Managing participation in partnerships based on patents sharing

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Résumé :

In this research, we investigate how firms manage their participation in patent pools, which are private interorganizational arrangements for sharing patents on a large scale. Drawing on the licensing and open innovation literature, we elaborate a conceptual framework to analyze the organizational capacities that enable firms to manage their participation in patent pools. We illustrate and enrich this conceptual framework through an in-depth study of Technicolor. Our findings show that the company develops and leverages its patent portfolio to strengthen its positions both as a licensee and licensor *vis-à-vis* the pools' members through three distinct capacities: absorptive, desorptive and patent generation. We also reveal how the company assesses opportunities to join patent pools. The organizational perspective articulated in this paper enhances understandings of patent pools and expands the literature on licensing and open innovation.

Mots-clés : patent pools, management, organizational capacities, patenting, licensing, open innovation.

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INTRODUCTION

Firms increasingly use patents to develop and sustain competitive advantages in a knowledge-based economy. Early research rooted in economics and law showed the relative inefficiency of patents as an appropriation mechanism (Cohen et al., 2002; Levin et al., 1987). Management research has revealed that patents are valuable, not only as resources for achieving strategic goals beyond simple protection, but also as sources of organizational capacities that affect firm performance (Blind et al., 2006; Greenberg, 2013; Hsu & Ziedonis, 2013; Pitkethly, 2001; Reitzig & Puranam, 2009; Reitzig & Wagner, 2010; Somaya et al., 2007; Teece & Grindley, 1997). Management scholars have highlighted that many firms evolve in multi-invention contexts characterized by technologically complex standards and products with multiple components that have been individually patented by independent actors (Granstrand & Holgersson, 2013; Teece et al., 2011). Developing complex innovative products thus requires managing the tension between technology integration and patent fragmentation while avoiding the risk of patent infringement (Di Minin & Faems, 2013; Somaya, 2012). Managing this tension involves collaborative arrangements among patent holders of all elements involved in standards and products (Lerner & Tirole, 2004; Shapiro, 2001; Vakili, 2016).

Firms increasingly use patent pools as collaborative arrangements to address patent fragmentation challenges. A patent pool is an agreement between two or more patent holders to cross-license their patents in a specific field and to license all pooled patents to third parties. Patent pools are “one-stop shops” that facilitate large-scale licensing and promotion of a technological standard (Joshi & Nerkar, 2011; Rayna & Striukova, 2010; Vakili, 2016). Competition authorities approve modern patent pools to promote both competition and innovation (U.S. Department of Justice & Federal Trade Commission, 2007); they have spread to many sectors, thereby establishing economic significance[1] (Lerner et al., 2007; Uijl et al., 2013; WIPO, 2011). Empirical evidence shows that the formation of patent pools reduces both technological and appropriation uncertainties for firms and increases the rate of follow-on innovations based on pooled patents (Vakili, 2016).

Due to the economic significance and widespread diffusion of patent pools, economics and management scholars have investigated the antecedents and consequences of their formation (Baron & Delcamp, 2015; Baron & Pohlman, 2011; Bekkers et al., 2011, 2012; Dequiedt & Versaevel, 2013; Layne-Farrar & Lerner, 2011; Lerner & Tirole, 2004, 2007; Lerner et al., 2007; Lévêque & Ménière, 2011; Joshi & Nerkar, 2011; Uijl et al., 2013; Vakili, 2016). To date, few scholars have thoroughly examined how firms manage their participation in patent

[1] In the mid-2000s, the income generated in the United States from sales of products incorporating technologies related to patent pools exceeded USD 100 billion per year (Clarkson & Dekorte, 2006).

pools. To the best of our knowledge, Uijl et al. (2013) were the first to investigate the management of patent pools when technologies become increasingly complex. However, their unit of analysis was the pool, not participating firms, meaning that their findings do not indicate how firms manage their participation. Such participation can be challenging, since firms share their proprietary resources with actual and potential competitors and must balance the tradeoff between value creation and value capture (Vakili, 2016). It is therefore important to understand which capacities firms need to successfully manage their participation in patent pools. Thus, we ask: Which capacities do firms deploy to manage participation in patent pools, and how do these capacities interact? Addressing this issue can expand existing literature on patent pools and help both scholars and managers better understand patent management in situations of ownership fragmentation and technological complexity (Di Minin & Faems, 2013; Somaya, 2012; Teece et al., 2011).

First, we develop a conceptual framework of the capacities involved in managing patent pool participation by building on a related, but disconnected research stream related to licensing and open innovation. Second, we enrich this framework with findings from qualitative fieldwork at Technicolor, a worldwide technology leader in the media and entertainment industries. Since the company has participated in several patent pools (e.g., MPEG2, Premier BD, MVC) since 2002, it provides an appropriate context for a case study aimed at refining the conceptual framework. Using a qualitative design to analyze firms' participation in patent pools is consistent with recent calls in the literature encouraging the use of case study research to understand the mechanisms and processes by which firms develop and deploy patent management capacities (Plamqvist et al., 2012; Somaya, 2012).

Our conceptual framework highlights three organizational capacities: absorptive, desorptive and patent generation. It also reveals how these capacities are deployed and interact to manage different aspects of participation in patent pools (e.g., by developing and defending the firm's patent portfolio and supporting its interests as both a licensee and licensor). We contribute to the literature on patent pools by: (a) providing a detailed understanding of factors affecting firms' decisions to join pools by identifying another parameter (i.e., pool administrators); and (b) revealing the organizational dynamics explaining when and how firms integrate more patents into pools. We also expand the literature on licensing and open innovation by showing how licensing-out and licensing-in capacities interact and mutually reinforce each other.

1. LITERATURE REVIEW

Patent pools are private collaborative arrangements through which firms share their patents and collectively license them to third parties (Lerner & Tirole, 2004; Lerner et al., 2007). They represent multilateral licensing agreements involving multiple firms (patents holders and other licensees) and are explicitly approved by regulators to avoid the tragedy of the anticommons, accelerate the adoption of technological standards, and facilitate interactions between licensors and licensees (Uijl et al., 2013).

Patent pools foster the development of nascent technological standards and subsequent innovation by promoting access to essential patents under fair, reasonable and non-discriminant (FRAND) conditions (Vakili, 2016). Patents for inventions that comprise technological standards and are important to developing standards-compliant products are considered "standard-essential" (Baron & Delcamp, 2015; Bekkers et al., 2012; Lerner & Tirole, 2007; Shapiro, 2001). A patent is standard-essential when there are no technological alternatives to the invention it protects, meaning that it is not possible to develop standards-compliant products without patent infringement. Hence, patent pools offer advantages by providing both licensors and licensees collective access to essential patents, thereby reducing transaction costs, improving rent collection, reducing holdup hazards, etc.

