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The role of patents in business ecosystem's coordination: how do leader firms maintain technological knowledge and create new trajectories?

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Abstract

This paper aims at explaining how a leader firm is able to manage the successful coordination of a Business Ecosystem (BE) by strategically managing its patents. From this perspective, patents are not only used as an “exclusion” and innovation protection tool but more as a new way to coordinate and secure BE. We show that thanks to an active licensing-out strategy to subcontracting SMEs a leader firm can ensure the stability and sustainability of the BE.

Indeed the firm gives the opportunity to its subcontractors to exploit the patents and develop new products applied to new markets and consequently develop new businesses. So far, they maintain technological knowledge but also create unanticipated technological trajectories by enabling new potential applications. In this sense, the coordination of a BE through the management of IPR is also at the root of specific new uses of technologies, highly dependent on the context. The emerging literature on the determinants of technological change shows that radical innovation is not necessarily linked to an endogenous evolution of an industry. Indeed, radical innovation in an industry may result from the deviation of the technological trajectory of another industry. Technological exaptation or pre-adaptation indicate a generating entrepreneurial activity of technological innovations through the redeployment of an existing knowledge base for unanticipated applications. In this sense, entrepreneurs are trying to find new markets for their technologies instead of seeking new technologies to their

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markets. However, this literature has mainly studied technological exaptation at the firm level and remains silent on the inter-firm level.

According to the Open Innovation paradigm (Chesbrough, 2003) innovation is increasingly an open process that leads to purposive inflows and outflows of knowledge. These flows rely on an active management of Intellectual Property Rights (IPRs) thanks to an extensive licensing strategy that improve innovation beyond firms' boundaries. However this paradigm mainly focuses on a transactional approach of IPRs management and underestimates its collaborative dimension. The emerging literature on BEs mainly stresses this collaborative perspective of innovation and outlines how the convergence of industries conducts to the need for new coordination logics. In this perspective, BEs are particularly relevant, as the concept has precisely emerged to highlight new coordination and interactions logics between heterogeneous actors linked by a common fate. Some studies on BEs addressed this issue of the need for new coordination logics by emphasizing on the powerful coordination role of leader firms within an ecosystem. Other research has looked to the importance of coordination mechanisms and tools such as physical platforms (e.g. IT solutions) or intellectual ones (e.g. patents) to understand why BE are valuable for innovation and for its coordination processes. However this rich literature does not specifically focuses on the way IPRs may be used within BEs. So far, there is little discussion regarding the possibility that patents, although usually seen as a "protection tool" can be used by leader firms with the objective to coordinate and manage a BE and how this can influence BE's survival and performance and what are the implications in terms of technological change.

In article we address the question of how the sustainability of an ecosystem can be achieved and how does new technological trajectories can emerge through IPR management?

We propose that both leader firms' coordination role and coordination tools are important but we suggest that above all it is how such tools are mobilised in the coordination process that is interesting in order to understand BE development and survival. This conducted us to propose a framework showing a number of insights into the coordination mechanisms of a BE: we show that through a relevant management of patents leaders firms can secure a BE and protect their partners' development from external threats and they are able to support upstream partners who are the most dependent and the most vulnerable through the grant of some of their patents' operating licences. This study further demonstrate that leader firms of a BE need to adopt a proactive patent management approach in order to help their partners overcome external threats encountered while at the same time taking into account these

partner's specificities and conjectural needs. We also provide an illustration of the relevance of patents for successful BE's coordination and management. So far we show that while ensuring the stability of its BE the leader firm also create new unanticipated technological trajectories.

In what follows, we situate our research question in the connexion the limits of works on technological exaptation and business ecosystems. In a second point we introduce the literature on open innovation and patents management as framework which will help us to provide answers to our research question. Then, we present our research setting and results. Finally, we conclude with a discussion and conclusion.

1- LITERATURE REVIEW

The literature of our paper is structured around two points. In a first point, we present the literature on technological pre-adaptation and show that the latter is mainly studied at the firm level and not at inter-firm level. In a second point, we introduce the concept of BE's as relevant form to study this managerial phenomenon on inter-firm level. Our literature review on BE's shows equally that the role of firm's leaders is little explored by researchers. By using the research on technological pre-adaptation and BE's, we can formulate our research questions.

1-1- Technological pre-adaptation:

The concept of technological pre-adaptation follows the research literature on technological change and the determinants of radical innovation (Cattani, 2005, 2006). Traditionally, works on technological change have shown that patterns of technological change are characterized by phases of gradual change accentuated by a phases of abrupt changes that lead to radical destructive-creative innovations (Tushman&Anderson, 1986; Anderson&Tushman, 1990). Thus, two types of innovation are identified by this literature: incremental vs. radical. However, some authors believe that this opposition doesn't adequately reflect the dynamics of innovation and technological change (Levinthal, 1998; Adner&Levinthal, 2002; Dew&al., 2004). Indeed, Adner&Levinthal (2002 p.50) suggest that *“the discontinuity typically does not lie in a radical advancement in technology itself; rather, the discontinuity stems from a shift of an existing technical lineage to a new domain of application”*. In the same vein, Cattani (2006 p.312) states *“a seemingly radical technological change might actually reflect the novelty of the new selection environment in which a firm re-deploys its knowledge rather than perform a discrete shift in its technological knowledge base”*. Indeed, many historical innovations such as Internet, Laser or GPS are not the result of

