THE 'DISTINCTIVE CAPACITY': MANAGING THE INVENTION PROCESS BY MANAGING THE PRIOR ART

Chipten Valibhay, Pascal Le Masson, Benoît Weil

Centre de Gestion Scientifique, Mines ParisTech, PSL University
60, Boulevard Saint-Michel, 75006 Paris
chipten.valibhay@mines-paristech.fr
pascal.le_masson@mines-paristech.fr
benoit.weil@mines-paristech.fr

ABSTRACT

While patents are recognized as a key resource to sustain innovation activities, patenting activities are mainly conceptualized as protective means quite unrelated to innovation issues. By conducting an exploratory case study of French IP advisor, this paper identifies four unusual patent practices oriented towards a strategic management of the inventive capacity of a firm. These practices offer the opportunity to introduce a new capability of a firm, the 'distinctive capacity', which describes the ability of a firm to manage and organize the relationship between its inventions and the prior art articulated and structured based on strategical considerations (competitive environment, legal risks, technological choices). Building upon 'dynamic capabilities', we claim that the 'distinctive capacity' of a firm allows to better characterize the features of a specific knowledge management adapted to increasing a firm's inventive capacity.

INTRODUCTION

The role of patents in the management of innovation remains curiously scarcely explored. While it is commonly accepted that patents are a key strategic resource for innovation activities, most of the patenting activities are associated with transactional, legal or financial issues (procedures, enforcements and litigations, licensing and market value, technology and knowledge transfer contracts, etc.) (Somaya, 2012). Although these dimensions are critical to manage any patent portfolio, it lies on the assumption that the patents are already available and must be managed as an asset or real options for managers (Reitzig, 2004a; Rivette and Kline, 2000). Then, the different activities by which the patented invention is obtained – namely the firm's inventive capacity – is considered out of the scope of IP (intellectual property) activities. As a result, the inventive activity is supposed to be independent of the strategic use of the patents. Yet, design-around activities required for reinforcing its legal position over a given technology ('defensive' strategy) or designing a novel technology based on a long-term research ('first-mover' strategy) are two examples in which it appears that the IP-related strategical choices are closely associated to a specific management of the inventive capacity of the firm.

Similarly, the management of innovation often assumes that the invention phase depends on a process unrelated to the exploitation phase. As a matter of fact, numerous cases of "sleeping" inventions are regularly pointed out as a proof that invention does not cover the essential stages of innovation (Granstrand, 1999). At the same time, in terms of technological innovations, the ability to produce novel inventions in order to have distinctive capabilities and resources is often highlighted as a strategic competitive

advantage (Teece et al., 1997; Leonard-Barton, 1992). Then, how inventive activities can contribute to structure the innovation strategy and ultimately increase the innovation performance of a firm ?

Recent works on patent law suggests that the inventiveness of a solution (Valibhay et al., 2018) will depend on the structure of the prior art. The invention should be novel and not be obvious to a *person skilled in the art (PSA)* (inventive step criteria). It appears that this legal fiction, the PSA, refers to a given knowledge structure from which a certain number of obvious solutions could be deduced for a given problem, based on rules of 'independence' (the invention should be independent from the 'obvious solutions'). From this perspective, being inventive is not necessarily related to creative skills, but rather to the ability to differentiate its technology from a given prior art. In fact, inventive activity should rely on a *specific form of knowledge management* allowing a firm to build one (or several) knowledge referential(s) on which design engineers would design, evaluate and value their inventions. Counter-intuitively, it means that increasing a firm's inventive capacity would strongly depend on its ability to manage and structure its knowledge and expertise in regards to the state-of-the-art, rather than managing its creative skills.

Therefore, this research suggests that patent-related activities can be oriented towards innovation strategies by a specific *management of invention* allowing the invention to be positioned and differentiated compared to a given knowledge referential, "the state-of-the-art" composed of potential competitor's technologies. The ability to manage and control how a technology differs from the prior art appears as a key feature of innovation strategies (Teece, 1986). We label this feature of the management of invention 'the distinctive capacity'. This type of management allows to design at an early stage an invention accordingly with the innovation strategy. Then, this research claims that the innovation potential of a technology can be to some extent 'injected' while designing the invention. Generally speaking, a technology is assumed to be innovative when it differs sufficiently from the prior art. This broad definition implies two main capabilities that are rarely emphasized. First, the firm's actors are supposed to be able to identify the relevant prior art associated with their technology. Second, it is assumed that the actors are always able to identify clearly what constitutes a "difference" between two close inventions. This research suggests that these two capabilities – *'distinctive capacity'* - are interdependent and closely related to the inventive capacity of a firm. The aim of this article is to introduce distinctive capacity - the ability to organize and structure the relationship between a firm's knowledge and the prior art - as a critical component of inventive activity.