Economics and management scholars have analyzed the antecedents and consequences of patent pool formation. The *ex-ante* perspective addresses the optimal design of patent pools (Brenner, 2009; Lerner & Tirole, 2004, 2007), the role of regulators (Gilbert, 2004, 2010a, 2010b), the timing of patent pool formation (Lévêque and Ménière, 2011), effects of patent pool formation on firms' behaviors and their incentives to engage in R&D (Baron & Pohlman, 2011; Dequiedt & Versaevel, 2013), and determinants of the decision to (not) join patent pools (Layne-Farrar & Lerner, 2011). The *ex-post* perspective sheds light on how patent pools affect innovation, patent integration strategies and industry structures, and consequences of increasing technological complexity on patent pools (Baron & Delcamp, 2015; Joshi & Nerkar, 2011; Uijl et *al*., 2013; Vakili, 2016; Wen et al., 2013).

In these previous works, however, scholars remained silent about how firms manage their participation in patent pools. Although Uijl et al. (2013) analyzed the evolution of patent pools and proposed a model to describe the main phases of the patent pool life cycle as well as the various activities that must be managed in each phase to ensure the pool's success, their unit of analysis was the pool, not the participating firms. Their model does not explain how firms manage their participation in patent pools. This is striking, given the widespread diffusion of patent pools (WIPO, 2011); moreover, many companies participate in multiple patent pools. Patent pool participation is challenging; firms must share proprietary resources with rivals (both actual and potential) and balance the trade-off between value creation and value capture (Vakili, 2016). We believe that the management of patent pool participation merits deeper analysis at the firm level to obtain a more complete understanding of these inter-organizational arrangements.

2. CONCEPTUAL FRAMEWORK

Although they address similar issues, the literatures on patent pools and licensing and open innovation are disconnected. Patent pools inherently reflect situations in which firms are engaged simultaneously in two processes: licensing-in (acquisition) and licensing-out (sales). In licensing and open innovation contexts, scholars have attempted to explain when and how firms participate in technology markets (Bogers et al., 2012; Chesbrough, 2006; Conti et al., 2013; Giarratana & Fosfuri, 2010; West et al., 2014). Interestingly, findings outline the

capacity to manage licensing activities as one of the most important determinants in the decision to engage in technology markets (Ceccagnoli & Jang, 2013; Gambardella & Giarratana, 2013). Specifically, firms must bundle and coordinate disparate resources and skills to develop these capacities in order to improve their performance and obtain competitive advantages (Bianchi et al., 2014; Pitkethly, 2001; Somaya, 2012). Two distinct concepts are used to analyze the management of licensing activities: absorptive capacity (ACAP) for licensing-in and desorptive capacity (DECAP) for licensing-out.

Cohen and Levinthal (1989, pp. 569–570) initially defined ACAP as a "firm's ability to identify, assimilate and exploit knowledge from the environment." Other scholars clarified its components or constitutive dimensions (Lane et al., 2006; Todorova & Durisin, 2007; Van Den Bosch et al., 1999; Zahra & Georges, 2002). This proliferation of definitions reflects the great attention devoted to the concept as well as its reification[2]. For this reason, scholars recommend analyzing the constitutive dimensions of ACAP separately depending on the research purpose (Lane et al., 2006; Volberda et al., 2010)[3].

Consistent with previous works, we use two dimensions of ACAP, identification and acquisition, to investigate the licensing-in side of patent pools. Researchers who study technology markets analyze licensing-in based on the monitoring and acquisition components (Ceccagnoli & Jang, 2013; Laursen et al., 2010), while those who study open innovation use the identification and acquisition components (Lichtenthaler, 2011; Lichtenthaler & Lichtenthaler, 2009, 2010; West & Bogers, 2014; Ziegler et al., 2013). We use the identification and acquisition components because: (a) the ability to manage licensing-in implies not only what and who (i.e., identification), but also how (i.e., acquisition) (Nicholls-Nixon & Woo, 2003); and (b) exploitation components (e.g., transformation, application) do not need to be considered when analyzing licensing-in or technology transfer for exploration purposes (Lichtenthaler & Lichtenthaler, 2010). In patent pool context, we use these components of ACAP to investigate how firms gather information about relevant technologies and acquire the rights to use them.

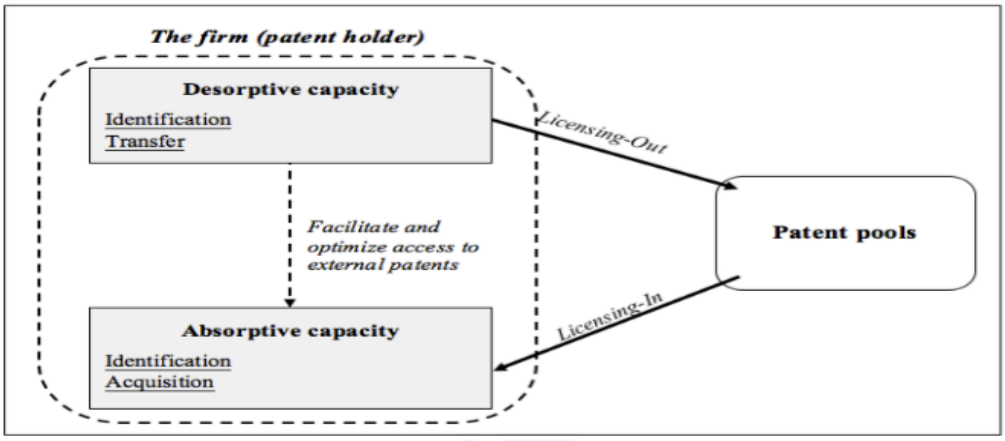
DECAP describes "a firm's ability to externally exploit knowledge" (Lichtenthaler & Lichtenthaler, 2009, p. 1321) in order "to appropriate returns from innovation" (Ziegler et al., 2013, p. 5). Similarly, Ceccagnoli and Jiang (2013, p. 407) defined a firm's licensing-out capacity as "the ability to identify and communicate the value of its technology and to transfer the necessary know-how to potential buyers." Thus, both DECAP and licensing-out capacity reflect a firm's ability to identify external opportunities to leverage internal knowledge by transferring it to other firms (Bianchi et al., 2014; Lichtenthaler, 2011; Lichtenthaler & Lichtenthaler, 2009, 2010; Ziegler et al., 2013). Licensing-out requires firms to determine the

[2] This reification was highlighted by Lane et al. (2006, pp. 833–834), who found that "the construct becomes taken for granted and researchers fail to make explicit the assumptions that underlie their use of it."
[3] For Lane et al. (2006, p. 857), "explicitly separating them is necessary, because each of these dimensions requires different processes within the organization. Explicitly separating the dimensions forces researchers to recognize the different nature of the processes underlying these constructs, as well as the interrelationships among them."

value of patents from a cost-benefit perspective, contract with partner firms, and implement agreements that enable partners to use patented knowledge (Ziegler et al., 2013). We thus use the identification and transfer components of DECAP to analyze a firm's ability to manage the licensing-out side of patent pools.