an endogenous technological change of an industry (Dew&al., 2004). They are rather the result of a redeployment and reallocation of an existing technology in another emergent industry (Levinthal, 1998). As a consequence, radical innovation in a particular industry is not so much related to a technological breakthrough as a deviation from the technological trajectory of another industry. This phenomenon is qualified by Levinthal (1998) and Adner&evinthal (2002) as *technological speciation*. In evolutionary biology, the concept of speciation was initiated by Mayr (1963) and further developed by Gould&Eldridge (1977) in the framework of the theory of punctuated equilibrium. According to these authors, speciation describes an evolutionary process of the emergence of new species due to the differentiation of a population and the isolation of a group that evolves into a new trajectory. In the field of management and economics of innovation, technological speciation is defined as “*transplanting the existing technological know-how to a new application domain where it evolves in new directions*” (Adner&Levinthal, 2002 p.51). In other words, it is the exploitation of an existing knowledge based in a new area-market application (Levinthal, 1998). Indeed, several technologies have deviated from their original paths to find refuge and application in new areas. Laser technology and fiber optics perfectly illustrate this change. The optical fibers were originally developed in the medical and military fields before being used in long-distance telecommunications (Cattani, 2006). Similarly, the laser has been deployed in several fields of use: medicine (microsurgery), industrial processes (materials cutting, drilling and welding, etc.), military (guided bomb), telecommunications, etc. (Dew&al., 2004). This notion of speciation allows a better understanding of technological change and the determinants of radical innovation.

This “weird” deviation in technological trajectories (Dew, 2007) is actually based on an entrepreneurial activity that generates more innovations. Indeed, technological speciation involves a capacity of differentiation between technologies and markets to find new creator of value combinations in other markets (Adner&Levinthal, 2002). In this sense, some authors indicate that “*leveraging competences through new product development consists of de-linking competences from current products, and re-linking of current competences to new products*” (Danneels, 2002 p.1115). In other words, “de-linking” involves an understanding of the technology itself independently of the products that incorporate it to imagine opportunities in other applications, while re-linking involves the development of more specific complementary assets to the new markets-applications. In the context of technological speciation, Dew&al. (2004) define this activity “*exaptation*” which is “*an important mechanism by which new markets for products and services are created by entrepreneurs*”

(p.69). Indeed, it is under the influence of an entrepreneur that new technologies-application areas combinations appear (Adner&Levinthal, 2002). In this regard, it should be noted that the type of combination described by exaptation (technology-markets) is fundamentally different from that traditionally described by literature (technology-technology). Indeed, Dew&al. (2004 p.73) specify “*exaptations are not another way of describing the entrepreneurial process of creatively combining existing ideas...Exaptation instead points to a different phenomenon, one that depends on context changes that change the utility of technologies. Exaptation therefore thrives on acts such as connecting a technology with a new domain of use – in other words, on technology-domain combinations, not on technology-technology combinations*”.

Cattani (2005, 2006, 2007) introduces an important nuance about technological exaptation by focusing on micro-processes of speciation and particularly on the specificities of the knowledge base object of the redeployment. Indeed, research on morphological changes shows that exaptation includes two processes: adaptive and non-adaptive ⁴ (Gould&Vrba, 1982). Based on this distinction, Cattani (2005, 2006) proposes the concept of *technological pre-adaptation*⁵ in order to describe “*that part of a firm’s technological knowledge base that is accumulated without anticipation (foresight) of its subsequent uses, though might later on prove valuable for alternative, yet unknown, applications*” (Cattani, 2006 p. 289). In other words, “*the notion of pre-adaptation suggests that in the course of technological evolution, one can identify the existence of an ideal “dividing line” between the phase in which firms accumulate knowledge without anticipating its subsequent applications and the phase in which firms leverage that knowledge in a new domain as new environmental conditions and information about possible uses come along*” (Cattani, 2006 p.290). The works of Cattani therefore show that technological speciation results from a combination between environmental change and intentioned actions. Indeed, the exploitation of an existing knowledge base in an emerging area of application involves the recognition of new opportunities and the commitment of pre-adaptive investments to capitalize on the firm experience and technology to operate it in the new application domain.

Existing research therefore provides a good understanding of the dynamics of technological pre-adaptation. Nevertheless, they are limited to the level of the firm only (Cattani, 2006) though technology exploitation in other fields of use can be externally made

⁴ “A character, previously shaped by natural selection for a particular function (an adaptation), is coopted for a new use—cooptation....A character whose origin cannot be ascribed to the direct action of natural selection (a nonadaptation), is coopted for a current use—cooptation” (Gould and Vrba, 1982 p.5).

⁵ Adaptation within the meaning of Gould and Vrba (1982).

through licensing or selling of patents to other companies (Teece, 1986; Fosfuri 2006; Danneels, 2007). We believe that the analysis of pre-adaptation at the inter-firm level can enrich our understanding of the phenomenon of technological pre-adaptation.

1-2- Business Ecosystems as relevant concept to analyze inter-firms relationship

In the last decade, the concept of business ecosystem has received an increase attention from both researchers (Adner&Kapoor, 2010; Andriani&al., 2011; Iansiti&Levien, 2004; Moore, 1993, 2006; Teece, 2007; Pierce, 2009) and practitioners (Intel, 2004). Moore (2006 p.33) describes the business ecosystem (BE) as “the intentional communities of economic actors whose individual business activities share in some large measure the fate of the whole community”. These intentional communities of economic actors include one leader firms, their value chain partners (upstream and downstream actors) and their complementors. Upstream and downstream partners (suppliers, subcontractor, contract-manufacturer and distributors) contribute directly to the performance of the leader firms by giving the component its products and services (Adner&Kappor, 2010). The complementors play a particular and strategic rule in BE. They provide customers with complementary products and services that permit extracting the full value to the products of leader firms (Brandenburger&Nalebuff, 1995). In doing so, the complementor contribute indirectly to the performance of the leader firms by enhancing the value of its products for customer’s (Pierce, 2009; Adner&Kappor, 2010). Examples of complementors are the hardware with software firms in IT markets, car manufacturers with leasing firms and aircraft manufacturers with airports or training simulator manufacturers in air cargo. Thus, the relevance of the concept of BE is the highlighting of the complementor role. In fact, the traditional concept in strategic literature that describes the external environment (value chain, industry sector, for example) doesn’t reflect the set of actors that allow customers to extract the full value of the products of a given firm (Brandenburger&Nalebuff, 1995; Teece, 2007). For strategy making, the definition of boundaries of BE rely on a dynamic and systematic environment mapping used to identify the firms that are influenced and can influence the actions and decisions of the leader firms (Iansiti&Levien, 2004).

