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Organizational Innovation as an Enabler for the Emergence of a Non-Precompetitive Knowledge Ecosystem

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Abstract

In this paper we conduct a qualitative case study on how knowledge management occurs within a regulated safety context that seeks to make its knowledge sustainable. Thus, organizations, which operate in this context, try jointly, to create, share and, above all, sustain this knowledge for a long time. The most effective way to meet their objectives is to redesign their inter-organizational architecture into a non-competitive knowledge ecosystem. The back and forth between the research field and the theory, led us to ask the following research question: how a regulated safety context should evolve into a non-pre-competitive knowledge ecosystem? To answer this research question, we adopted an organizational perspective, integrating knowledge management and organizational innovation streams. Our results show the emergence of a non-pre-competitive knowledge ecosystems where actors' interactions are strictly collaborative due to its main goal: sustainable and inter-organizational knowledge management. This emergence is enabled by internal and inter-organizational innovation, i.e., the development of a knowledge management process. Organizational innovation is articulated within the actors' own (intra-organizational) knowledge systems, but also through the knowledge flow that is exchanged at the inter-organizational level. To achieve this, ecosystem governance is ensured by a focal actor (through regulatory legitimacy) who assumes the role of orchestrator, to sustain the knowledge flow through coordination and collaboration of ecosystem members.

Keywords - Sustainable Knowledge, Knowledge Ecosystem, Non-precompetitive Ecosystem, Organizational Innovation, Regulated Safety

Paper type - Academic Research Paper

1 Introduction

Knowledge ecosystem has gained attention in the strategic, innovation and entrepreneurship management literature. The concept is mostly mobilized to study how a network of actors collaborates to create knowledge for value creation and exploration. Defined as a meta-organization, knowledge ecosystems are organized around joint knowledge search that can differ in terms of nature and target (Järvi et *al.,* 2018). Beyond the traditional question of what a knowledge ecosystem is, and how it differs from other ecosystems' type (Valkokari et *al.,* 2015; Cobben et *al.,* 2022), a focus has been on how a knowledge ecosystem transfers to a business ecosystem, how it enables the emergence of a business ecosystem or how it facilitates the development of entrepreneurial activities (Clarysse et *al.*, 2014; Attour and Lazaric, 2020). More recently, in line with Van der Borgh et al., (2012), the management literature sheds light on how knowledge ecosystems are organized (Jarvï et *al.,* 2018; Öberg and Lundberg, 2022); and how knowledge is created and shared for value creation within such type of ecosystems. Some of these works paid attention to specific knowledge ecosystem they conceptualized as patent ecosystems (Schillaci et *al.,* 2022). But, whatever the specificity of the knowledge ecosystems studied, they have a common characteristic: ecosystem members (such as universities, public research institutions, and for-profit firms) collaborate to create and share knowledge (to create value) in a pre-competitive context of innovation (Järvi et *al.,* 2018). That is because the ecosystem outputs collectively generated is innovation (Thomas and Autio, 2020).

Innovation in such ecosystems refers to outputs of innovative processes (i.e., products, services, processes, business models, and knowledge) as well as to the process itself. It occurs in pre-competitive setting, where actors' activities are far from downstream activities that seek to exploit and commercialize newly generated knowledge (Valkokari, 2015). Such setting is thus a pre-commercialization one (Järvi *et al.,* 2018). Collaboration is dominant at that stage. It remains however framed by the easily anticipated competitive tensions that will take over once the pre-commercialization phase is over. Most often technological,

product or service, innovation is indeed the ultimate goal sought by the actors of the knowledge ecosystem. Moreover, knowledge creation and share fostered by the precompetitive knowledge ecosystem is a catalyst for these innovations. In other words, pre-competitive knowledge ecosystems support innovation in its exploration stage through research activities involving the creation of new knowledge, recombination of existing knowledge and inventions to be applied to new products, technologies, and services (Järvi *et al.,* 2018).

This paper sheds light on the inverse relation: how innovation supports knowledge management. We identified such a relation by studying the case of a non-pre-competitive knowledge ecosystem, which are unstudied by the literature. We define a non-precompetitive knowledge ecosystem as the gathering of heterogeneous actors mobilized to create and manage sustainable knowledge. The output here is therefore not innovation, but the sustainability of knowledge. Innovation occurs however, but in an organizational setting. Organizational innovation deals with the creation of new knowledge related to innovative organizational methods, practices, and structures, in contrast to existing ones that were established to achieve the organization's goals (Birkinshaw *et al.,* 2008).