Furthermore, patent pools involve managing situations in which licensing-in and licensing-out occur simultaneously. Managing such situations requires deploying ACAP and DECAP simultaneously (Lichtenthaler & Lichtenthaler, 2009, 2010), which can challenging because each capacity has a specific purpose that requires using dedicated processes and skills (Helfat & Winter, 2011; Winter, 2003). In cross-licensing arrangements such as patent pools, firms deal with conflicting priorities: a desire to share proprietary technologies, and simultaneously gain access to proprietary technologies owned by exchange partners, including competitors. Hence, ACAP and DECAP must be deployed carefully to exploit the full potential benefits offered by patent pools and to avoid disadvantageous situations in which partners benefit more from the partnership. In the literature on licensing and open innovation, scholars suggest that the two capacities are deployed in unidirectional scheme in which DECAP is used to support ACAP, meaning that licensing-out is used to gain access to external patents (Grindley & Teece, 1997; Lichtenthaler & Lichtenthaler, 2009, 2010). Figure 1 summarizes the two capacities of the conceptual framework inspired by the licensing and open innovation literature.

Figure 1: Conceptual framework of how firms manage their participation in patent pools.



3. RESEARCH METHOD AND EMPIRICAL SETTING

To further investigate which capacities firms use to manage their participation in patent pools, we performed a single in-depth qualitative case study with the objective of enriching and illustrating our conceptual framework "to get closer to theoretical constructs (and) to unravel the underlying dynamics of phenomena that play out over time" (Siggelkow, 2007, p. 22). Indeed, "the vividness, concreteness, and richness of (qualitative data) allow an abstract idea or model to be brought to life, making it more persuasive and credible" (Graebner et al., 2012, p. 278). Illustrative cases anchor empirical findings in existing theory and make them less

dependent on a specific research setting (Graebner et al., 2012; Vaara & Monin, 2008).

We studied Technicolor (formerly Thomson Multimedia). With 16,720 employees, Technicolor is a worldwide leader in two activities: (a) developing products related to the connected home (€1,451 million in 2015) (e.g., broadband modems, digital set-top boxes, software); and (b) entertainment services (€1,676 million in 2015) related to video (visual effects, animation and postproduction) and DVD/Blu-ray/CD production. Technicolor also has a technology business unit (€511 million in 2015) focused on basic research and intellectual property and licensing (IP&L) activities.

We chose to study Technicolor for three reasons. First, the company participates in multiple patent pools, generating more than €200 million/year. Second, with its vertically-integrated business model, it represents the type of firm that typically joins patent pools (Layne-Farrar & Lerner, 2011)[4]. Third, Technicolor invested 3.8% of total revenue in R&D activities between 2003 and 2015 and was listed among the top 20 owners of portfolios of declared standard-essential patents[5].

3.1. Data Collection

We collected primary and secondary data to obtain qualitative and quantitative information for our case study. We conducted 11 semi-structured interviews with company managers, yielding over 200 pages of transcripts. A major concern associated with interview data is information bias introduced by impression management and retrospective sense-making (Eisenhardt & Graebner, 2007; Graebner et al., 2012). To address this concern, we interviewed organizational actors from different functional areas as well as outside observers. Interviews typically lasted between 60 and 80 minutes and were conducted with highly knowledgeable informants directly involved in the phenomenon studied. We selected informants using snowball or chain sampling based on recommendations from interviewees. In some cases, the same actor was recommended by several people.

We triangulated the internal informants' narratives by interviewing outsiders and collecting archival data (Eisenhardt & Graebner, 2007; Graebner et al., 2012). The outsider informants were managers of Alpha (a company that participated with Technicolor in some patent pools), and a VP of an investment fund dedicated to international patent licensing[6]. Furthermore, we collected data from public sources such as the company's annual reports and press releases, print articles and radio transcripts published between 2000 and 2017, and websites of the patent pools in which the company participated (MPEG-LA, ARIB Uldage, Premier BD). To collect data about the evolution of patent pools, we used the Internet Archive (accessible at https://archive.org) to extract information from websites between 2002 and 2015. We also

[4] In the case of MPEG2, vertically-integrated companies represent about 90% of the pool's members.
[5] Baron and Pohlmann (2015) identified over 2,000 different companies that declared standard-essential patents to the following standard setting organizations: ETSI, 3GPP7, ISO, IEC, CEN, ITUT, ITUR, IEEE, IETF, OMA, ANSI, SMPTE, ATSC, OASIS, TIA, Broadband Forum, ATIS, Blu-ray Disc Association and DVD Forum.
[6] The names of the company and the investment fund are not mentioned to protect informants' anonymity.

collected quantitative or numeric data from these sites to corroborate qualitative information (Eisenhardt, 1989).

3.2. Data Analysis

We began our analysis by organizing the empirical material around critical events related to how Technicolor managed its participation in patent pools (Langley, 1999). Then, we coded the data using an orienting theoretical frame (Dumez, 2016; Locke, 2001) to ensure that the coding process did not specify outcomes (Aliseda, 2006; Pettigrew, 1997; Siggelkow, 2007). In this sense, we used a blended coding and analytical approach that combined both induction and deduction (Graebner et al., 2012).

We coded the empirical material by using the conceptual framework to identify ACAP (identification and acquisition) and DECAP (identification and transfer) and creating loose categories derived from the general literature on organizational capacity to enable empirical identification and operationalization (Felin et al., 2012; Foss et al., 2012; Lamaanen & Wallin, 2009; Grant & Verona, 2015; Spender et al., 2010; Verona & Ravasi, 2004). We used three categories—actions performed, actors directly involved, and their knowledge and coordination mechanisms—as proxies to identify and analyze the dimensions of our conceptual framework.