The concept of BE highlights the strong interdependence and collaborations between actors from various industries in a context of open innovation and competition between technological standard. In fact, *“a given innovation, however, often does not stand alone; rather, it depends on accompanying changes in the firm’s environment for its own success. These external changes, which require innovation on the part of other actors, embed the focal*

firm (leader) within an ecosystem of interdependent innovations” (Adner&Kapoor, 2010 p.306). These interactions between firms from various industries with different competences enhance value creation and promote innovation within the BE (Van der Borgh & al., 2012). Indeed, *“managers establish business ecosystems to coordinate innovation across complementary contributions arising within multiple markets and hierarchies”* (Moore, 2006 p.32). Thus, the BE facilitates the innovation process of individuals firms and the creation of innovation community.

Literature in strategy describes innovation as social process of exchange and combination of knowledge (Kogut&Zander, 1996). The combination allows the connection of knowledge elements not initially connected or the development of new ways of articulating elements initially connected. However, when the knowledge elements are held by independent actors, the exchange between them is a prerequisite for the combination of knowledge. This knowledge is legally and qualitatively located in the firms and not at the level of BE (Kogut&Zander, 1996). Consequently, promote innovation in BE requires mechanisms and artifacts to coordination between firms legally independent but strategically interdependent (Kogut, 2000).

The leader firms plays an important role in facilitating coordination among the BE members (Moore, 2006; Andriani&al., 2011). In fact, *“the keystone (leader firms) aim to improve the overall health of their ecosystems by providing a stable and predictable set of common assets that other organizations use to build their own offerings”* (Iansiti&Levien, 2004 p.5). These assets represent platforms for members of the BE to develop complementary products and services that enhance the value of the leader firms products. Assets can be physical (tools, services or technologies) or intellectual (Iansiti&Levien, 2004). The intellectual assets are patents, trademarks, copyright and registered designs. Most authors have focused on the "physical" platforms and more particularly on the role of IT in coordination within BE (technology of sharing information in real-time between Wal-Mart and its partners, for example). Thus, to Evans&al, (2006) *“those software platforms are at the heart of “economies” or “ecosystems” that consist of mutually dependent communities of businesses and consumers that have symbiotic relationship with the platform”*. But intellectual assets have received limited attention in this context.

Intellectual assets, patents especially, are particularly important in the context of BE. Indeed, Kogut (2000) states that the patents may constitute technological bottlenecks that determine the emergence and development of a network of companies creating value. In the case of BE developed around technological standards, the development of complementary

products and services is conditioned by access to essential patents of technologies which compose the standards. The case of Philips is exemplary in this respect. In fact, Philips has allowed, via the Patents-Pools DVD3C and MPEG-2, more than 1900 licensed access to many essential patents for the development of products using technologies and DVD compression and decompression of images and videos. This cooperative approach regarding patent management widely disseminated Philips technology that has facilitated the emergence of BE. As we have explained, the management of patents is at the heart of the issue of the BE management and coordination between partners. However, the issue was little investigated in literature dedicated to the BE.

In this context, the objective of our research is to understand how the sustainability of an ecosystem can be achieved and new technological trajectories can be initiated through the management of intellectual property rights.

2- Open Innovation and Intellectual Property Rights (IPRs) management

Chesbrough's studies on Open Innovation have mainly outlined the way firms can use IPRs within an open logic for innovation. They also focus on the major role of IPRs in technological standards within the various actors of an innovation. According to the author *"the Open Innovation paradigm can be understood as the antithesis of the traditional vertical integration model where internal research and development activities lead to internally developed products that are then distributed by the firm [...] Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas..."* (Chesbrough 2006, p.1). In order to use both internal and external ideas firms have to recognize a new and proactive role of IPRs management. In the so called « closed innovation paradigm » IP is created and used internally with an objective to maintain control over the in-house ideas and to exclude others from using them. On the contrary, the open logic considers IP as a new class of assets that has to be manage both to create and to capture value within Open Business Models (Chesbrough&Rosenbloom 2002). IP may be the source of new revenues but also offers the opportunity to entry into new businesses. According to Rivette and Kline (2000) companies have to offer their IP for sale to others. Moreover in the Open Innovation model they also systematically have to encourage the integration of external knowledge. From that point of view, firms are considered both as active buyers (licensing-in practice) and active sellers (licensing-out practice) of IP. So far, open Innovation companies use licensing extensively and do not suffer from the well known *Not Invented Here* syndrom, neither from the *Not Sold Here* one (introduced by Chesbrough). This implies that IP is

managed at a strategic level. Firms that aim to leverage their IP have to be able to identify business models that may be valuable for their technologies, even if they do not use these business models themselves. According to Chesbrough this extensive IP licensing leads to the development of intermediate markets to trade IP. The latter are defined as markets where an upstream supplier licenses its know-how and intellectual property to downstream developers and producers. This introduces a clear division of labor between R&D activities. Finally, IP transactions facilitate exchange of ideas and technologies between the various actors of the innovation process.

