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Intellectual property management practices at small and medium-sized enterprises

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Abstract: Small and medium-sized enterprises (SME) contribute to innovation and economic growth, despite their resource shortages and lack of professional intellectual property (IP) management practices. Drawing on social practice theory and combining insights from recent scholarship on IP strategies and its management, this paper examines the cases of three pharmaceutical SME providing insights into how they appropriate returns on research and development (R&D) investments. It discusses their IP strategies and management practices, examining how the IP management practices are embedded in the firm's organisational structure. Moreover, this paper develops recommendations for SME regarding the professionalisation of their IP management practices.

Keywords: IP management; intellectual property rights; IPR; IP strategy; patents; pharmaceutical industry; practice theory; small and medium-sized enterprise; SME.

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1 Introduction

The world has experienced a tremendous rise in the importance of intellectual property rights (IPR) over the last decades. Patent applications increased so dramatically, that the various patent offices had difficulties to handle them in time (McGinley, 2009). As IPR are essential to secure returns on innovation, firms professionalised their intellectual property (IP) management in order to explore innovation opportunities and tended to execute more aggressive strategies. Due to limited resources, small and medium-sized enterprise (SME) were found to have major disadvantages as they lacked the expertise and experience to compete in the increasingly combative business environment (Lanjouw and Schankerman, 2004). However, SME contribute significantly to innovation and economic growth, as for example in the German pharmaceutical industry that consists to 90% of SME (BPI, 2006), with SME being often the source of innovative products in this industry (Reepmeyer, 2006).

Next to the increase in IPR application, the shift in IP management practices is marked by a change of recognising the value of intangible assets and IP (Nonaka and Takeuchi, 1995; Parchomsky and Wagner, 2005; Rivette and Kline, 1999). Also, with the change towards more open innovation strategies, licensing and trading of IP becomes an important part of business revenues (Arora, 2006; Chesbrough et al., 2006; Lichtenthaler, 2008). With few expectations (e.g., Bellini, 2005; Bougrain and Haudeville, 2002; Gurau, 2005; Lee et al., 2010; van de Vrande et al., 2009); most studies on open innovation activities related to IPR focus on larger corporations. This study adds to the case studies by providing examples of three SME that aim to increase their open innovation activities.

Previous research discussing IP strategies and IP management found, that they highly depend on the specific industry group (Blind et al., 2006; Cohen et al., 2000; Lichtenthaler, 2008): knowledge and technology intensive industries such as the life sciences apply patents, whereas service industries and consumer goods rely more on trademarks, trade secrets and first mover advantages. Managerial advice, in respect to best practice concepts and improving IP management, usually suggests experts, broad financial and human resources, and external advisers such consultants and lawyers. (Berman, 2009; Cantrell, 2009; Rivette and Kline, 1999). However, high costs of patenting activities such as application in different countries and litigation costs hinder SME to apply patents as much as larger companies (Arundel and Kabla, 1998; Hanel, 2006; Lanjouw and Schankerman, 2004). SME rarely employ in-house patent attorneys or other patent experts. Accordingly, costs of external advisors could add to the financial burden as well. Because IP management practices have to be successful with limited financial and human resources, we analyse how three SME manage their IP under resource constraints. Moreover, IP strategies are determined by IP management practices and vice versa (Cantrell, 2009; Harrison and Sullivan, 2006). The defining, adaptation and execution processes of strategies are key to improve current strategies (Cantrell, 2009). Understanding how these processes are embedded in practices of the firm is a basic requirement to clarify why and how firms change and improve their strategies, in order to derive recommendations for improvements.