One of the main actors of this specific type of knowledge management related is the IP advisors: they have to position the invention against the state-of-the-art and carefully design and draft the invention's claims. More than a pure 'translation', this activity reveals a specific way of organizing the prior art around the patent in order to reveal its novel and inventive technical contributions and avoid infringements. However, this specific skill is only viewed as a legal requirement while it seems to be a valuable competence to ensure a firm's technological distinctiveness compared to the prior art. By helping the firm to organize its knowledge, the IP advisors could *a priori* contribute to increase the firm's inventive capacity.

Based on this assumption, we conducted a series of interviews of IP advisors and an exploratory case study of a French IP advisors office, recognized as particularly active (and successful) in helping companies to structure their innovation strategies. Then, the aim of this article is to explore the grounds to characterize how IP management and IP methods can contribute to increase the 'distinctive capacity' of a firm and thus increase

a firm's inventive capacity. One surprising result is the identification of IP methods used by one actor that are very unusual for the profession: he identifies and explores extensively the prior art of the invention in collaboration with the inventors (we call this process 'state-of-the-art review'), he helps the inventors in their inventive activity by helping them to structure their design process accordingly with their strategy, he contributes to organize firm's patent portfolio by assessing technological area. Therefore, this research allows to: 1) identify the activities and methods of IP advisors which participate in structuring a firm's inventive activity, 2) introduce a new form of knowledge management that we label 'distinctive capacity'.
The paper is structured as follow: first, we review the literature about IP management and innovation management to highlight the need for a management of invention seen as a management of 'distinctive knowledge'. Second, we present our methodology. In the third part, we present our results, especially the 'unusual' IP methods used by one IP advisor and in the final part, we will further analyze and discuss these methods.

THEORETICAL CONTEXT

We review the relationship between the innovation management and the patent management literature to highlight that despite an acknowledgment of the importance of patents in achieving competitive advantage, it remains unclear how patent-related activities should be managed in regards to innovation activities. Then, we show that the literature about knowledge management and innovation offers fruitful theoretical frameworks to better capture the relationship between innovation and patents seen as 'distinctive' knowledge asset. However, we show that this literature does not consider some specific features of inventive activity which are central for the purpose of increasing a firm's inventive capacity.

1. The management of patent: an optimization of IP as protective means.

In a context of a rapidly growing number of patent applications (Hall), the emergence of new patent strategies (Ayerbe, 2008) and the expanding uncertainty of patent-related rights (Lemley and Shapiro, 2005), there is an increasing interest in IP (Intellectual Property) management. At the same time, the existence of a positive causal relationship between patents and innovation is widely criticized for multiple reasons: the intellectual property system itself seen as a reward mechanism for inventor is argued to be inefficient (Boldrin and Levine, 2008), the density of patents in IT or pharmaceutical industries has led to warn about the existence of 'anticommons' (Heller and Eisenberg, 1998), and the value of granted patents is questioned (Jaffe and Lerner, 2006). This debate about the patent system clearly shows that the relationship between the management of innovation and the management of patent still needs to be clarified and further investigated (Candelin-Palmqvist et al., 2012). These difficulties encountered at the ecosystem-level have led scholars to focus IP management on the valorization of patents by mitigating uncertainties (technological, legal and commercial). Somaya (2012) highlights that this management should be adapted to patent strategies (proprietary, defensive or aggressive) oriented towards a protective mechanism. The main issue is to maximize the potential of the firm's patents as a barrier to imitation – using patent thickets or patent pools (Blind et al., 2007 ; Markman et al., 2004; Shapiro, 2000) - or to minimize the strength of competitor's patents – using blocking patents, litigation strategies for patent breaking or design-around strategies (Merges, 1994; Somaya, 2003).
In summary, IP activities are mostly oriented towards: 1) clearly defining the technological advance during patent drafting activities to manage the trade-off between

patent breadth and risk of patent rejection by the patent office or patent breaking by competitors, 2) optimizing the legal strength (resistance to patent litigation) associated with the patent life by optimizing the application process (van Zeebroeck and van Pottelsberghe de la Potterie, 2011), 3) managing patent portfolio in order to control the balance between costs and the capacity to 'protect' or valorize the intellectual assets of the firm (Parchomovsky and Wagner, 2005; Reitzig, 2004b; Sincholle, 2009).