Furthermore, we alternated between empirical work and theoretical reviews to capture relevant insights that emerged during the analysis but were not anticipated during our elaboration of the conceptual framework. By doing so, we remained open to surprises and used unanticipated information to refine the initial theory-based conceptual framework (Aliseda, 2006; Eisenhardt, 1989; Graebner et al., 2012; Siggelkow, 2007).

4. FINDINGS

4.1. Patent Management as a Strategic Issue

Technicolor's business model creates and leverages patent-related synergies between two lines of business: operations (i.e., products and services) and licensing. This business model is fueled by research efforts in technologies related to video, audio, content distribution, interoperability, etc., and by researchers' involvement in more than 50 standardization body working groups. Technologies resulting from these efforts are patented with two distinct goals in mind: developing products to compete in various markets, and licensing patents to consumer electronics manufacturers. To fulfill these dual purposes, the company actively manages its patent portfolio using two levers.

The first lever relies on internally developing patents through close collaboration between researchers/inventors and patent engineers. Tight collaboration ensures that inventions are assessed for their patentability and value before patent applications are submitted. Patent engineers also revise inventors' articles prior to publication. The company selects inventions

to be patented based on potential returns on the company's R&D investment.

> *When we invest in R&D, the first mechanism of return on investment is innovation to overtake our competitors and the second is licensing. Our research serves the two: innovation for products and inventions which we could monetize through patent licensing. (VP of Operational Performance)*

> *Concerning the choice of inventions to patent, an important parameter is if there is interest for licensing. (Head of Patent Operations Department)*

Additionally, patent engineers and inventors collaborate early in the research process to define which domains to explore. Indeed, the department of patent operations regularly interacts with research entities to influence their strategies and identify promising research areas for operational and licensing activities:

> *We try to influence at our modest level the decisions of the other units concerning research topics to see if there are uses for consumer electronic markets...because all the company has a strong culture of licensing. (Head of Patent Operations Department)*

> *Regular meetings were held between Research and IP&L to review research programs and influence them from a licensing perspective. We often visited the labs and made presentations about licensing programs to demonstrate the essential importance of licensing income to the company. (Head of intellectual property and licensing)*

Patent applications are a high priority for Technicolor, which internalizes related activities to preserve their value and facilitate subsequent identification for enforcement and licensing. The VP of Operational Performance explained:

> *There is a distinction between the invention and the intrinsic qualities of the patent...As we are in a licensing model, [we file] patents for technologies that will be used in consumer products and which we will be able to detect...We are not so fond of subcontracting because we are very attached to a way of drafting from a detectability perspective...External patent counsels do not necessarily have this focus.*

This first lever (patenting through close collaboration with researchers) is the most important for portfolio development, with internal patents representing more than 85% of the company's portfolio.

The second lever involves acquiring patents from other entities. The goal of patent acquisitions is to strengthen the company's position in certain technological fields, reinforce the company's market position and/or extend licensing revenues in anticipation of patent expirations. However, patent acquisitions are expensive, complex and subject to intense competition with rivals and patent brokers. To facilitate decisions about the value of a patent

acquisition, the company created a less formalized process.

> *The skills of several services are involved. The main problem in acquisitions is the speed of reaction because, when a portfolio is for sale, it is also available to third parties. So, if we had very heavy procedures...the portfolio would slip through our fingers. (IP Assessment Director)*

The process involves three actors: the IP assessment director, who identifies external patents and their owners; the business intelligence manager, who estimates the value added by the identified patents; and a patent engineer, who assesses the risk of challenging the scope or validity of these patents. After this process, the company decides (not) to pursue the acquisition and a licensing manager negotiates with the patent's owner to conclude the transaction.

Together, these two levers (internal development and acquisition) comprise an active approach to patent management that has enabled the company to accumulate a portfolio of approximately 40,000 patents and to sustain its dual business model. Furthermore, this patent portfolio ranks the company among the top 20 owners of portfolios of declared standard-essential patents (Baron & Pohlman, 2015), making it an active participant in patent pools.

4.2. Technicolor and Participation in Patent Pools

We discuss the different steps or events characterizing Technicolor's participation in patent pools, and the actors and actions involved in managing this participation.

The call to join a patent pool

The decision to join a pool is considered when the pool's administrator announces the formation of a pool to promote the licensing and use of a technological standard and invites standard-essential patent holders to participate in preliminary discussions. The IP&L division appoints a licensing manager to attend these meetings and obtain information about the licensing strategy of the pool and how it will be governed, as well as other patent holders' goals. A licensing expert with experience in patent pools elaborated:

> *Some companies participate in the first round of discussion not because they are wanting to join the pool as patent holders, but to try to influence and reduce the royalties applied by the pool.*

The licensing manager thus mobilizes skills in different fields (technical, business, law, cross-cultural negotiation) to understand the strategic interests of the pool administrator and other patent holders, and to defend Technicolor's interests related to royalties and product development. After these meetings, the licensing manager creates a dossier explaining the

administrator's strategy, how the pool will be governed (royalty rate, royalty-sharing rules, profiles and sizes of targeted licensees, etc.), and the profiles and interests of other patent holders. The business intelligence manager uses this information to create forecasts or revenue models reflecting the potential position of the company within the pool as well as its share of royalties. To elaborate these revenue models, the business intelligence manager works with patent engineers who conduct a preliminary analysis of the company's portfolio to identify potential standard-essential patents and delineate their characteristics (number, importance to the standard, filing jurisdiction, etc.).

> *First, we try to understand the conditions of the pool: [What is] the proposed royalty rate? If we join the pool, are we obliged to take a license? Is there a royalty maximum for each company? It is necessary to understand the royalty-sharing rules between patent holders. Do we consider the countries of manufacturing, countries of sale or both? If you are the only one to have Chinese patents, it is very interesting to join the pool when, for example, the country of manufacturing is one of the parameters of royalty-sharing...You say how many patent families do we have? Where they are filed? Are there any in China? And then, it is necessary to examine the other patent holders: Are there many patent holders? Are there many patents? Where have patents been filed? (Business Intelligence Manager)*

The resulting revenue models are submitted to managers in the IP&L division and the top management team.