The aim of this paper is therefore to introduce the concept of non-pre-competitive knowledge ecosystems by understanding how it may emerge. To answer this research question, we adopted an organizational perspective, as suggested by Jarvï *et al.,* (2018). As section 1 of this paper presents it, we integrate two separate streams of research: knowledge management and organizational innovation. We furthermore believe this study is the first to consider the specific case of non-precompetitive knowledge ecosystems. For that purpose, we conduct an exploratory case study of a regulated safety context that seeks to make its knowledge sustainable, as section 3 details it. Our results show that, within this context, safety is a matter of life or death (Halgren *et al.*, 2018). Thus, organizations, which operate in this context, try jointly, to create, share and, above of all, sustain this knowledge for a long time. To this end, actors need to innovate their intra-organizational architecture by building first a knowledge management system within their own organization. As well as through the knowledge flow within a knowledge management community. We develop these results in section 4 and derive three theoretical contributions discussed in this section. We conclude that our case study revealed the significance of non-pre-competitive knowledge ecosystem, its main characteristics and highlighted its role in effective inter-organizational knowledge management. We provide

recommendations for organizations on how to effectively manage and utilize knowledge within this specific knowledge ecosystem.

2 Literature Review

Both, management literature and business communities recognize knowledge as a critical resource for organizations (Prahalad and Hamel, 1994; Nonaka, 1994). More precisely, knowledge is perceived as an enabler of innovation and a facilitator of the value proposition of a company. And, knowledge management (KM) is defined as the process of creating, using, sharing, storing, coordinating, recombining, and managing knowledge and information within an organization to achieve its objectives (Alavi and Leidner, 2001; Sambamurthy and Subramani, 2005). Those processes are described as a complex social process. When knowledge is held by several actors or is located outside the boundaries of a single organization, a knowledge exchange mechanism is required (Kogut and Zander, 1992, 1996; Nahapiet and Ghoshal, 1998). Such a mechanism relies on several elements, such as: the opportunity and capacity to exchange and combine knowledge, the anticipation of the value created, the motivation of the actors in this process, the social interaction between the different actors, a common understanding and the accumulated experience favoring knowledge transfer through common routines, culture and language (Kogut and Zander, 1993, 1996; Teece *et al.,* 1997). From there, KM is understood as a set of principles and practices that aims to improve collaborative and cooperative interactions that occur within a particular intra and inter organizational environment. Interactions between individuals, organizations and knowledge artefacts are the primary enablers of knowledge processes.

To understand knowledge management mechanisms and processes within and inter-organizational environment, some recent works examined and/or mobilized the concept of knowledge ecosystems (Van der Borgh *et al.,* 2012; Järvi *et al.,* 2018; Öberg and Lundberg, 2022; Cobben *et al.,* 2022). Knowledge processes and, particularly knowledge development and transfer, are studied as the objective goals of the ecosystem. Two reinforcing mechanisms for knowledge development in the knowledge ecosystem are identified: structure and openness (Öberg and Lundberg, 2022). Structure describes a linear knowledge transfer accomplished through the ecosystem members who need to develop their capabilities to generate knowledge, rather than to develop the content of knowledge. Openness describes how ecosystem members interact and achieve common or shared purposes, how knowledge is developed and, how ecosystem expands its

knowledge base through collaborations with parties outside its own boundaries (Van der Borgh *et al.,* 2012; Järvi *et al.,* 2018). Those collaborations are made by firms rather than by a focal actor playing the role of coordinator (orchestrator) or than a public institute such the one of university. Indeed, in this literature, knowledge ecosystems are defined as "*heterogenous set of knowledge-intensive companies and other participants [, such as universities, regional system networks, etc.], that depend on each other for their effectiveness and efficiency and as such need to be located in close proximity*" (Van der Borgh *et al.,* 2012, p. 151). From that view, knowledge ecosystems focus on the development, transfer and integration of knowledge among parties (Cobben *et al.,* 2022), in pre-competitive settings where the output of knowledge processes is innovation (Järvi *et al.,* 2018).