It is important to note that the licensing of IPR's is not only motivated by the direct generation of income through royalties from licenses. In fact, the licensing of patents may have strategic objectives such as the establishment of a technological standard in an industry (Somaya, 2012), access to technologies from other companies (Grindley and Teece, 1997), the acceleration of international development (Fosfuri, 2006) and the development of a competitive network of enterprises (Lichtenthaler, 2007; Kutvonen, 2011). Consequently, the management of IPR is an essential component of the overall business strategy and not a marginal activity (Lichtenthaler, 2007; Somaya, 2012).

3- RESEARCH SETTING & METHODS

To elucidate how IPRs management can insure the stability and the development of a BE, we examine the case of a specific network in the Aeronautics and Space industry: the “PEGASE pole de compétitivité” or “Pole PEGASE” name given to the network after the implementation of the pole de compétitivité industrial policy. Throughout time this network has proved to become a successful BE with organizations revolving around leader firms among which some have used IPRs as a coordination tool and BE development and survival. We will first briefly introduce the Pôle de compétitivité industrial policy, how it works and what are the policy's objective, then present the Pole PEGASE and the leader firm we focus on, i.e. INDUSAT (disguised name).

3-1- The “Pôle de compétitivité” policy context

The case study research is conducted in the context of the French Pole of Competitiveness policy (*pôle de compétitivité*). The innovation policy, focus on R&D to reinforce main existing national assets. Major part of this strategy consists in encouraging the creation of R&D-led innovation clusters that possess a critical mass of actors in a specialised area of expertise, and that would be able to strengthen the region's economy and make it visible at the global level. Three major axes summarise Poles' objectives: reinforce the specialisation of

regional economy, strengthen the attractiveness of the territory and favour the emergence of new activities via synergies between research and industry. Local actors need to ask for a Pole label at the national level. In order to be selected, they have to draw from their local resources and economic potential to present their R&D and innovation capacities, the nature of actors existing in the region, as well as their involvement or potentiality of involvement in global innovative networks. The ultimate end is to create incentives to improve interaction between local academic and industrial actors in the definition and emergence of innovation processes, in order to build specific local capabilities. In 2013, 71 poles have been created in different regions of the country and in several different areas of expertise. These poles are evaluated every 3 years. The latest evaluation results (2013) have seen the rise of Pole PEGASE to be ranked number 1, all criteria taken together.

3-2- The “Pole PEGASE” case study and the leader firm: INDUSAT

Ranking apart, several features made the **Pole PEGASE** particularly suitable for our research purpose. The Pole Pegase is a network of major players in the Aeronautics and Space industry of the Provence-Alpes-Côte d’Azur region. Pegase networks industrial companies, research and training organizations, but also clients looking for more efficient aircrafts, air and space services (for example civil protection or fire service representatives...). The network pools together 200 players involved in the development of a new generation of aircrafts. This objective has conducted to the emergence of real ecosystem founded on already rooted and dense relationships revolving around two main leaders. Indeed, the whole aeronautic field in Provence-Alpes-Côte d’Azur is grouped together around: INDUSAIR (disguised name), the world’s No.1 helicopter manufacturer and INDUSAT (disguised name), the European leader in satellite systems and a major player in orbital infrastructures. These two main leader firms organize the relations with partners and subcontractors in the network and are confronted to the problematic of sustaining and developing their ecosystem. We focus on INDUSAT as it is the pivotal player in space systems designed to explore the Universe and the main coordinator of the PEGASE network particularly as far as SMEs, subcontractors and innovative partners are concerned.

Information about the network was extracted from interviews and complemented with several secondary data sources and other informal meetings with INDUSAT managers and regional agents and bodies. Our original objective in this study was to explore and understand the role of the management of intellectual property rights on innovation and collaboration. However, while data were collected and analysed, the case study appeared with new meaning and

research interest: not only the management of intellectual property rights was a tool for the sustainability of an ecosystem but also leverages new technological trajectories for existing technologies. We have chosen to explore this issue through a case study research design that focuses on one main actor (INDUSAT) and its business ecosystem. Several counter-intuitive insights of the management of IPR have derived from the case of INDUSAT making it a particularly relevant case representing a quite innovative and rare situation (David et Hatchuel, 2007). To obtain these insights into the new role of patents over the coordination of ecosystems and new technological trajectories, we gathered several types of qualitative data. We started with six main consistent interviews conducted with five INDUSAT managers (manager's IP of the parent company of INDUSAT, IP manager INDUSAT, director of research and director of research and technology INDUSAT-Toulouse) and the Director of SMEs (MATEC) has benefited from licensing-out practice. In addition, we observed and took notes at several management meeting at INDUSAT and governance meetings at Pôle PEGASE (studio taping was not allowed) as well as several phone conversations, we shared and examined our notes after each meeting and we used them during the data analysis. We also analysed secondary data such as internet websites and internal company documentation to better understand the current context of licensing out practice.

The case study: EmptyTech Pre-adaptation within the INDUSAT Business ecosystem

First of all, we will show interests and constraints of developing an BE by INDUSAT. Then, we will present the role of patents management in structuring and securing the BE. Finally, we will show how the leader of the EA mobilizes its patents in order to ensure the sustainability of the BE and initiate new technological trajectories.

1 - Interests and constraints of developing an BE by INDUSAT:

Despite its historical status as a "satellitaire"⁶, INDUSAT is increasingly involved in the development of an inter-organizational system to reduce costs and access to specific skills.

“The strategy of the company regarding the production and supply, is to mobilize the industrial bases of the five countries where it is implanted to distribute the production of various equipments necessary for satellites” (INDUSAT CEO, 2011).

Indeed, in some cases, the activity is not large enough so that INDUSAT commits investments. The use of SMEs can be an advantageous option for INDUSAT.

⁶ A satellitaire is a company capable of supplying a satellite with its infrastructures (payload, platform and thrower).