The decision to join: Evaluating the opportunity

Along with managers from the IP&L division, top managers evaluate the opportunity to join a patent pool by considering stakes and interests for company's business units. For the operations business unit, they consider three goals: (a) promoting a technological standard to influence a favorable business environment for internally-developed products; (b) facilitating market adoption of the standard, thereby securing the development and commercialization of compliant products by others; and (c) joining a pool that aggregates the largest number of essential patents to reduce licensing transaction costs and mitigate the risk of patent enforcement by other contributors to the standard. Table 1 presents the company's positions in pools that promote three important standards and the benefits of joining these pools (i.e., the ability to use the essential patents owned by other industry players). For instance, the MVC standard is used in the products and services developed and commercialized by both business units. By participating in the pool that commercializes this standard, the company acquired a single license for more than 1,100 patents owned by 19 patent holders.

Third, participation in pools is used as tactic to strengthen business relationships with strategic partners. In the case of the Blu-ray standard, for instance, two competing pools were being formed: *One-Blue* by Sony and *Premier BD* by Toshiba. The company joined the second pool to get close to two film studios (Disney and Warner Bros) which are important

clients for the entertainment services business unit. In the same vein, joining a pool extends collaboration with the contributors to the technological standard. The senior VP in charge of IP partnership for Alpha explained:

> *Patent pools allow us to develop relationships with partners, with the companies that hold patents. It is a beneficial model because often these companies have worked with us in standardization groups.*

Table 1. Technicolor's position in three patent pools

	PremierBD (BD Decoders	MPEG2	MVC
Technological area	Blu-Ray/DVD	Video/image compression/decompressio	Digital video coding
Number of patent holders	5	27	19
Number of patents in the pool	1107	1080	1145
Number of licensees	47	1164	41
Number of patents (Technicolor/Thomson)	562 (51%)	196 (18.3%)	30 (3%)
Licensee (Technicolor/Thomson)	Yes	Yes	Yes

Decision makers also consider royalties for the licensing business when assessing potential membership in a patent pool. This involves estimating the opportunity cost of licensing through patent pools vs. direct licensing. Participation in pools seems relatively advantageous because it enables rapid licensing and frees up resources to identify and negotiate with future licensees. The senior VP of Licensing explained:

> *In the pool, revenues arrive much faster because when the pool is created, those who are already part of the pool take licenses...The curve is much more [exponential]...You will have a stronger market coverage because the pool will, after 3 or 4 years, reach up to 90% of market licensees. If you are alone, it will take more time: 2 or 3 years before the first agreement is signed and 5 to 6 years to reach 60% or 70%. Moreover, when you're all alone, you will most probably litigate to enforce your rights.*

However, this relative advantage depends on the pool's administrator and its licensing ability. Indeed, the shortfall or the opportunity cost of licensing through a pool can be higher if the administrator is unable to reach a higher number of licensees for the standard. To reduce this risk, the company considers the administrator's track record and ability to take legal action against firms that are using the standard to convince them to sign the licensing agreement. This parameter was decisive when the company decided to join a patent pool for the first time:

> *MPEGLA had successfully licensed computer manufacturers in the United States following a lawsuit, and this convinced us that the MPEGLA model was relevant. And*

> *so we decided in 2002 to join MPEGLA. (Senior VP of Licensing)*
>
> *The lawsuit against PC manufacturers was a swing in the incomes of members of the MPEG2 video pool. It is a market between 300 and 350 million units. (Business Intelligence Manager).*

Two outsider informants confirmed the importance of this parameter in the decision making process:

> *In the choice, there is also how the agent will handle and manage [the pool] and its vision or policy of litigation as part of the marketing of a pool. (Deputy Legal Director, Alpha).*
>
> *It is a competitive market with several agents. The first question we ask is, "With which agent we are going to work?" Everyone is saying, "Is this agent is able to represent me well or not?" (Licensing expert with experience in patent pools)*

Joining the pool

Once the company decides to participate, the pool's administrator obtains the right to license its patents and the licensing manager joins the executive board of the pool. The board includes the administrator and the other patent holders and represents the locus of competition and tensions based on members' divergent interests. Indeed, patent holders often have different business models (e.g., licensing-based vs. vertically integrated) and conflicting expectations related to participation (e.g., higher royalties for the former vs. lower royalties to promote the standard for the second). Hence, the fact that Technicolor is interested in both royalties and diffusion of the standard places it in a delicate position that requires the licensing manager to actively defend the company's interests in governance activities and board decisions.

In parallel, the patent operations department designates a patent engineer to work permanently on pool-related activities. The first task of the patent engineer is to identify standard-essential patents and submit them for external assessment. Each patent pool works with an independent expert to evaluate the essentiality of patents before they are integrated into the pool. This serves as a legitimation tool to address criticisms regarding operational transparency and the quality of licensed patents. The deputy legal director for Alpha explained:

> *The submission to the expert is important and increasingly critical...the potential licensees complain about the quality of patents, the real essentiality of patents and even the transparency on these issues. Independent experts are responsible for evaluating the essentiality to ensure that the patent is essential to the standard and allow the patent to go into the pool. If the evaluation is negative, the patent cannot be integrated into the pool and the holder cannot join the pool.*

This assessment process generates significant costs for patent holders.

> *It is quite expensive. Whenever you submit a patent, you must pay $10,000. This is the price to pay to the patent assessor for spending time to analyze your invention. (Senior VP of Licensing)*

Identifying essential patents in the company's portfolio and demonstrating their essentiality is highly complex because it implies not only searching a broad portfolio (40,000 patents) but also knowing which technological standards to identify and understanding how specific patents are related to the pool's standard. For this reason, the patent engineers work closely with researchers and inventors who contribute to and participate in standardization body working groups. The aim of these close working relationships is to combine the skills of patent engineers with those of researchers and inventors to identify and assess the essentiality of internal patents.

> *We call technical experts who have a good knowledge of standards. This allows us to clearly identify patents and inventions which possibly apply. We look much more in detail to determine whether or not these patents are essential. (Head of Patent Operations Department).*

> *Patent engineers are close enough to engineers who know the standards...There is a debate between the patent engineer and researchers to identify whether the patent is actually essential or not. (Senior VP Licensing)*

The outcome of this collaborative work is a chart that explains to the independent assessor how the invention claimed in a patent contributes to the pool's standard. Demonstrating and convincing independent assessors of patents' essentiality are crucial activities, since essential patents determine Technicolor's position in the pools and its share of royalties.