2. The management of patent as a management of invention: relating innovation strategies with patent management.

Paradoxically, the introduction of patent management in corporate strategy has reinforced the idea that patents have acquired an autonomous strategic and financial value, quite independent from innovation itself (Duhigg and Lohr, 2012; Hall and Ham, 1999; Macdonald, 2004). Various works from scholars and practitioners have emphasized the different functions of patents in organizations - coordination mechanisms, reward mechanism for researchers, negotiation tool with competitors or investors, source of information for technological benchmarking and competitive intelligence, evaluation criteria etc. (Ayerbe, 2016; Ayerbe et al., 2014). Although these functions stress the important role of patents (beyond being an 'asset'), the "innovative" function of patent is eluded. Then, in which manner patenting activities can contribute to and sustain a firm's innovative activities?

While invention is associated with an act of intellectual creativity, the innovation activities are related to bringing invention into commercial use (Schumpeter, 1939). Based on this linear model of innovation, in spite of criticism against this approach (Godin, 2006; Kline, 1985), inventive activity is mainly described as an input of innovative activities (Archibugi, 1992; Roberts, 2007; Rogers and Rogers, 1998) and this input is supposed to have an influence on innovation output. This is why patents are often assumed to be a valuable proxy for measuring innovation (Basberg, 1987; Griliches, 1998). This measure assumes that the production of patents by a firm is at least a signal for innovation potential (Pavitt, 1985, 1982). From this perspective, it appears that there is a need to better understand how the "act of intellectual creativity" at the basis of the invention process integrates the potential to achieve actual innovation. Moreover, it reveals that there are patents particularly relevant for innovation. Instead of 'selecting" inventions once they are designed, there is a need to strategically design "innovative patent".

Based on this view, it has been argued that thanks to intellectual property assets, a firm can strengthen its opportunities and positions. This is why some scholars have advocated for organizing the generation of IP assets as a way to identify and protect business opportunities at an early stage (Felk et al., 2011; Kokshagina et al., 2017; Lindsay and Hopkins, 2010). Instead of assuming that R&D will produce technological inventions quite independently from strategic consideration, there is a growing interest in managing inventive activity towards designing purposeful technologies (Yu and Hang, 2011). Thus, it would mean that the invention process could be managed in a strategic way that increases a firm's ability to produce technological innovation (Nissing, 2005).

3. The strategic management of invention as a management of 'distinctive' knowledge

One facet of a strategic management of invention is the ability to produce distinctive knowledge in order to reduce the appropriability of the invention by competitors or imitators (Teece, 1986). Based on the resource-based view of the firm and the concept

of "capabilities" (Teece et al., 1997), the strategic management literature has conceived that one major component to achieve competitive advantage is the existence of differentiating resources, specific to the firm described as "core capabilities" (Leonard-Barton, 1992), incorporated in specific assets (equipment, infrastructures), technical skills (competences and expertise) or organizational skills (routines or relational asset for example). However, in a context of rapid technological change, scholars have theorized the impact and the conditions of learning process into regenerating these capabilities. As a result, "dynamic capabilities" have been proposed as a specific knowledge management aiming at identifying and leveraging business opportunities. Dynamic capabilities are defined as a strategic management in "adapting, integrating and reconfiguring internal and external organizational skills" (Teece et al., 1997). Integrating this type of knowledge management would steer managers toward "creating distinctive and difficult-to-imitate advantages" which would give a stronger position to a firm.

Ahmed & Wang (2007) have identified three main interrelated components to dynamic capabilities: adaptive capabilities, absorptive capabilities and innovative capabilities. In fact, this framework reveals different types of knowledge resources required for each capability: 1) knowledge of the business environment to quickly adapt and align internal resources with external change, 2) knowledge of 'the value of external knowledge' (mainly determined by the level of prior knowledge) (Cohen and Levinthal, 1990), 3) knowledge in product or service development related with existing or potential markets. Based on this observation, one common feature is that knowledge management is always recognized as a balance between "prior knowledge" conceived as "internal knowledge" and the ability to evaluate the value of "external knowledge", "new opportunities" and "new products". As a result, those results suggest that achieving dynamic capabilities and competitive advantage would depend on a specific knowledge management (Tseng and Lee, 2014) oriented towards learning processes. Even though an extended literature has treated this question through the problem of "knowledge transfer" by showing the cognitive barrier of knowledge, the appearance of new actors or the need for specific relational competences (Carlile, 2002; Kale and Singh, 2007; Meyer, 2010), there is a weak connection between these learning processes and a specific attention to inventive activity. While it is assumed that this learning should enable adaptation, integration or creation of new competences to achieve technological innovation, it lies on the assumption that the accumulation or the diversification of knowledge will somehow induce the generation of distinctive resources (Cohen and Levinthal, 1990). "Core rigidities", "path-dependencies" are some recognized drawbacks of knowledge accumulation. One surprising consequence is that there is a need to manage – not only acquisition and integration of new knowledge – but also "existing knowledge" or "prior knowledge" in a way that does not hinder the invention process. For now, there is little exploration of how firms can proactively manage "prior knowledge" in order to sustain inventive activities for the generation of distinctive knowledge asset.

