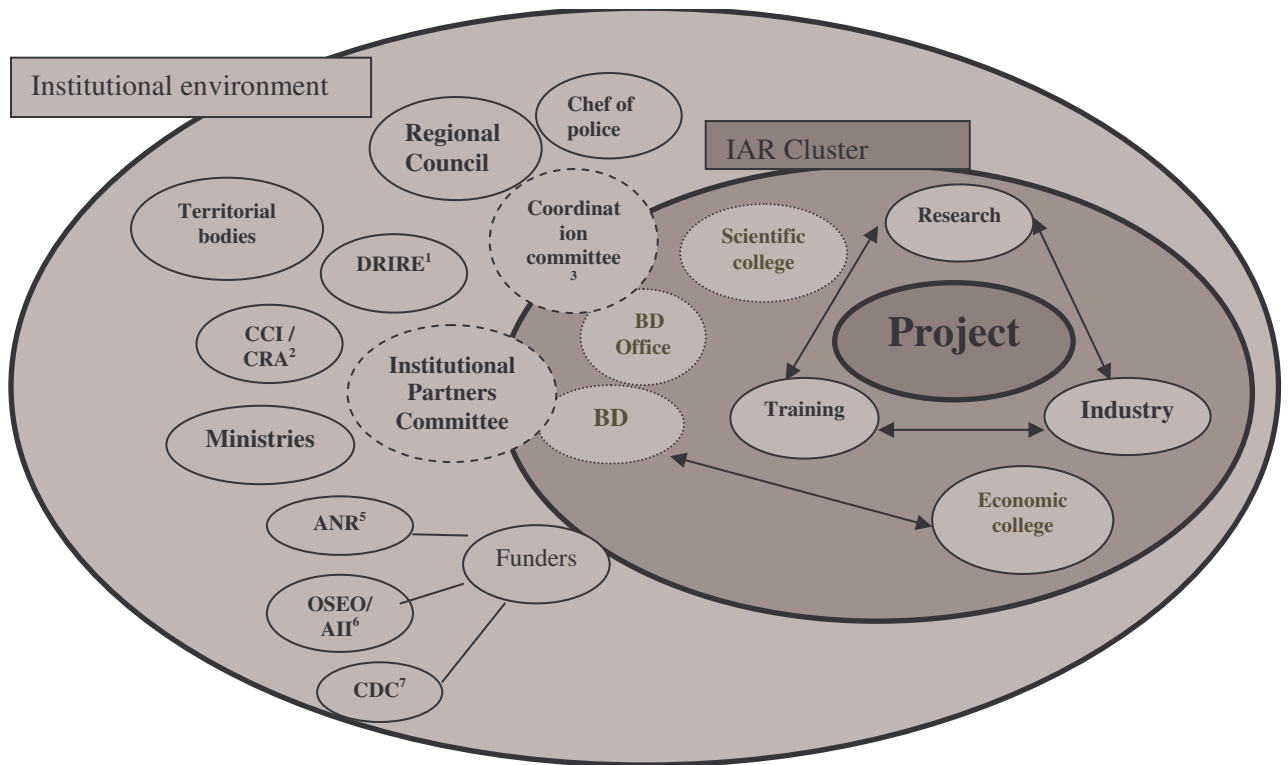
We distinguish then three different network levels in terms of coordination: project level, cluster level and institutional environment. Each dimension refers to different governance levels (Brousseau, 2000).

3.3. Research propositions about governance of knowledge creation of biobased activities

In systemic innovation, relationship governance influences the quality of the relationship in terms of trust, commitment, conflicts, willingness to invest on assets and the expectation of continuity. This will affect the knowledge creation and share between research areas and business firms (cf. figure 4). In this context, the uncertainty makes difficult the establishment of contracts, so market governance seems risky. Also the diversity of partners which belong to different organizational environments makes hierarchy not appropriate or not realist to implement. The hybrid mode of governance seems to be the most appropriate and the most efficient for systemic innovation of Biobased sectors. The more the partners are various, different and the more the environment is uncertain, the more we need a specific governance structure far from market and hierarchy.

Proposition 1: Hybrid mode of governance is appropriate for knowledge creation in systemic innovation

Figure 5: Governance levels in IAR Cluster



The lack of subordination link and the reciprocal interdependence of the various partners (Thompson, 1967) need the development of a specific function of governance in order to foster cooperation and to try to align the mental patterns of the various partners. In the case of innovation network in the emergent biobased activities, it is needed to create an interactive space where different actors could exchange and help the fuzzy ideas to become project-ideas and then projects. This function could not be accomplished by the project governance because it is needed upstream in the value system. The intermediate level of the network is then competent.

In describing the relations between industry and research in the biobased industry we found that there are different levels: (1) the institutional environment constituting by national public institutions but especially regional institutions (2) the ‘meta-governance’ or ‘relation-governance’ materialized by the ‘pôle de compétitivité’ association where the different partners meet to maximize the benefits of the cooperation between the different actors and (3) the ‘project-governance’ governing the relation-project assumed by a pilot (generally a firm). There is a complementarity between the ‘cluster-governance’ assumed by the ‘pôle de compétitivité’ and the project level. We suggest that the cluster governance has mainly a cognitive function while the project governance guarantees the double function. The effectiveness of the relation depends on the capacity to create the complementarity between the different governance levels.

Proposition 2: In systemic innovation of biobased activities there are three distinct levels of knowledge governance exchange.

Proposition 3: Each level has specific characteristics in the exchange of knowledge which necessitate appropriate mechanisms of governance

	<i>Institutional-environment</i>	<i>Cluster-level</i>	<i>Project-level</i>
<i>Knowledge-Definition-Characteristics</i>	<i>Information (as a low dimension of knowledge)</i>	<i>Explicit Simple</i>	<i>Tacit Complex</i>
<i>Disciplinary function</i>			<i>Contractual governance</i>
<i>Cognitive function</i>	<i>Contractual governance</i>	<i>Relational governance</i>	<i>Relational and contractual governance</i>

Conclusion: Managerial and theoretical implications

We suggest that analysing and understanding innovation go through an investigation of what is knowledge: its nature, dimensions and its processes. We attempt to articulate the three components of strategy until now separately discussed in the literature: innovation, knowledge and governance. For that the traditional corpus of governance (principally a contractual approach) is no more sufficient to understand the innovation in the sense that knowledge (the real content of its nature and dimensions) is excluded from the analysis. In using the KGA approach as well as Teece, Penrose, Drucker, Schumpeter and others, we attempt to shed a new light on the point of junction between innovation, knowledge and governance.

We think that the management of radical innovation induces a need for a specific governance of knowledge, which means understanding the complex characteristics and transformation processes of knowledge implicated in a given innovation pattern. This new conception leads to some implications in understanding the governance modes of knowledge for innovation, and especially the idea of *governance functions and levels* that are complementary within 'global innovation systems'.

A complementary research focused on the dynamics aspects is in progress: its objective is to identify the key components of the knowledge-based innovation process and its implications on the design of governance mechanisms. A better understanding of factors that influence the knowledge creation for innovation could be a great help for managers and policy makers. The future of innovation is linked to the control of the process of knowledge transformation, creation and exchange.

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- [1] Regional direction for Industry, Research and environment
- [2] Regional consular for industry, commerce and agriculture
- [3] Institutional Partners Committee: the two president of the regional council and the chef of department
- [4] Head of an administrative area
- [5] National Agency for Research
- [6] OSEO- AII: Regional agency for innovation
- [7] Caisse Des Dépôts: Public fund for the economic development
- [8] Regional Center for Innovation and Technology Transfer in Chemistry and Environment

Websites:

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