> *If Thomson succeeded in MPEG2 video, it is thanks to our patent portfolio, and of course, to our ability to defend this patent portfolio vis-à-vis the independent assessor... we prepare the cases to submit to the assessor to be sure that the independent assessor says "I consider this patent essential to the standard." (Business Intelligence Manager)*

Monitoring participation in patent pools

While participating in patent pools, the company engages in technical and business monitoring to defend and strengthen its position. This is achieved through collaborative work of different departments.

Technical monitoring: Following the evolution of standards and the patent portfolio

The goal of technical monitoring is to strengthen the company's position from a patent perspective. Because bargaining power and royalties are a function of the number of patents a company contributes to the pool, companies try to contribute more patents over time. In the

MPEG2 pool, for instance, the company contributed 117 additional patents from 2002 to 2015 to strengthen its relative position in terms of bargaining power and royalties (from €89 million in 2005 to €301 million in 2015).

Technicolor adopts three strategies to contribute new essential patents to pools. The first is adjusting the scope of existing patent applications by considering the evolution of a standard. In the words of an experienced patent lawyer:

> *The challenge is to manage outstanding patent applications related to standards to be sure that, during the delivery procedures, we consider the standard and possibly its development. We find ourselves in a situation where we have, on the one hand, a patent application which evolves, and on the other hand, a standard which potentially evolves also. Then, the exercise is to ensure that, when we modify the claims, we don't deviate from what this standard says. It is very critical.*

Indeed, technological standards evolve and their specifications change because new functionalities are integrated and/or existing ones are improved. These evolutions lead to new inventions, and in turn, new patent applications, including those from pool members. In the words of Alpha's Deputy Legal Director:

> *Standards are frozen at a point in time, but they continue to evolve over time. You take Wi-Fi, for example; even if the central technology does not evolve, between Wi-Fi A, B or C, you have new features that are added...when the standard evolves and when one continues to submit contributions to the working groups of standardization bodies, yes, at some point if innovations are covered by patents, there is a significant chance that these patents will be essential to the standard.*

To ensure pending patent applications are essential, Technicolor internalizes these evolutions through information exchanges and close coordination among patent engineers, inventors who contribute to technological standards and infringement analysts who have empirical knowledge of these standards.

> *People who are more aware of what is being discussed are the people who participate in working groups on standardization. When we make contributions, are they accepted or not? How is the final standard specification being established? Also, if we file patents related to these contributions and they are not accepted, it should be known...If there is a patent application related to a contribution we made and this contribution will be accepted, the objective is to make sure that, throughout the procedure with the office, the claims do not stray from what was originally said. (VP of Operational Performance)*

> *We are here as technical experts to help patent engineers...Certain standards are extremely dense. So, we intervene to help them to make the connection between patent applications and standards and then accompany them during the delivery procedure.*

(Head of Infringement Analysis Department)

This close coordination is also useful in the second strategy of increasing essential patents through divisional applications. The latter is based on a "parent application" when the claimed invention is essential to a standard and is formed by several features. Hence, these divisional applications allow the company to apply for several essential patents on the basis of an initial patent filed but not yet delivered.

> *A divisional application means: I have a pending application and there is another application which was born from this pending application [because] a patent application covers an invention and an invention may have many aspects. When the invention applies to a standard, we can say, "Well, there are three aspects in the invention and these aspects are all essential to the standard, thus I can make three patent applications instead of only one." Then, each aspect can become an independent patent application. (Head of Patent Operations)*

However:

> *There can be a maximum number of divisional patents which we can submit. Once you have filed a number of divisional patents, they do not allow more because there are people who have engaged in abusive behavior and who have a lot of divisional patents to increase their share. It's abusive, and therefore there can be rules that govern it. (Business Intelligence Manager)*

Therefore, patent engineers pursue divisional applications for essential patents in consultation with actors (i.e., licensing manager, business intelligence manager) who know the pools' rules and the value of a divisional application, if such value exists.

A third strategy is acquiring patents from other patent holders. Technicolor offers some of its internal licensees the opportunity to pay all or a part of the royalties due in the form of patent transfers, thereby increasing its share in the patent pool.

In addition to increasing its quantity of patents, Technicolor tries to increase the quality of its patents by expanding them to additional jurisdictions. A patent's jurisdiction (i.e., the country where it is filed) is an important criterion in dividing royalties among patent holders because the licensing policy of the pool considers both the value and the scope of patents. For instance, some pools assign higher value to patents filed in the jurisdictions of both manufacturing sites (e.g., China) and commercialization markets (e.g., United States, Germany, Japan), compared to patents filed in only one of those jurisdictions. Technicolor considers these rules when making decisions about extending essential patents to other jurisdictions. Internally, patent engineers and the business intelligence manager collaborate to extend to jurisdictions with high value for the pool based on the size of the market for standard- compliant products and/or the presence of manufacturing sites for these products, depending on its licensing policy. Once the patents affected by these actions (divisional

applications, adaptation of patent claims and scope, patent acquisition, jurisdictional extension) are approved by patent offices, patent engineers and researchers evaluate their essentiality before submitting them to the external assessor.

Business monitoring: Participating in the pool's governance and projecting royalties

Business monitoring consists of participating on the pools' executive boards and planning and controlling the revenues received. The licensing manager actively participates on executive boards to track the performance of the pools' administrators, to take part in decision- making processes and to defend the company's interests *vis-à-vis* other pool members and outsiders. As indicated previously, pools are comprised of actors (firms, universities, etc.) with different business models (some are both patent holders and licensees, while others are only patent holders). Divergence, tensions and alliances emerge among patent holders as they seek to influence the licensing policy of the pool, the royalty rate and/or the royalty-sharing rules.

There are great influences depending the holders' size. When you represent 5, 10 or 15% of the patents which will be in the pool, you have a stronger voice than others. The licensing agent is somewhat obliged to pay more attention to a large holder, especially if the latter is required to take a license also, because it is the future income of the pool...There are games of alliance between the small holders to counteract the weight of the biggest. (Deputy Legal Director, Alpha)

The Business Intelligence Manager underlined the importance of monitoring and negotiation to defend the company's interests:

> *We need a very regular monitoring and it is necessary to defend our positions...We are not the only patent holders. There are people who will say we can decrease the royalty's rate. But if the rate is lowered, we realize that it is not favorable to Thomson Licensing. So, it is necessary to have the capacity to negotiate and to defend our licensing positions.*

Board members also shape the pool's licensing strategy by defining how to approach certain licensees, and pursuing litigation against licensees who do not pay and/or companies that refuse to take licenses. For Technicolor, such litigation can be a competitive maneuver against firms and rivals that use the pool's patents without paying royalties. This situation presents a double disadvantage for patent holders like Technicolor: as a licensee, the company pays to ensure the widespread development and commercialization of its products, meaning costs increase; as a licensor, the company competes with companies that violate its patents and erode its technological advantage.