4. Research questions

Therefore, this paper aims at connecting two literatures: while patent management is oriented towards a management of assets as 'protective means', the strategic innovation management literature highlights the importance of having non-imitable, differentiated resources for sustaining appropriability mechanism and increasing a firm's performance. Then, we hypothesize that patenting activities associated with innovation activities would mainly aim at developing 'distinctive' knowledge.

From the literature review above, we can summarize the outline of the argument as follow: 1) there is a need in managing inventive activity in order to generate "innovative" patents, 2) these "innovative" patents should be designed as 'distinctive' technical knowledge, 3) the development of this knowledge will depend on a specific management of "prior art" that will allow a firm to increase its inventive capacity.
Hence, our research question is: **How to characterize the specific features of a patent management adapted to the management of invention ? And more precisely, what type of knowledge management associated with patenting activities could contribute to the inventive capacity of a firm ?**

METHODOLOGY: AN EXPLORATORY CASE STUDY OF AN IP LAW FIRM TO UNCOVER 'DISTINCTIVE CAPACITY'

The aim of this paper is to explore how patenting activities could contribute to increase a firm's inventive capacity. Since this approach is quite unusual, we conducted our qualitative research in an exploratory way in order to identify which practices appear relevant to this question. Our main assumption is that the production and identification of 'distinctive knowledge' is a critical component in having an impactful management of invention. Therefore, we needed to identify potential actors recognized as having an important impact on inventive activity of a firm and its performance, relatively to other actors implied in the management of invention. We studied the practices of IP advisors in their interaction with firms. Since one of the main activities of IP advisors is patent drafting, they have expertise in positioning a patent's claims against a given prior art. This specific competence appears to be particularly adapted in helping firm to position their technological asset within the 'prior art'. They do not only formalize the invention, they have to carefully build the claims in regards to prior art to ensure that the patents respects patentability criteria and avoid infringements.
Therefore, we have conducted our research based on two different type of interviews:

1) the first type of interviews serves as "reference": we interviewed three IP advisors from three different IP Law firm (we will call them 'A', 'B', and 'C'). These three IP Law Firm are among very well-known French IP Law Firm (ranked in the top 9 IP Law Firm according to "The Legal 500 Paris").
2) then, we conducted a case study upon a specific IP advisor, co-founder of a fourth IP Law Firm (that we will call 'X') recognized by several actors – patent examiners, patent consultants, patent lawyer, and inventors - as particularly active and successful in helping firm to structure their patent portfolio and their innovation strategies. In particular, we conducted three interviews with the co-founder and participated in a workshop organized by him.

This structure of the research allows comparing the practices between (A, B, C) and X. The comparison of IP advisor 'X' with the other IP advisors allows us to identify "surprising" practices that are not common in the profession and we highlight their contribution to build the inventive capacity of a firm. We would like to highlight that this research does not aim at describing extensively IP advisor's practices since it would require a broader data collection: our aim is to emphasize 'unusual' practices that are not described by the literature but help to better understand how IP activities can be related to inventive activity.
We will present the practices of IP advisors A, B, C and X along these three main activities.

RESULTS - IDENTIFICATION AND DESCRIPTION OF 'UNUSUAL PRACTICES' OF PATENT MANAGEMENT

During our research, it appears that several 'practices' of IP advisor X are unusual and differ from the practices of other IP advisors. Therefore, we will focus the presentation of our findings on these surprising activities to further analyze their impact in developing a firm's inventive capacity.

1. Identifying the 'unusual' practices of IP advisor X compared to IP advisors (A, B, C).

We have identified four 'unusual' practices of IP advisor X: "the state-of-the-art review" performed with the inventors, the 'patent tasting' meetings, the structuration of patent portfolio based on 'technological nodes', the support on patent design process. In the following parts, we successively describe each practice based on the interviews.