A distinction is furthermore made between pre-competitive knowledge ecosystems searching for a knowledge domain and those searching within an identified knowledge domain, respectively characterized as prefigurative and partial forms of organizing (Järvi *et al.,* 2018). While in prefigurative ecosystem elements of organizing are absent but sufficiently predictable to be introduced later; in partial organized ecosystem, regulation and monitoring are present. They structure the organization logic of the ecosystem, as they are in use for coordinating the participants and their knowledge creation activities. But, as observed by Järvi *et al.,* (2018), despite the identification of the two organizational logics, the variety of knowledge ecosystems involves different configurations of search processes, because of a movement of back and forth between the two types of searches (for and within a knowledge domain). While the authors explain this movement thanks to a problem-solution pairs mechanism in reference to Von Hippel and Von Krogh (2016), we assume that the organizational logic of a knowledge ecosystem is itself subject to innovation. We do here reference to organizational innovation defined as "*changes in the organization's structure and processes, administrative systems, knowledge used in performing the work of management, and managerial skills that enable an organization to function and succeed by using its resources effectively*" (Damanpour *et al.,* 2009, p. 655). Based upon this definition Fernandes Rodrigues Alves *et al.,* (2018) identified several activities they classified as organizational innovation, such as brand management, divisional structure, leadership development, decentralization, the balanced scorecard, intellectual capital measurement and Six Sigma. All these activities are however emblematic to a business logic of organizational innovation, where the objective goal is business performance and the firm's environmental context is

competitive. Once can here ask if organizational innovation matters in non-competitive environment. This paper addresses this gap by examining the case of the emergence of a non-precompetitive knowledge ecosystem.

3 Methodology

3.1. Research context: Kronos ecosystem

For the purpose of our research question, we conduct an exploratory case study of a regulated safety context, applying a thematic analysis method (Gehman *et al.,* 2018; Williams and Moser 2019). A qualitative approach is appropriate for exploring the characterizing observed phenomena (Yin, 2008). Due to confidentiality issues, we will refer to the studied case under the code name Kronos. Kronos is an ecosystem form by various organizations in the energy field. These include (see table 1): public industrial and commercial establishments (Alpha, Eos, Helios), multinational companies (Daedalus, Talos), public companies (Icarus), professional federations (Perseus), administrations (Atlas, Sisyphus), and public institutions (Orpheus). Evolving in a safety-regulated context, the main objective of Kronos is to establish a sustainable knowledge for safety-related activities. This safety purposes within the ecosystem will be driven by certain standards and regulations to achieve a common public objective which requires strong technical know-how. Contrarily to traditional knowledge ecosystem, this objective is thus not hampered by individual positioning strategies of the actors. There is no competition between actors neither in upstream nor in downstream phases of the ecosystem's life cycle (emergence and existence). This stress the need to understand how a non-pre-competitive ecosystem emerges.

3.2. Data collection

We collected primary and secondary data during a period of sixteen months (from 2021 to 2022). Primary data were collected from 42 semi-structured interviews we conducted with members of the studied regulated safety context (see Table 1). It represents approximately 60 hours of recording for 700 pages of transcripts. Primary data were extended with secondary data from multiple sources; archives (mainly internal documents and public ones representing approximately a total of 1300 pages), frequent interactions with field actors (including regular meetings and informal exchanges) and observations through participation in various events. Data collection and analysis were conducted

iteratively between field and theory (Suddaby, 2006; Eisenhardt *et al.*, 2016; Gehman *et al.*, 2018).

Semi-structured interviews were conducted to have access to the experience of the ecosystem's various actors (Langley and Meziani, 2020), in order to expand our understanding of the studied phenomenon. We progressively identified the relevant informants through various exchanges with field actors and preliminary interviews. The interview guide on which we based our data collection was gradually built around several themes identified as the study progresses (e.g., intra- and inter-organizational KM, ecosystem, dynamics of interactions and collaborations, KM process, organizational structure and architecture).