“In contrast to this trend of verticalization, the value of working with SMEs partners would be to benefit from lower hourly rates because SMEs do not necessarily have very heavy integration means. Furthermore, they do not necessarily have the same structure and therefore, the hourly rates are a priori lower and it can be quite significant: 30%, 40% lower” (Research & Technology Director INDUSAT).

Similarly, SMEs may have some important skills on technology segments that INDUSAT does not control or doesn't want to develop.

“From the point of view of our activities, some SMEs have very specific crafts which we are not ready to develop because we will not have enough businesses to invest in certain domains” (IP Director INDUSAT).

“The provision of services is quite different because we started working with them with this activity. We built a strong partnership over the last past years ... We know the business, we know how they work and we are involved in solving their problems. So, we are, in a way, in a relationship partner which implies that when they have a problem, we do our best to sort it out as a mutual technical partnership” (Director of an SME partner).

The need for qualified SMEs capable of providing low-cost products attributes to INDUSAT a leader role responsible for his BE and its SMEs members:

“I think we are at the beginning of a migration of an opportunist buyer logic where we did not feel at all responsible for the network members. We bought at the best price if we found an SME which provided us the good product... We are evolving slowly towards, hem..., we can have a more long-term liability, a little more durable. Maybe we would have to develop SMEs that can then benefit from it” (Research & Technology Director INDUSAT).

The responsibility of INDUSAT dealing towards its partners SMEs is also justified by the cyclical nature of the evolution of the market in the space industry. Indeed, the market of spatial telecommunications, 57.3% of industry sales (GIFAS, 2009-2010), experiencing dramatic declines that may reach 50% in just two years (Commissariat général à la stratégie et à la prospective, 2011). This cyclic evolution of the markets of INDUSAT can have dramatic consequences for its SMEs partners.

“The market is much more artisanal in fact. So, it's more difficult to have a long term vision with SMEs ... If (SMEs) depends only on INDUSAT, it is endangered. The day we are going wrong, the day when we do not win any contract, when we want to repatriate activity to us because we have workers, technicians, engineers deal, we can kill the SMEs” (Research & Technology Director INDUSAT).

“We will not bring to them a sufficiently important market for them to live.... It is a market much more punctual” (IP Director INDUSAT).

Indeed, the cyclical evolution of markets, and consequently the order book of INDUSAT, is translated by an immediate decrease in the level of outsourcing and business for SME members of the BE INDUSAT which can destabilize or endanger them. In addition, the

economic crisis and the U.S. competition have greatly reduced the sales of European industrialists as INDUSAT. In 2012, the number of satellites to be constructed is 18 (25 or 30 during periods of growth) including 2 satellites for INDUSAT (4 in total if we include other types of order). Thus, the market share of INDUSAT on the telecommunications segment passed from 33% to 11% these last years.

This shows that the will of INDUSAT to develop a BE consisted of SMEs in order to reduce its costs and benefit from their skills encounters several constraints (cyclic evolution markets, intense competition, economic crisis).

2 – Patents Management by the leader INDUSAT

The strategy of patenting by INDUSAT essentially aims the reinforcement of its competitive position in industry space. Indeed, INDUSAT continuously tries to improve its commercial offer to customers and protect themselves from legal attacks by competitors.

“Our basic motivations to have a patent portfolio are these ones. It is the dissuasion which allows us to position ourselves in markets: we make things, patents that are deposited, that return within the value of the company, it has an impact, I would say a commercial impact, it is a way to position ourselves regarding customers: you have applied for a patent, the patent is strong, there is a solution, we are requested to find a viable solution, an inexpensive, effective, brief solution. It is a commercial and defensive argument because it allows the ground to mark the areas of interest” (IP Director INDUSAT).

“It is a protection because we can put patents to have the right to use our own property before someone else uses it” (Research Director INDUSAT).

Moreover, SMEs INDUSAT partners indirectly benefit from patents filing. Indeed, the development of technologically reliable and legally secure products protects INDUSAT and SMEs of its BE. In the absence of patents, the offer of INDUSAT leader may be subject to destabilizing maneuvers by competitors (violation of patents).

“When we file a particular patent, I'll take one example, a flight management system of an aircraft, it will cover a number of equipments. We're going to use several (SMEs) who are going to act in subcontractors to make sometimes software, sometimes cabling of card, etc.” (IP Director of Parent Company INDUSAT).

In this case, SMEs develop a product for the purpose of leading INDUSAT based on its technology and may be able to sell to other customers in the space including INDUSAT competitors.

“Suppose we have a very good idea that the best way for us to achieve this is to have carried out by an SME, it can be done as part of a license agreement for a patent. Under this agreement, we have the following open question: can we allow SME to sell the products it develops for us to others? in this case, it will produce more and will be more stable, which will improve its quality. It will provide us with products that may

be much less expensive, so it is good for us, but it is also beneficial for others. We can very well imagine schemes where if it sells for us, it sells it for the price with the negotiated margin. However, if it sells to others, we would agree because it would be beneficial for the SMEs and indirectly for us, but as we do not want a competitor to draw a too strong competitive advantage, we can put royalties to ensure that the products it sells to others is more expensive” (Research & Technology Director INDUSAT).

Indeed, a large number of patents filed by INDUSAT are very specific to space industry and have no application outside space. As a result, INDUSAT authorizes SMEs to sell components developed from its technology to competitors to encourage them to make investments it does not want to realize it-self. However, some patents filed by INDUSAT involve more generic technologies (application space and outside space). INDUSAT is not at all interested in the outside spatial exploitation of these patents.

“We do not have any vocation to seek all possible applications, no we don’t. We do not have the means and then do not have the will to do that. We are really focused on our business: we protect our markets, we protect our business, our activity with our patents” (IP Director of Parent Company INDUSAT).