The third aim of board participation is to track the performance of the pool's administrators and to collect information about its evolution (i.e., royalties, licensees, lawsuits, etc.). This information is diffused and shared with the business intelligence manager to project the company's share of royalties. The business intelligence manager elaborates revenue

projections by considering the evolution of the pool in terms of the markets using the standard and dynamics of patent ownership (i.e., new patents and/or patent expirations) among the different patent holders.

> *It is necessary to follow the pool; if you rest on your laurels, you are going to have unpleasant surprises...You can anticipate the evolution of your share...Today, I have 10%; next year, I'll have 20% because the portfolio of such patent holder will strongly reduce because patents expire. The following year, in my portfolio, some patents will expire, so my share will decrease. (Business Intelligence Manager).*

> *When you are in a patent pool, you need a team to monitor the pool's activity because it's time consuming. (Senior VP Licensing).*

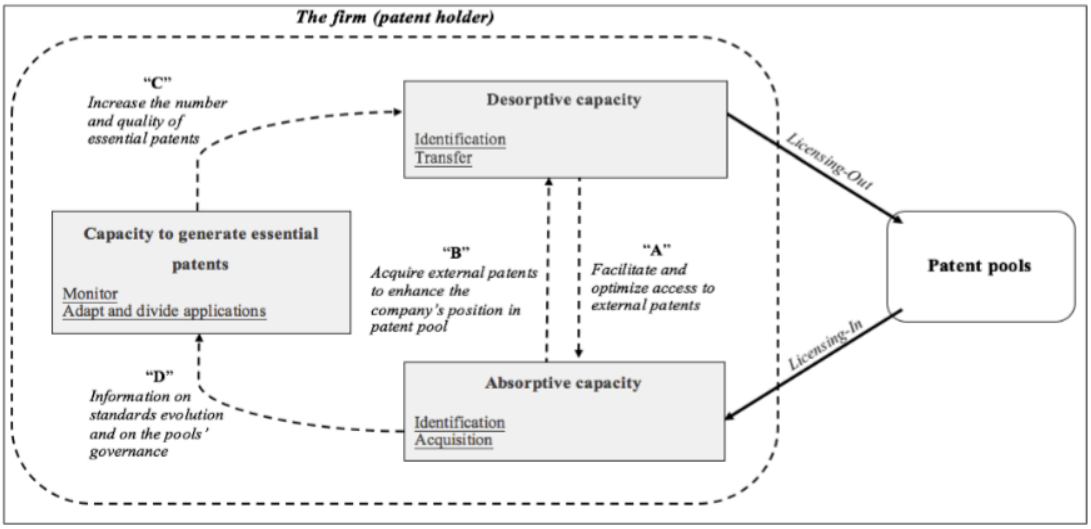
Revenue projections are used by the licensing manager during negotiations with other board members as well as by the cost controller responsible for financial and budgetary monitoring (the royalties paid by the pools, expenses, etc.).

5. DISCUSSION

We began the paper by asking how a firm manages its participation in patent pools and proposing a conceptual framework highlighting the dimensions of ACAP and DECAP that support these efforts. The findings from the Technicolor case illustrate and enrich this framework (see Figure 2).

Our framework indicates that the licensing-in side of participation is supported by ACAP: specifically, the capacity to identify and acquire the right to use external patented technologies. Consistent with our framework, the case reveals the abilities of (a) top decision makers to evaluate the relevance of licensing-in opportunities to ensure widespread development and commercialization of products created by the operations business unit, and (b) the licensing manager responsible for negotiating with the pool's members to acquire licenses under the most favorable conditions to reduce transaction costs. The findings also reveal an unexpected pattern of ACAP during participation in patent pools since Technicolor sometimes buys patents from third parties to strengthen its position *vis-à-vis* other pool members. The IP assessment director maps the technological landscape to identify external patents, and patent engineers and the business intelligence manager assess their value for both the operations and licensing business units and negotiate with relevant patent holders. In this sense, acquiring external patents complements and enriches the company's portfolio and strengthens its power as a licensor within the pool. In other words, ACAP supports DECAP (see arrow B in Figure 2).

Figure 2. Framework of capacities to manage participation in patent pools.



Technicolor also considers patent pool participation to be an outlet for the licensing- out business. Consistently, our framework indicates that participation in patent pools involves a licensing-out component and requires DECAP to identify external exploitation opportunities and transfer patents to external partners. The case reveals the importance of assessing the opportunity to license through the pool since Technicolor has its own licensing division. The first dimension of DECAP, identification, requires understanding the pool's strategy and governance and elaborating different scenarios to compare pool-based revenues against direct licensing revenues. The identification dimension of DECAP hinges on collaboration among the licensing manager, patent engineers and the business intelligence manager. The second dimension of DECAP, transfer, is just as important. Technicolor's capacity to contribute patents to the pool is critical because it reflects the company's ability to convince independent evaluators and determines the company's share of royalties. Second, transferring patents to the pool involves conceding the exclusive right to license the patents to the pool's administrator, whose performance and strategy must be monitored to prevent disadvantageous situations (e.g., royalty shortfalls, competitors failing to purchase licenses). Organizationally, different actors evaluate and demonstrate the patents' value (i.e., patent engineers, researchers/inventors and infringement analysts) and monitor the pool administrator's performance (i.e., the licensing manager, business intelligence manager and cost controller).

Overall, DECAP supports the management of the licensing-out component to gain a higher royalty share and counterbalance any royalties paid as a licensee. This result clarifies the relationship between licensing-out and licensing-in and is consistent with the prediction of our framework that DECAP supports ACAP (see arrow A in Figure 2).

Finally, the findings show that Technicolor dynamically manages its patent portfolio to contribute more patents to patent pools, thereby strengthening its position as a licensor. This is achieved by taking specific actions on pending patent applications to adjust patent claims and increase both quantity (i.e., through divisional applications and acquisitions) and quality

(i.e., by expanding to additional jurisdictions), depending on technological and business considerations. These actions hinge on close collaboration between (a) patent engineers and researchers/inventors to integrate the evolution of the standard into patent applications; and (b) the business intelligence manager, who considers the pool's governance rules. These findings resonate with findings in the literature that combining inventors' ideas with lawyers' skills in "the esoteric and complex domain of patent law" (Somaya et al., 2007, p.924) improves innovation outcomes in terms of the size and the quality of a patent portfolio (Reitzig & Puranam, 2009; Reitzig & Wagner, 2010; Somaya et al., 2007). In the case of patent pools, we showed that the capacity to combine various skills and knowledge enables Technicolor to increase the quantity and quality of essential patents throughout its participation in patent pools and thereby strengthen its position as a licensor.