Table 1: Interviews

Organizations	**Typology**	**Number of interviews**	**Interviewees**
Alpha	Public industrial and commercial establishment	28	Knowledge manager (1), Knowledge engineer (2), Safety manager (5), Safety engineer (4), Scientific and technological manager (3), Scientific and technological engineer (3), Memory manager (1), Strategic manager (2), Engineer (4), Archivist (2)
Eos	Public industrial and commercial establishment	1	Knowledge manager (1), Knowledge engineer (1)
Helios	Public industrial and commercial establishment	3	Knowledge manager (1), Project manager (2)
Icarus	Public company	1	Project manager (1)
Talos	Multinational company	2	Project manager (1), HR manager (1)
Daedalus	Multinational company	2	Knowledge manager (2)
Atlas	Administration	2	Senior official (1), Archivist (2)
Sisyphus	Administration	1	Archivist (1)
Orpheus	Public institution	1	General archivist (1), Archivist (2)
Perseus	Professional federation	1	Project manager (1)
Total	3600 min (60h) / 700 pages of transcripts (400,000 words)		

3.3. Data analysis

In order to bring out different explanatory mechanisms, the main data (the interviews) were fully transcribed and analyzed in several stages with thematic

analysis method (using Nvivo software for qualitative data analysis) to gradually construct meaning (Williams and Moser, 2019). Following Gioia *et al.,* (2013) systematic approach to qualitative data analysis, several codes emerged inductively from the data (Gehman *et al.,* 2018).

Initially the analysis is conducted through an abstract process of open coding (Strauss and Corbin, 2003). Then, during the analysis process we categorized the different information directly from the field (at the 1st order level of informants). And we compared these different categories allowing themes to emerge that would allow us to begin to explain and understand the phenomenon under study (at the second-order level of theoretical themes) (Gioia, 2021). Finally, we organized and structured these emergent themes into global dimensions to be able to build and support our theorizing at a higher level of abstraction (Gioia *et al.,* 2013; Williams and Moser, 2019).

4 Results

Our results highlight that Kronos is a non-precompetitive knowledge ecosystem emerging from two specific contexts aiming to satisfy recent political regulations (4.1). This new knowledge ecosystem differs from traditional knowledge ecosystems in the conditions of its emergence. The non-precompetitive knowledge ecosystem Kronos emerges through organizational innovation materialized at the internal and external level. Organizational innovation takes the form of development of knowledge management systems. In the case Kronos, such development is operated at the internal (4.2) and the inter-organizational level (4.3).

4.1 The emergence of a new form of ecosystems

Kronos is in the process of emerging following three main pre-existing conditions: two context specificities, that are (i) safety context and (ii) non-pre-competitive context; and (iii) a focal actor able to orchestrate activities and KM processes generating sustainable knowledge.

4.1.1 A regulated safety context

Organizations involved in Kronos evolve in a context very constrained by regulations to ensure a long-term perspective of safety-activities (i.e., the activities and their objective are envisaged over a long period, corresponding to several decades). This objective is materialized by the ability of ecosystem members of Kronos to control and/or apply safety standards.

"There are management measures that guarantee long-term operation (…) What is important for us is that we have a device that is operational and that lasts over time." (#32)

Indeed, in this type of context, organizations are forced to demonstrate their ability to control security. For these purposes, they must provide written and formalized evidence. This evidence is subject to validation by regulatory bodies. Thus, the day-to-day operational procedures are not subject to the law of "chance". Every procedure must be authorized before being put in place. These validation and control processes between the operating organizations, on the one hand, and the organizations having the role of control, on the one hand, produce a huge number of interactions.

"[Ecosystem actors] have [safety] requirements, which are prescriptions of means, and they also have prescriptions of objectives. In fact, it's a mix, they have objectives to follow and, in some cases, for some particular things, means to follow as well. And so, that, we [public authorities] check all the time." (#32)

4.1.2 Non-pre-competitive context

Here there is no competitive logic between the actors. They are, as they describe it, in "*the same boat*". The survival of their business depends on their joint effort to collaborate and achieve the safety objective jointly. Due to the context and its specificities, actors of Kronos are interdependent, and they have predefined roles (see figure 1), and their main activities are contractually or legally defined.

"We all work together for a common goal and a common vision; beyond that we also have common projects." (#40)

Those activities materialize sustainable and inter-organizational knowledge flows within Kronos. Those activities are composed of complex and varied knowledge and know-how (including more than 50 domains of expertise), through several projects (sometimes over decades). It implies collaboration and coordination between Kronos actor which in turn generates inter-organizational knowledge share, combination, and creation. This collaboration and coordination mechanisms ensure the sustainability of shared, combined and created knowledge. The value proposition materialized by Kronos is thus the flow of sustainable and inter-organizational knowledge within the ecosystem. Such main goal of Kronos characterizes its non-pre-competitive context orchestrated by Alpha.