However, it would be ready to cede license to the SMEs of its BE for exploitation on markets outside spatial activity.

“We have patents, some are very specific to spatial activity, so it can not attract a large number of SMEs that are not in the field, and some may have potential applications outside of spatial activity” (IP Director INDUSAT).

In this perspective, a counterintuitive approach of outside spatial industry valuation of INDUSAT patents by SMEs has been established. The aim target was to develop and sustain a BE capable of meeting the needs of a cyclical market. This approach has been experimented with a first SME with the goal of expanding it to the other members of BE INDUSAT.

3- Exploitation outside spatial activity of a spatial technology by MATEC

MATEC (disguised name) is an SME established in 1996 and has achieved a turnover of more than 2 million € in 2012. It employs 30 people and specializes in space engineering and electronics and graphics applied to scientific communication and training.

Within the BE of INDUSAT, MATEC has the distinction of being a supplier and partner as far as she answers its commercial offers (data cables and power, computing cables, cables of measures etc.) and is also involved in solving complex technological problems. Indeed, MATEC has a good knowledge of the space environment through advanced skills in thermal and mechanical testing (preparation of satellites to validate their operation in orbit, assessing their degree of resistance, etc.) and in equipment design for satellites (berries

thermal control console regulation, automat, electronic box, etc.). Nevertheless, despite its skills in space, MATEC remains highly dependent on its main customer INDUSAT and its activity and has difficulty to diversify its customer portfolio in spatial industry.

“MATEC is a diversified company with three main areas of activity, but it is not diversified at the client level. We have the problem of having too large important consumer and therefore we have to make a customer diversification, not craft...The market of the space is a highly concentrated market ...we are in a technical niche; this is why diversifying customer related to this craft is very complicated. So tomorrow; the only way for me to diversify in this business is to work with OHB in Germany.... The customer diversification is very hard to make” (MATEC Director).

The consumer diversification difficulty in spatial market for SME is indeed a real problem whose INDUSAT is aware.

“In France or even in Europe, we quickly toured the question: it is difficult for SMEs to export to USA, Japan. Therefore C’INDUSAT⁷ and us are its potential customers in the space, or even OHB if they go to Germany” (Research & Technology Director INDUSAT).

This shared awareness of the need for consumer diversification and markets for SMEs like MATEC has initiated an outside spatial industry valuation project of some initially developed and industrialized technologies for the needs of the spatial industry. It should be noted here that the historical relationship between INDUSAT and MATEC have enabled the development of relational capital between staff of the two companies that favored the initiation and implementation of the project.

“The idea has made headway during a relational discussion. If there had not been this conversation with this person, the patent would have remained on a shelf.... The relation between INDUSAT and MATEC in the space activity truly allowed the partnership to be launched” (MATEC Director).

This project is based on the sale by INDUSAT of an exclusive license for MATEC to develop from the same "EmptyTech" technology products for the spatial market and other for outside spatial market.

“The goal of INDUSAT is to use a product they need but also a product they could not industrialize..... So, actually, the goal of INDUSAT is to have a product at a lower cost....As for MATEC, its current need is to have a turnover and customers who are outside of the spatial market to be less dependent on this activity...MATEC will effectively be able to: 1. Go out of the spatial activity, 2. make a product that interests everyone” (MATEC Director).

The EmptyTech technology was invented by INDUSAT for its own purposes in the field of space. It helps to develop a sensor able to quantify and measure in real time a mass of

⁷ Disguised name of national competitor INDUSAT.

suspended matter and the amount of gas contained in a vacuum chamber. This technology can improve productivity and ensure the quality of products in terms of reliability and accuracy of the measurement. Indeed, existing technologies are measuring very small amounts of material (on the order 10^{-8} g/cm² of a few 10^{-5} g/cm²) and are not adapted to the specificities of the space. However, the technology does not fit EmptyTech perfectly with the heart of INDUSAT business who does not want either to make investments to industrialize and develop a product which nevertheless answers its own needs. Indeed, the need for INDUSAT of small series of this product does not present a real investment opportunity for it. Therefore, INDUSAT would be ready to buy the product from an SME that would be able to industrialize the technology in order to develop the product it needs.

As regards other outside of spatial industry applications of EmptyTech, these were neither anticipated nor identified by INDUSAT. Rather, MATEC has tried to identify them by conducting market research and technical studies to identify other opportunities for applications and other potential customers might be interested by EmptyTech.

“It is very interesting today to note that when we had interest in this product at the time, we did a market study and we found that with the exception of the spatial activity, other businesses might be interested by this product including people who work in the metallization, the people who work the freeze-drying, people working in the wooden drying, etc.” (MATEC Director).

Thus, MATEC succeeded in identifying other markets outside the spatial sector that use vacuum chambers as metallization, wood drying, freeze drying or waste treatment by vacuum evaporation. The marketing of new products in these markets will allow MATEC to achieve a turnover of 12 Millions € over seven years. In this process of identification of the outside spatial applications of EmptyTech, MATEC mobilized external resources due its limited internal resources. Indeed, it relied on the skills of a public research laboratory specialized in physical of materials, thermodynamics etc. for further research on the technology and its applications. Similarly, it was based on the expertise of a company specialized in design and production of circuit boards. Finally, the project has received funding from a public bank dedicated to SMEs and was granted a loan of 2.2 million €. Indeed, the limited financial resources of MATEC did not allow him to make investments of such magnitude.

It is also worth noting the important role played by INDUSAT. Indeed, beyond the sale of an exclusive license with a symbol rate of royalties (0.2% of sales realized by MATEC), INDUSAT has mobilized its researchers to accompany MATEC in the assimilation and

understanding of technology. Also, INDUSAT put some of its production installations (the benches of tests⁸) available to MATEC to help it in the industrialization of the technology.