This finding enriches our framework in two ways. First, the capacity to generate essential patents fuels or hinders DECAP, since it enables Technicolor to contribute new patents to pools, and thereby enhance its royalty share (see arrow C in Figure 2). Second, ACAP supports the capacity to generate essential patents (see arrow D in Figure 2) because this ability implies the integration of external information concerning technological standards and pools' governance rules, and close collaboration between gatekeepers (i.e., researchers/inventors, the licensing manager and business intelligence manager) and information users (i.e., patent engineers).

CONCLUSION

In this paper, we tackled the issue of how firms organize internally to manage their participation in patent pools by conducting a single case study to illustrate a conceptual framework informed by related, but disconnected research streams. Our findings contribute to the literatures on patent pools and licensing and open innovation.

Our paper introduces an organizational perspective on patent pools that complements previous works addressing the antecedents and outcomes of their formation (Baron & Delcamp, 2015; Joshi & Nerkar, 2011; Layne-Farrar & Lerner, 2011; Uijl et al., 2013). Our conceptual framework highlights organizational capacities to manage both licensing-in and licensing-out and to balance the tradeoff between value creation and value capture in patent pools. Our qualitative insights reveal the actors involved and the actions they perform at the firm level to: (a) evaluate opportunities to join patent pools, (b) develop and defend the company's patent portfolio, and (c) manage interactions with multiple stakeholders (pool administrators, other patent holders and independent assessors) to support Technicolor's interests as both a licensee and licensor throughout its participation.

Our findings further explain patent pool outcomes by revealing the process underlying patent integration. Baron and Delcamp (2015) found that, after their formation, patent pools grow significantly as incumbent members continue to add new patents. We provide a firm- level explanation for this phenomenon by showing how and when the capacity to generate essential

patents enables a company to contribute more patents to a pool. Our findings highlight the value of an organizational perspective to research on patent pools by complementing findings on the consequences of their formation.

A second contribution relates to the decision to join a pool. Layne-Farrar and Lerner (2011) found that this decision is affected by two parameters: a firm's business model (vertically-integrated vs. licensing) and the rules of rent sharing. We revealed the importance of a pool's administrator (past achievements and strategy) when considering the opportunity to join a pool. Our findings thus complement those of Layne-Farrar and Lerner (2011) and provide a more detailed understanding of the factors driving participation in patent pools.

Our detailed analysis of licensing management contributes to the licensing and open innovation literature. Previously, scholars studied dyadic relationships (i.e., cross-licensing between two companies); however, we provide empirical evidence related to cross-licensing dynamics and patent sharing arrangements on a large scale (i.e., between more than two firms) (Bogers et al., 2012; Grindely & Teece, 1997; Lichtenthaler, 2011; Pitkethly, 2001). Beyond shedding light on the patterns of these arrangements, our findings provide a more nuanced understanding of the capacities to manage licensing processes. Previous works suggest a unidirectional view of the interaction between the two capacities and indicate that DECAP supports ACAP (Lichtenthaler & Lichtenthaler, 2009, 2010). Notably, our findings show that ACAP likewise supports DECAP, thus revealing a bidirectional pattern of interaction between the two capacities. This bidirectional pattern can be explained by the fact that Technicolor operates in two markets (technologies and products) and centralizes the management of all patent issues, including licensing, in a single organizational unit. This centralization at the corporate level offers several advantages in terms of accumulating knowledge on technological transactions, providing efficient coordination between different specialized actors and facilitating better alignment among divergent interests (Arora et al., 2013; Pitkethly, 2001).

Overall, these findings contribute to the patent management literature by revealing qualitative insights on how firms manage licensing partnerships in a multi-invention context and deal with the tension between technology integration and patent fragmentation (Candelin-Plamqvist et al., 2012; Di Minin & Faems, 2013; Somaya, 2012; Teece et al., 2011).

From a managerial perspective, our findings reveal insights for managers of companies that are interested in joining patent pools. A pool is not a purely cooperative arrangement, since the participating firms have different business models and pursue coopetitive strategies to compete with pool members to increase their bargaining power and royalty shares. Thus, managers must define a clear strategy to negotiate and defend their companies' interests, either as a licensor or as both a licensor and licensee, and to manage the patent portfolio (especially pending applications) by considering governance rules and the standard's evolution. Also, it is crucial for managers to monitor the pool administrator's actions to assess potential risks of an aggressive strategy.

Limitations and Research Avenues

Despite these notable contributions, our study has several limitations. Our findings are based on a single case study and focus on how a firm manages its participation in patent pools. We did not address how this participation affects a firm's innovation capacity. We believe this topic deserves more attention, especially since the results of quantitative research indicate both positive and negative effects (Joshi & Nerkar, 2011; Vakili, 2016).

Our study also opens up several avenues for future research. A natural extension of our study would be a comparative study of other firms in patent pools. The objective would be to understand how the capacities supporting the management of this participation can be heterogeneously distributed among the pools' members and how these differences affect their individual performance. In this sense, we believe that comparing the capacities of firms with integrated business models (e.g., Sony, Philips) and unintegrated business models (e.g., Dolby) can enhance our understanding of individual performance relative to patent pool participation. In the same vein, scholars could investigate how firms with integrated business models balance divergent interests and manage tensions between their operational businesses, which pay to participate in the pools, and their licensing units, which receive income from participating. In the future, researchers also could examine how licensing management capacities in pools differ from or are similar to those deployed in dyadic cross-licensing contexts (Somaya, 2012).

Beyond studying participating firms, researchers could explore the roles and strategies of pool administrators. Few scholars have examined how this dimension affects decisions to (not) join patent pools (Layne-Farrar & Lerner, 2011). Our findings reveal the importance attributed by firms to the strategies of pool administrators and their abilities to license and litigate strategically. However, our findings do not explain how pool administrators attract both patent owners and licensees. We believe that understanding these issues is important for scholars in management and economics, as well as for practitioners (managers and policymakers) to illuminate mechanisms of value creation and appropriation in patent pools from multiple perspectives.

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