"Multilateral interactions are strongly driven by [Alpha], necessarily (…) globally, it is still pretty structured, with committees that exist, participants who are more or less designated, and all of this is driven by [Alpha] according to the challenges of the upcoming schedules (…) there is always this management by [Alpha] and this centralization by [Alpha]." (#37)

However, the inter-organizational knowledge flow within Kronos is composed of various knowledge typologies: scientific knowledge (required by R&D for innovation), technical knowledge (for the development and achievement of projects), practical knowledge (on the products and services provided), organizational knowledge (all the knowledge of the organizations and their members, required to perform the activities) and know-how (tacit knowledge of organizations' members). This implies interactions between actors, to align with the safety regulated system. Such alignment is enabled through a focal actor that is Alpha.

4.1.3 Orchestrating external and inter-organizational knowledge management

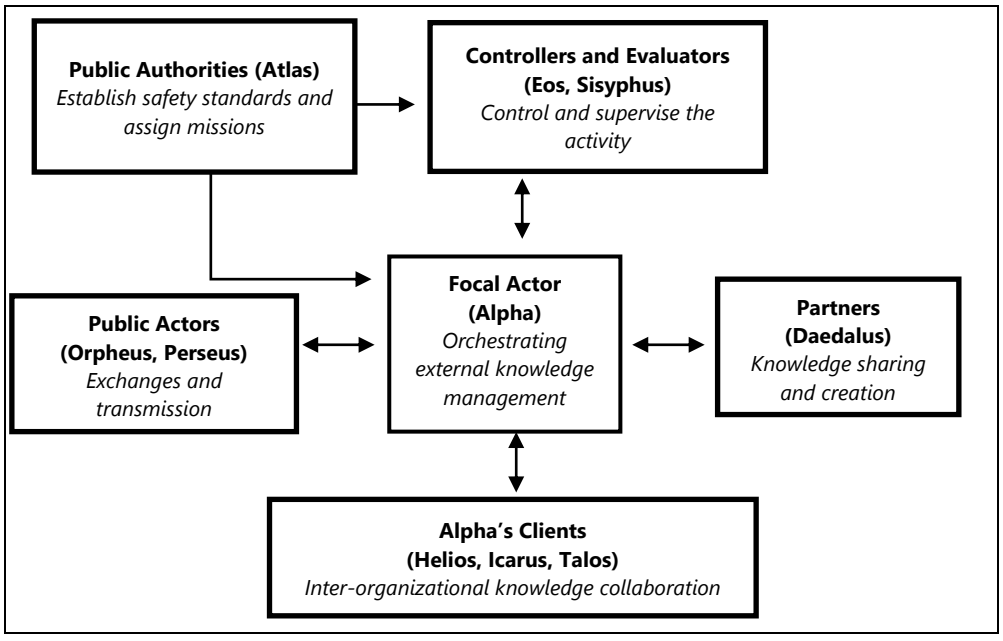

Figure1: Kronos ecosystem

As shows it figure 1, interactions induced by the regulated safety context materialize between three groups of Kronos's members: public authorities that establish safety standards and assign missions (Atlas), controllers and evaluators

who control and supervise the activities from a safety perspective (Eos Sisyphus), and a focal actor (Alpha).

Alpha appears as a focal actor of Kronos as it is positioned as an orchestrator between actors achieving control processes and three other groups of actors. The first other group of actors includes members of Kronos who are concerned by knowledge transfer (Orpheus and Perseus), those who are concerned by knowledge generation (Daedalus), and those who are concerned by knowledge collaboration (Helios, Icarus, Talos). Both three groups must comply with its standards in their knowledge management processes. The focal role of Alpha is then characterized by its capacity to ensure the flows between knowledge management processes and enforcement of regulatory standards. In other words, Alpha is the focal actor of the ecosystem, because it is in charge of ensuring the coordination and collaboration among all groups of actors.