DISCUSSION & CONCLUSION

The case study presented in this paper shows how in the context of a network-based and open innovation the leader can ensure the stability and sustainability of the BE through active management of patents. More specifically, the leader undertook a process of licensing-out to subcontracting SMEs so that they can exploit the patents and develop new products applied to new markets and consequently develop new businesses which would be less dependent on the main activity of the BE's leader. This process is characteristic of the Open Innovation perspective. But contrarily to what is argued in the Open Innovation paradigm, here, the licensing-out is not dedicated to capture value but to secure the BE. Indeed The purpose of this initiative is to strengthen the BE's capacity to withstand external shocks such as unfavorable economic situations. Indeed, the literature on BE indicates that the robustness and performance of BEs depends on their ability to face the evolutions of their environment and external shocks (Iansiti and Levien, 2004). The case study shows that leader has anticipated these external shocks by allowing its partners to diversify their activities and reduce their risks. Indeed, for subcontracting SMEs a strong dependence to the main activity of the BE increases their vulnerability: a drop in orders may put them in danger and conduct to their disappearance. Inversely, the disappearance of the BE partners, in particular subcontractors that provide components products to leaders, can destabilize the BE and thus negatively affect the overall performance. The case study shows that the leader has succeeded to anticipate such a risk by granting licenses to its upstream partners in to order to help them develop new activities while remaining a member of the BE. Consequently, the case study shows how technological pre-adaptation may occur on inter-firm level. Indeed, in the context of a business ecosystem, licensing-out can facilitate the emergence of new technological trajectories and operation of technological knowledge base for unanticipated applications and by a firm other than who developed the knowledge base pre-adapted. Licensing-out by the leader to the SME-partner has enabled the latter to exploit one technology performed for the needs of the space to develop products addressing markets other than space.

This approach has four main advantages:

⁸ A bench of test is a physical system allowing putting a product in conditions of use customizable and checked to observe and measure its behavior.

- Stabilization and sustainability of the BE due to the reduction of economic risk to subcontractors who are now diversified;

- Income generation for the leader: the royalty license paid by licensees (subcontractors);

- Enrichment of the skills and the knowledge basis of the subcontractors. Indeed, the development of a new business is an opportunity for organizational learning and development of new knowledge. The acquisition of new knowledge by subcontractors positively affects the performance of the leader as a result of improving the skills of members of the BE ;

- Creation of new unanticipated technological trajectories. By facilitating the exploitation of patents by subcontractors, the leader firm enables the emergence of new markets and opportunities far from its own activities.

However, it should be noted that such a strategy is possible only under certain conditions. The first condition is the will of the leader to open its patent portfolio and allow partners to exploit it. Furthermore, the leader must develop a desorptive capacity allowing it to exploit its patents by its partners (SME subcontractor). This desorptive capacity has two important dimensions: the identification of areas of application and technology transfer to SMEs partners-potential licensees (Lichtenthaler&Lichtenthaler, 2009). The case studied in this paper shows that the identification of areas of application outside space has been achieved in a collective manner (MATEC, public research laboratory, etc.) and the transfer of technology involved staff training MATEC by the inventor of the technology INDUSAT. The second condition is related to the quality of patents held by the leader. Indeed, the simultaneous use of patents in the space and outside space industry by SME partners requires patents on generic technologies. Indeed, generic technologies have many industrial applications which facilitate their use in different markets (Gambardella&al., 2007). In contrast, the external valorization of patent by the partners of the focal firm becomes more difficult when the technology has specific applications. Finally, third condition, the partner must own (or at least be able to develop) the complementary assets necessary for the exploitation of the technology to develop products addressed to new markets. Indeed, the exploitation of a technology for the development of new products requires a production and marketing capacities specific to the new markets. Our case shows that MATEC has developed these new complementary assets by combining its existing internal resources with external resources.

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Appendix:

Quotes inserted in the text have been translated from French. Below the original quotes in their order of appearance in the text

« La stratégie de l'entreprise, en ce qui concerne la chaîne de production et d'approvisionnement, consiste à mobiliser les bases industrielles des cinq pays où elle est implantée pour répartir la production des différents équipements nécessaires aux satellites » (INDUSAT CEO, 2011).

« À l'inverse de cette tendance de la verticalisation, l'intérêt de travailler avec les PME partenaires serait de bénéficier de taux horaires plus bas parce que les PME, elles n'ont pas forcément des moyens d'intégration très très lourds, elles n'ont pas forcément la même structure et donc à priori leurs taux horaires sont plus bas et ça peut être assez sensibles : 30%, 40% plus bas » (Research & Technology Director INDUSAT).

« Du point de vue de nos activités, il y a des PME qui ont des métiers bien spécifiques qu'on n'est pas prêt à développer nous parce qu'on ne va pas avoir suffisamment d'activités pour investir dans certains domaines » (IP Director INDUSAT).

« La partie prestation de services est un peu différente parce que c'est par là qu'on a commencé à travailler avec eux. C'est une relation qui se fait sur le temps...on connaît je dirais le métier, on connaît leur façon de travailler et on est impliqué dans leur besoin pour résoudre des problèmes. Donc, là on est, je dirais, dans une relation de partenaire qui fait qu'à un moment donné, quand ils ont un problème on essaye de le résoudre comme dans un partenariat technique réciproque » (Director of an SME partner).

« Je pense qu'on est au tout début d'une migration d'une logique d'acheteur opportuniste où on ne se sentait pas du tout responsable du réseau d'entreprises. On achetait au meilleur prix si on trouvait une PME qui nous fournissait le bon produit... On est en train d'évoluer doucement vers, euh, on a peut-être une responsabilité un peu plus long terme que ça, un peu plus pérenne. Peut-être qu'il faudrait qu'on développe des PME pour qu'on puisse ensuite en bénéficier » (Research & Technology Director INDUSAT).