1.1 The "state-of-the-art review"

The IP advisors all emphasize the importance of patent drafting activities as one of their core activity and core business activities. IP advisors A, B, C describe this general process as follow: 1) the inventors file a descriptive draft of their invention: this document should describe the prior art as known by the inventor and make explicit how his invention makes a technological advance; 2) if the firm has a 'patent committee' (mainly companies with an intellectual property department), this invention is discussed and it is decided – most of the time independently from the IP advisor – if a patent will be filed or not; 3) the description of the invention is sent to the IP advisor for patent drafting; 4) depending on IP practices or the complexity of the invention, the IP advisor interacts with the inventor to design the patent claims. (A, B, C) recognize that these interactions are limited: for example, IP advisor C highlights that most of the time he cannot interact directly with the inventor because IP engineers or the technical director serves as intermediary. One common feature is that IP advisors (A,B,C) do not make specific 'prior art' research and mainly relies on the knowledge of the inventor to draft the patent. According to IP advisor 'C', he interacts mainly by phone or email and rarely sees the invention 'for real'.

IP advisor X has developed another process for patent drafting that differs from other's practices that we label *"state-of-the-art review"*: instead of relying on a descriptive document written by the inventor(s), he organizes face-to-face meetings with the technical director and the inventors implied in the inventive activity. Based on their description, he identifies keywords and directly makes a 'live' prior art research: he displays on a screen the results of the keywords in Google Patents and if necessary extends the research by using a specialized tool. Based on the abstract and the drawings of the different patents identified, IP advisor X helps the inventors to formulate the technical advance of their invention. Each 'close' patent is recorded in a document for further analysis. If it appears that the 'prior art' related with the first formulation appears to be saturated (a lot of very similar patents already exist), the IP advisor X then asks further question about related technologies, other specific properties of the solution or the environment of the technology. Based on this novel description, he identifies a new potential invention, and reiterates the previous steps until the technological area identified in the prior art allows to clearly distinguish the invention. During this process, the actors from the firm are exposed to the basics of patent rules (patentability criteria and rules) explained by the IP advisor, and they are involved in the patent search process which triggers different learnings: 1) they identify their technological competitors, 2) they have an overview of 'similar technologies' which offers them the opportunity to

identify potential substitute, 3) they see how a *simple* 'prior art' search - based mainly on keywords in Google Patent - can be done, 4) they are forced to formulate and make explicit what makes their invention distinctive from the prior art.

1.2 'Patent tasting' meetings

IP advisor 'X' participated in creating a new type of practice with one of his customers, allowing a firm's actors to keep updated with novel patents related to its activity. Two to three patents are identified and selected by the technical director or the IP manager of the firms based on two criteria: either it is a patent filed by a competitor on a similar technology, or it is a patent that opens interesting technological paths not explored by the firm. These patents are regularly presented to different actors from different departments of the firm - marketing, finance, legal, engineering and production - during a meeting. According to IP advisor 'X', it allows the different actors to get involved in patent-related issues and 'react' to this patent based on their experience. While the marketing team could identify potential competitors', products associated with the patents, the engineers could compare the technology to their current technological choice in their products. Therefore, this meeting aims at allowing the different actors to discuss the potential of the patents for their own research strategy: identification of business opportunity, or legal threat, or path for product or process development etc. According to the IP advisor, the appropriation of the patents by the different actors often leads to the decision of allocating resources in exploring technical opportunities related to the patents presented.

1.3 Structuring of patent portfolio based on technological nodes

Regarding the structuring of patent portfolio, IP advisor A and C emphasize that this activity will depend on the type of firms they have to deal with. In case of large enterprise, they have few impacts on the structuration of the patent portfolio: this process is made independently of them in internal IP department. For small and medium size businesses, they punctually intervene to identify potential inventions: based on the description made by the inventors or the technical director during a meeting, they help the firm to 'extract' potential patentable inventions in order to file one or several patents that will constitute the patent portfolio.

Regarding SMEs and start-ups, IP advisor 'X' presented one methodological approach used with one of his clients: he describes the design of a patent portfolio based on the scoring of technological nodes. First, during the discussion with the engineering department, he identified 'technological nodes' which are the major technological challenges related to the product developed. Once these challenges are identified, they are qualitatively scored based on several dimensions: 1) is it a 'technological area' that offers an important competitive advantage (there are few chances that the patents will be threatened by competitors); 2) is this 'technological area' creating an important entry barrier ?; 3) what is the degree of maturity of this technological area ?. Based on this type of scoring constructed accordingly with strategic issues, the patent portfolio is designed accordingly with the technological nodes "score": a highly scored node should be associated with several patents while a low scored node will be associated with one patent only. This work is based on two sources of knowledge: the knowledge of the different actors of the firm (director, marketing, engineers, etc.) and the knowledge from the patent base which indicate the 'density' of patents over a technological area. Once this work is done, the IP advisor 'X' discusses with the engineering team to identify their technological choices and how they succeed to resolve technical challenges in order to build a patent portfolio accordingly with the patent strategies

decided through the scoring of technological nodes. Several clients of IP advisor 'X' have further used this 'scoring' to allocate R&D resources accordingly.