> *"Afterwards, at the national level, I consider that everything must come from [Alpha]. It is the official actor who is in charge of [the ecosystem activity] and it must come from [Alpha], not to formalize knowledge, but to establish rules. And then, of course, it also comes from [Alpha] through [a common knowledge base], etc. To have a level of knowledge and capitalization of knowledge that is somewhat the basic foundation. After that, it's up to each actor to build on this base, to develop methods and elements of standardization and knowledge management within the organization. This is what we do, in a more or less formalized way." (#33)*

However, sustainable knowledge creation also requires organizational innovation in the form of the development of a knowledge management system at both intra and inter organizational level.

4.2. Organization of knowledge management process at the internal level

To create and share sustainable knowledge, the actors of the ecosystem must implement an inter-organizational knowledge system. To this end, actors must first innovate in their intra-organizational architecture by building a knowledge management system within their own organization.

To take part in the inter-organizational knowledge flows within the ecosystem, actors must each have a knowledge management system at the intra-organizational level. In the case of Kronos, some actors did not have internal knowledge management systems, or their knowledge management systems were not sufficiently well organized to meet the objectives of inter-organizational knowledge management at the ecosystem level. To fill this gap, progressively, the

main actors in the ecosystem have initiated different approaches to manage their knowledge internally.

4.2.1 Organizing internal knowledge management through four stages

This was done through different stages that lead to the construction of different knowledge systems. We named these stages as follows: (1) Needs, (2) Means, (3) Objectives, (4) Structuring.

At the first stage, actors identify the knowledge management (KM) needs.

> *"[Helios] has become aware, [Helios] became conscious of the fact that KM was important and that it would not be bad if we had a centralized management and at least a common methodology and that we could share, since as I said, each one was doing their own thing in their own corner, which does not mean that it was not good, but simply that it is true that it is perhaps more interesting if we can have an extended model that can be used by the whole organization." (#40)*

Organizations in the ecosystem have gradually become aware of the need and interest in managing their knowledge, through various factors and triggers related to the regulated safety context or to internal organizational needs. At the regulated safety context, there may for example be external institutional pressures (e.g.; new standards or recommendations). At the internal level, there is for example the need to fill the risk of knowledge loss or to codify individual knowledge of experts from organizations likely to leave the ecosystem (for retirement, or a new job, etc.). Those needs can be identified at the hierarchical level of the organizations (the board of directors).

> *"I can confirm that this is a common problem for all the actors within [the ecosystem] (…) retirements (…) are a problem for [the ecosystem]". (#40)*

At stage two, organizations give to itself the means to enable the implementation of KM processes. This requires some organizational changes or evolutions within their own organization to initiate a global internal knowledge management process.

> *"[The support of the board of directors] is absolutely essential because we are in activities that have a lot of difficulty measuring their value (…) And so, either there are heads who are convinced of this and who think that there is a close association between general knowledge or shared knowledge and performance in general, or to avoid nonsense. Well, if they believe it, that's fine. If they don't believe it, it's very hard to prove it to them. There are ways to get around it. At the end of the day, you have to*

have metrics, you have to bring metrics. You have to give confidence." (#31)

At stage three, organizations set the targets to be achieved in terms of KM. They implement knowledge management processes within their borders according to different purposes and to reach several objectives. In the short term, these objectives consist of filling the need to codify tacit knowledge at risk of loss. In the long term, it is about improving performance, facilitating organizational innovation, and creating a knowledge memory.

> *"Knowledge management must meet your needs and your operational goals. It is even a guarantee of a more solid anchoring than a theoretical approach that would be diffused." (#38)*

And at stage four, actors' structure intra-organizational KM processes. They progressively built and organized their knowledge management process in a systemic way.

> *"[At Daedalus] we have defined a matrix [of the knowledge system] with different themes. So, we have five themes: knowledge transfer, knowledge sharing, capitalization, storage and distribution. And for each of these themes, we have identified three topics, and so the objective for us in the knowledge management program is to transform employee knowledge into corporate knowledge and make it accessible to everyone when needed." (#41)*

4.3. Moving towards the emergence of a non-precompetitive knowledge ecosystem through the development of an inter-organizational knowledge management system

As Kronos's actors evolve in a non-precompetitive but safety regulated context, the organizational innovation operated at the intra level also contribute to the development required at the inter-organizational level. Kronos emergence is materialized by the development of an inter-organizational knowledge management system facilitated through three enablers and three mechanisms of emergence.