« C'est un marché, beaucoup plus artisanal en fait. Donc, c'est assez, c'est plus difficile d'avoir une vision très long terme avec des PME...Si elle (PME) ne dépend que de INDUSAT, elle se met en danger. Le jour où nous on va mal, le jour où on ne gagne pas de contrat, le jour où on veut rapatrier l'activité chez nous parce qu'on a des ouvriers, des techniciens, des ingénieurs à occuper, on peut tuer la PME » (Research & Technology Director INDUSAT).

« On ne va pas leur apporter un marché suffisamment important pour elles pour vivre.... (C'est un marché) beaucoup plus ponctuel » (IP Director INDUSAT).

« Nos motivations de base d'avoir un portefeuille brevet, c'est celles-ci. C'est une dissuasion qui nous permet de se positionner sur des marchés : on fait des choses, on dépose des brevets ça rentre dans le cadre de la valeur de la société, ça a un impact je dirais un peu commercial comme même, c'est une façon de se positionner vis-à-vis des clients : vous avez déposé un brevet, ce brevet il est solide, on a une solution, on nous demande que la solution est viable, quelle est peu coûteuse, qu'elle est efficace, bref. C'est un argument commercial et défensif parce que ça permet de baliser le terrain sur les domaines qui nous intéressent » (IP Director INDUSAT).

« C'est une protection parce qu'on peut poser des brevets pour avoir le droit d'utiliser sa propre propriété avant de se la faire porter par quelqu'un d'autres » (Research Director INDUSAT).

« Quand nous on dépose un brevet particulier sur, je vais prendre un exemple, un système de gestion du vol d'un avion, ça va couvrir un certain nombre d'équipements. On va en (PME) utiliser plusieurs qui vont agir en sous-traitants pour faire tantôt du logiciel, tantôt du câblage de carte » (IP Director of Parent Company INDUSAT).

« Imaginons qu'on a une très bonne idée, que la meilleure façon pour nous de la réaliser c'est de la faire réaliser par une PME, ça peut se faire dans le cadre d'un accord de licence sur un brevet. Dans le cadre de cet accord là, on a la question ouverte est-ce que, la PME, on l'autorise de vendre le produit qu'elle développe pour nous à d'autres, auquel cas elle va en produire plus, elle va être plus stable, ça va améliorer sa qualité, elle va nous fournir des produits peut être encore moins chers, donc c'est bénéfique pour nous, mais c'est bénéfique aussi pour les autres. On peut très bien imaginer des schémas où si elle le vend pour nous, elle nous le vend pour le prix avec sa marge négociée et, par contre, si elle le vend à d'autres, on accepte parce que c'est bénéfique pour la PME et y compris indirectement pour nous, mais comme on ne veut pas que l'autre en tire un avantage compétitif trop fort, on peut mettre des royalties pour faire en sorte que le produit qu'elle vend aux autres soit plus cher » (Research & Technology Director INDUSAT).

« On n'a pas une vocation à aller chercher toutes les applications possibles, non. On n'a pas les moyens et puis on n'a pas la volonté de faire ça. On se focalise vraiment sur notre business, on protège nos marchés, on protège notre business, notre activité avec nos brevets » (IP Director of Parent Company INDUSAT).

« On a des brevets, certains sont très spécifiques à l'activité spatiale, ça peut donc ne pas intéresser un grand nombre de PME qui ne sont pas dans le domaine, certains peuvent avoir des applications possibles en dehors de l'activité spatiale » (IP Director INDUSAT).

« MATEC est une entreprise diversifiée avec trois domaines d'activité mais elle ne l'est pas au niveau des clients. On a la problématique d'avoir un client trop important et donc on est obligé de faire une diversification client, non pas métier...Le marché de l'espace est un marché très concentré... on est dans une niche technique qui fait que la diversification client liée à son métier est très compliquée. Donc demain la seule possibilité que j'ai pour moi pour me diversifier dans cette activité là c'est d'aller travailler avec OHB en Allemagne....La diversification client est très dure à faire » (MATEC Director).

« En France voir même en Europe, on assez vite fait le tour de la question : c'est assez difficile pour une PME d'exporter aux USA, au Japon et donc ses clients potentiels dans le spatial c'est C'INDUSAT et nous, voir OHB si elles vont jusqu'en Allemagne » (Research & Technology Director INDUSAT).

« C'est au cours d'une discussion relationnelle qu'est partie cette idée. Si on n'avait pas eu cette discussion là avec cette personne, le brevet serait resté sur une étagère.... C'est cette relation entre INDUSAT et MATEC dans l'activité spatiale qui a permis de faire sortir ce partenariat » (MATEC Director).

« Pour INDUSAT, leur but c'est de pouvoir utiliser un produit dont ils ont besoin mais qu'il n'aurait pas pu industrialiser....Donc INDUSAT, pour eux aujourd'hui c'est d'avoir un produit à moindres frais....MATEC aujourd'hui effectivement son besoin c'est d'avoir un

chiffre d'affaire et des clients qui soient en dehors du spatial pour être moins dépendante de cette activité là ça lui permettra effectivement de : 1. sortir de l'activité du spatial, 2. faire un produit qui intéresse tous le monde » (MATEC Director).

« Ce qui est intéressant aujourd'hui c'est quand on s'est intéressé à ce produit là, on a fait une étude de marché et on s'est aperçu qu'il y a avait d'autres métiers que le spatial qui pourraient être intéressés par ce produit notamment les gens qui travaillent dans la métallisation, les gens qui travaillent la lyophilisation, les gens qui travaillent dans le séchage de bois, etc. » (MATEC Director).

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