1.4 Support on patent design process

One specific activity to IP advisor 'X' is also the use of patent design methods in order to help companies in building their patent portfolio. It is the only IP advisor among the professionals interviewed who participated and coordinated this type of workshop. Using various methodologies, including "l'arbre des moyens" (the tree of means) which has been conceived by an IP consultant (de Kermadec, 2016) or TRIZ, he organizes workshops accordingly with a firm's innovation strategy. For instance, he describes a situation in which a firm had to design an integrated valve for the automotive industry. In order to avoid infringements with the patent portfolio of one of their customers, they had to carefully design their technology. First, they selected all the patents related with a "valve" in their competitor's patent portfolio and they sorted the patent with different indicators: 1) type of technology, 2) qualification by the type of owner (university, competitors, other firms), 3) qualification in terms of area of protection (countries), 4) legal value of the patents based on IP expertise. When a type of technology was too threatening in terms of freedom to operate or litigation with direct competitors, the technological choice was removed. Therefore, based on patent search (approximatively 500 patents were analyzed in this particular case), some technological possibilities were chosen for further research and patent filing. This three-day workshop was conducted in presence of the technical director, the business unit director and 4 to 5 engineers from the company.

2. Summary of the comparison between the IP practices in terms of patenting activities: characterizing patent management activities contributing to the inventive capacity of a firm.

Based on our literature review, the patent management practices could be divided in three main activities (see above): 1) patent drafting activities, 2) Optimization of the legal value of patents and 3) management of patent portfolio. The table 1 below presents our findings along these three topics. The case study that we conducted about the IP advisor 'X' shows how his practices are uncommon in the profession. Two aspects must be underlined concerning these practices: first, his practices are supported by a wide variety of methodological tools ("state-of-the-art review", "patent tasting", "structuring of patent portfolio" etc.) each adapted to a specific facet of patent management activities ; second, these methods are used 'upstream', sometimes before the invention process, which permits the firm to include patent strategies in their R&D activities. This approach reverses the classic idea that patent-related activities should occur after the invention. Instead of this linear approach, IP advisor 'X' has created a series of practices which structure and encourage the inventive activity. One specificity of these practices is that patents are not managed as 'static asset', there is a continuous control of the prior art thanks to technological monitoring practices ; however, this knowledge is not seen as a knowledge to be acquired, but rather as an opportunity to push forward the firm's inventive activity in order to produce 'distinctive knowledge' which will support the innovation strategy. As a result, several dimensions of patent management (such as minimizing legal risks, or ensuring a strong protection) that are key to the innovation process and achieving competitive advantage are directly related to R&D and engineering department.

Type of activities	Practices of IP advisor 'A', 'B' and 'C'	Practices of IP advisor 'X'
Patent drafting activities	• Patent drafting based on a written description of the invention • Punctual interactions with the inventor during the writing process to identify the inventive activity performed • In general, no 'prior art' search performed	• Patent drafting based on a "state-of-the-art review" process until the patent is clearly distinguished from the 'prior art' • Extended face-to-face interactions with the inventors with 'live' prior art search
Optimization of the legal value of patents	• Focus on patent filing process in order to ensure the patent grant (choice of countries, or type of patents – patent of improvement, patent of application or 'dominant' patent) • Focus on risks associated with procedures	• Implementation of 'patent tasting' as a specific technological monitoring of competitors' patents • Use of patent design methods related to legal risks compared to 'prior art' to design 'distinct' technologies on available technological area
Management of patent portfolio	• Help in identification of patentable invention in the technological asset of a firm (for SMEs) • Management of the IP administration (IP annuities and renewals)	• Implication in the structuration of patent portfolio based on the scoring of technological nodes related to prior art (for SMEs and start-ups) • Identification or design of patentable inventions accordingly with the patent strategy

Table 1. Summary of the comparison between IP practices based on the three main patent management activities

In particular, it appears from the analysis of these results that these methods share three common features that help us to characterize this specific management of invention based on patent-related activities:

1) these methods rely on a close analysis and structuring of the prior art based on technological and legal assessment,

2) these methods are associated with a common strategy: it forces the firms to distinguish themselves from the prior art,

3) these methods are used to identify or trigger the inventive activity in the firm for the purpose of producing 'distinct' technology compared to the prior art.