4.3.1 Enablers of emergence

The first enabler of Kronos emergence is the sharing of KM approaches between actors. The different knowledge management approaches of organizations will lead to be shared and disseminated in the context of their interactions. The second enabler is the sharing of knowledge bases and KM tools

between actors. Because of their cognitive proximity in terms of knowledge management, actors are led to share and have a certain number of common KM devices and tools. And the third enabler is the sharing of good practices between actors. In their operational interest and to reach the goals of their knowledge management approach, actors share their good practices and their feedback on knowledge management.

> *"We have a very strong ecosystem with companies to which we are closely linked. And it is essential that these companies know how to keep their knowledge to ensure the quality and monitoring of manufacturing. So, we intervene. We regularly intervene with partners to help them capitalize on their know-how, on their technical gestures or things like that." (#30)*

4.3.2 Mechanisms of emergence

The organizational innovation operated at the intra-level results in an improvement of actors' practices which in turn serve at the inter-organizational level. This leads them to organizational innovation in the way they organize and operate at the ecosystem level. Three inter-organizational KM mechanisms facilitate the emergence of Kronos. First, in the context of their activities and regulatory obligations, actors are led to exchange, combine and create knowledge in a sustainable way. The first mechanism is then knowledge processes between actors. The second mechanism is the development of common KM practices and issues within the ecosystem. Due to a common culture, actors have a certain cognitive proximity, which in terms of knowledge management translates into shared practices and issues. And, the third mechanism relay on actors' continuous learning to improve their practices and way of doing things through regular exchanges between them. The regular interaction of actors in charge of knowledge management in different organizations leads to the improvement of their practices and way of doing things through continuous learning.

> *"There are many aspects, subjects that concern us, but also [the ecosystem activity] itself, that are actually learning and are in a continuous learning perspective. And so, the more we learn and the more we develop practices, we identify best practices. These identified best practices are able to change the organization. And our goal is to do this continuously. And we are perfectly aware of different aspects that the organization modes or certain current practices are not the best or in any case, it could be better. There are avenues on this too, there is work, anyway, that aims to seek better ways of doing things, on all subjects." (#36)*

4.3.3 Obstacles

There are however two obstacles to face during the emergence process of Kronos ecosystem. First, the ecosystem actors are gradually moving towards inter-organizational knowledge management despite the challenges and difficulties identified. Second, the initiation of systemic shared knowledge management between ecosystem actors, lead the ecosystem to move towards systemic inter-organizational management.

> *"Today we have a basic foundation and a process that is established by [Alpha], but today we do not have a common rule (…) I would say that today we have methods and processes for knowledge management, through for example everything that is [shared knowledge base]. This is the foundation. And these processes are then declined in the knowledge file, knowledge control and [product] processes. But there is still a part, a part where we don't have, we remain at the macro level (…) But certainly for me, we would have feedback to share, that is, we take the best [products] of all, and we all do the same, that would be great. But today, it's not like that. We don't have fine centralized management, nor our technical processes, and therefore not our knowledge management processes." (#33)*

5 Conclusion

This paper examined the case of the ecosystem Kronos. It aimed to understand what type of knowledge ecosystem Kronos is. And to specifically study how such a new type of knowledge ecosystem emerge. The paper shows that Kronos is a non-pre-competitive knowledge ecosystem where actors' interactions are strictly collaborative due to its main goal: sustainable and inter-organizational knowledge management. The ecosystem's activities are organized through the development of projects involving long-term knowledge collaboration, where the role and missions of the actors are predefined. The regulated safety context structures furthermore the interactions between the ecosystem members in two ways: control (of security and safety) and collaboration. Emergence of the ecosystem is enabled by internal and inter-organizational innovation, i.e., the development of a knowledge management process. Organizational innovation is articulated within the actors' own (intra-organizational) knowledge systems, but also through the knowledge flow that is exchanged at the inter-organizational level.

To achieve this, ecosystem governance is ensured by a focal actor (a legitimate state actor), which is different from the focal actor of pre-competitive knowledge

ecosystem (a leading firm, or a research institute). In a non-precompetitive knowledge ecosystem, the focal actor assumes the role of orchestrator such as pre-competitive knowledge ecosystem. However, they differ in that, in non-precompetitive knowledge ecosystem (Alpha), orchestration activities are mainly ensured through regulatory legitimacy. The goal is to ensure the sustainable flow of knowledge through coordination and collaboration of ecosystem members.

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