As a result, these three properties of a management of invention are about structuring the relationship between the technical knowledge and the relevant prior art associated with this knowledge. From this perspective, the invention process is closely managed by controlling the distinctiveness of the knowledge produced: within the patent realm, this distinctiveness is achieved by assessing the legal value of the patents which include respecting patentability criteria but also freedom-to-operate and monitoring the density of patents over a given technological area. Consequently, while legal aspects of patents

are often seen as a hindrance to innovation strategy (Shapiro, 2000), this research suggests that, using appropriate methods, they can be used as rules for a better assessment of his competitive environment which is a core resource to achieve innovation strategy.

DISCUSSION: INTRODUCING 'DISTINCTIVE CAPACITY' AS A NEW FORM OF KNOWLEDGE MANAGEMENT ORIENTED TOWARDS INVENTION.

1. Definition of the 'distinctive capacity' and comparison to knowledge management perspective on building 'distinctive' resources.

We have shown how 'unusual' patent management practices can be associated with inventive activity thanks to a specific case study. To the best of our knowledge, this type of practices is not described in the literature: if the importance of patent information and the strategic design of patent portfolio is often emphasized (Somaya, 2012; Somaya et al., 2007), the 'micro-practices' and the specific coupling of patent expertise, prior art search and design methods identified contribute to renew the perspective on the management of invention in relation to innovation strategy.

From a knowledge management perspective, inventive capacity is often analyzed as a trade-off between 'internal' vs 'external' knowledge. For example, the "replication dilemma" of Kogut and Zander (Kogut and Zander, 1992) states that the codification of a firm's internal knowledge facilitates the diffusion of a technology and thus participates in a firm's growth ; however, it also encourages imitation from competitors. Therefore, they suggest that innovation should be mainly fueled by recombination of existing internal knowledge (see also (Fleming, 2001)). On the other hand, the seminal work on absorptive capacity emphasizes the importance of assimilating valuable 'external knowledge' to sustain innovation (Cohen and Levinthal, 1990) which has led to study complementary assets and open innovation process (Holgersson et al., 2018; Martín-de Castro, 2015). The previous findings highlight that, in the perspective of patent management, 'internal' and 'external' knowledge should be simultaneously managed: managing the inventive capacity of a firm in regards to innovation strategy force the R&D and engineering department to be continuously informed of the existing prior art compared to their technological choice, and their inventive activity should be driven by creating distinctive technology compared to the prior art. One specific feature of this management of invention is that the definition of the 'prior art' is not independent of the inventive activity performed: every modification in the design process (for instance, substitution of a component) involves a redefinition of the prior art. At the same time, the structure of the prior art – the existing relationship between different inventions and the density over a given area – obliges the inventors to follow different invention path.

We claim that this specific ability to manage the relationship between the 'internal' and 'external' knowledge and their interdependency in creating invention is a core capability in managing the invention process accordingly with innovation strategy. We label this capability the *'distinctive capacity'*.

This management of the relationship between internal and external knowledge in achieving competitive advantage is obviously closely related to the 'dynamic capabilities' introduced by Teece et al. (Teece et al., 1997). In the case of rapid technological change, they have introduced this concept to integrate a dynamic resource based-view in which a firm is able to "integrate, build and reconfigure internal and external competences". However, this concept is mostly based on the idea that the

'distinctive resource' of a firm is embedded in its processes (routines and organizational skills for instance), and is conditioned by its positions and available paths. The 'dynamic capabilities' are then mainly associated with coordination and integration mechanisms, learning processes (assimilation of external knowledge), and reconfiguration processes (change of a firm's asset structure or practices accordingly with markets and technologies). However, these processes cannot explain how 'technical distinctiveness' is achieved because it does not consider the ability to simultaneously identify, manage and challenge a knowledge referential but rather focuses on the different form of knowledge process independently of the requirement to increase the inventive capacity. The recent extension of the framework has not tackled this issue (Teece et al., 2016). Therefore, we argue that the 'distinctive capacity' offers a complementary and valuable framework to analyze the practices related to a strategic management of invention.

Based on the discussion above, the 'distinctive capacity' is then built upon a specific management of the state-of-the-art: while it is often associated with technological watch, the findings suggest that this state-of-the-art should be specifically structured and organized in order to be 'actionable' for the inventors. In the methods presented above, this structure is mainly defined by legal rules (patentability criteria), but also business rules (avoiding technological overlap with customer for instance).

2. An interpretation of the inventive step criteria as an evaluation of 'distinctive capacity'

Since the legal dimension of a patent appears as a structural component of the state-of-the-art in the management of invention, we would like to relate the 'distinctive capacity' to recent works on the relationship between the 'inventive step' criterion and specific knowledge structure.

A patent should respect various patentability criteria. In particular, the patent must be novel and nonobvious to the person skilled in the art (PSA). More than being "new" (different from any other technical solution), the patented invention should be impossible to achieve for the PSA: the invention should not be deductible from the knowledge of the PSA (Kokshagina et al., 2017; Valibhay et al., 2018). In a formal way, it appears that the knowledge of the PSA can be modeled as a specific knowledge structure. As an example, the contemporary patent law tends to structure the prior art in a combinatorial way: as a result, each invention will be described as a combination of technical components achieving particular technical effects. It is assumed in this knowledge structure that the PSA is able to recombine technical bricks that have already been combined, even though it is for a different application or in a different system. As a result, the inventor must distinguish his solution by achieving "combinatorial originality": he needs to perform unexpected combination of distant knowledge bricks to achieve synergistic effect (in order to avoid being considered as a "juxtaposition" of individual components) (see Guidelines for Examination in the European Patent Office).

From this perspective, it appears that the inventive step requires two main capabilities: 1) the ability to have a structured representation of the prior art, 2) the ability to know the rules that will make a solution 'distinct' or independent from this knowledge structure. This ability to 'distinguish' independency pattern in a given knowledge structure has been recognized as a key competency for the generation of innovative concepts (Le Masson et al., 2017)).

Therefore, we see that the inventive step criteria could be interpreted as an evaluation of firm's 'distinctive capacity'. It covers both the ability of a firm to position its

technology against a given prior art, and the ability to create independence to make his invention 'distinct' from the prior art. One key aspect of these two capabilities is that they are co-determined: if the knowledge structure determines in which manner an inventive (and therefore distinctive) solution can be produced, the rules defining the dependence or independence between inventions will in return structure the knowledge base. This specific feature explains why the inventive activity and the definition of the prior art are necessarily interdependent.

CONCLUSION

This paper studies how patent management activities can contribute to increase a firm's inventive capacity. By identifying 'unusual' patent management practices of a French IP advisor, this study reveals that patent-related activities can be used as a strategic management of inventive activity. Two findings can be underlined: first, we have identified four patent methods that are mainly oriented towards increasing a firm's inventive capacity (defined as the production of 'distinct' knowledge) ; second, we have shown that these practices share common features: 1) they rely on a structuring of the prior art, 2) they are based on a strategy of achieving technological distinctiveness, and 3) they help to identify or trigger inventive activities within the firm. Therefore, this research contributes to identify and characterize methods for the management of invention based on patents. We believe that this empirical work contributes to bridge the gap between innovation management and patent management (Candelin-Palmqvist et al., 2012), and it offers new opportunities in studying the role of IP actors in the innovation ecosystems and highlights specific skills of these actors related to patent legal, commercial and transactional rules.

In order to interpret how the methods identified participate in building a strategic management of invention, we introduced the concept of 'distinctive capacity' which designates the double ability of a firm to proactively manage and balance both the generation of technological choices and the associated knowledge referential (the prior art). The introduction of 'distinctive capacity' helps us to better characterize the necessary relationship between 'internal' and 'external' knowledge by highlighting the role of a specific knowledge management: the management of the prior art in regards to inventive activities. Rather than an accumulation of knowledge on different domains, it appears that each invention relates to a specific structure of the state-of-the-art (or prior art) while each state-of-the-art reveal technological opportunities. This framework has one major managerial implication: the management of invention should necessarily integrate a management of the 'prior art' which will allow a firm to structure this latter based on strategically chosen rules (legal, commercial or transactional).

Since this paper has been conducted in an exploratory way on a limited set of data, we have not been able to measure how the patent methods identified have impacted innovation performance of the firms. More generally speaking, a more detailed analysis of IP advisors' practices would be necessary to better understand how their expertise can help in building a firm's distinctive capacity. Furthermore, a more systematic review of knowledge management processes related to technological innovation could help us to validate the 'distinctive capacity' as an important capability in structuring the invention process. Some empirical studies have already demonstrated that patent law experts and researchers contribute equally to R&D performance of a firm (Somaya et al., 2007).

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