This paper is organised as follows. First, it will provide a brief overview of current issues and practice concepts of IP strategies and IP management. We will discuss their requirements if they are to be employed in businesses, and how the requirements fit the resource restrictions of SME. As patents are especially important IPR in the pharmaceutical industry, we limit our study to the management of patents and trade secrets, excluding trademarks and other IPR. Second, we will introduce practice theory as our theoretical background to gain insights into IP management. Next we introduce our three cases and give a detailed account of our data collection methodology. We provide an overview of the IP management practices at the three SME. By examining how IP management practices are embedded in their organisational structures, we discuss our findings and show how a practice theory approach can further the understanding of IP management and especially the advancement of IP strategies as part of innovation organisations within firms. The paper concludes with a discussion and recommendations of IP management concepts, the scientific implication of our results and some propositions for further research. Hence, this paper aims to contribute to innovation theory by advancing the understanding of IP management in SME. Moreover, this paper provides an extension of the IP management hierarchy by Davis and Harrison (2001) and conceptualisation of successful IP strategies at SME. By analysing how practices are embedded in the firms, this paper provides examples to practitioners of how to change IP management, acknowledging the resource constraints specific to SME.

2 Theoretical background

2.1 IP strategies and IP management

Firms have a strong interest to gain high returns from investment in innovation, hence to improve their innovation strategies and practices. In particular, IPR such as trademarks,

copyright, patents and trade secrets are important instruments for profiting from innovation (Anton and Yao, 2004). Firms chose different appropriation strategies, depending on the industry, business size, business model, and market dynamics (Blind et al., 2006; Cohen et al., 2000; Lichtenthaler, 2008). Whereas some attempt a first mover strategy combined with secrecy or complexity of product design, in the pharmaceutical industry where new product development requires considerable research investment and reverse engineering is possible, patents are considered to be of great importance (Arora, 2006; Cohen et al., 2000; Cunningham, 1998; Mansfield, 1986). Overall, patent application and grant statistics show a steep increase in patent activities over the last decades.

The increasing focus on patents compelled firms to professionalise their IP strategies and IP management practices. Nowadays, they use patents not only in the traditional way of preventing other firms from copying, but also more strategically (Anton and Yao, 2002; Bessen, 2003). More than tools to control market entry, they are for example bargaining chips in licensing negotiations and patent suits, or to hasten entry into new markets (Agarwal et al., 2009; Grandstrand, 2005; Ziedonis, 2004). When a firm holds a patent on a product, its competitors need to improve the products in order to patent the improvement (Blind et al., 2007). Whereas independent patents that provide full freedom to operate (FTO), (hence no requirements to obtain other patents) are the most desired form, even dependent patents of small improvements are beneficial as they can be offered for cross-licensing (Arora, 2006; Scotchmer, 1991). Moreover, firms advertise their patent portfolio of product, process and application patents to build reputations as innovative companies in order to attract new and retain existing customers, employees and investors (PriceWaterhouseCoopers, 2007).

In the era of open innovation, patents are also important in order to recruit cooperating business partners for joint research and development (R&D), marketing and sales. Furthermore, firms generate new income streams through licensing and selling of the IP (Chesbrough et al., 2006; Scheffer and Rehn, 2007). Due to inherence of restricted resources and the limited capability on managerial know-how, SMEs have to find new ways to cope with the challenges imposed by the changing market forces on the one hand and the realignment of big pharma on the other hand (Becker et al., 2007). In this context, particularly open innovation management offers SMEs new opportunities, but also new challenges in innovation management (Vanhaverbeke et al., 2008). When engaging in open innovation, especially knowledge leakage becomes a big threat and companies fear getting fleeced by their business partners (Chesbrough et al., 2009). Against this background, it has turned out to be essential for companies to develop a well-balanced innovation strategy representing both closed and open innovation approaches. In order to develop the necessary know-how and practices, companies first have to overcome their concerns and suspiciousness. Knowledge and IP management competences are crucial to implementing and executing the open strategies successfully. According to the open innovation literature, SME prefer to gather information from external partners and show reluctance to share information (Braun and Mueller, 2009). Consequently, IP strategies – "a solution that takes you from your current situation 'A' to a new situation 'B'" [Cantrell, (2009), p.4] – and IP management – the activities to generate, protect, administer and recoup value from IP – are important tools to leverage innovation and secure a sustainable competitive position (Davis and Harrison, 2001).

The key enabling criteria in IP management are a clear strategy with appropriate resource allocation and management plan (Cantrell, 2009). Amongst IP creation,

protection, monitoring and enforcement, the internal IP management functions, available knowledge and management skills should be clear. Firms should reassess their strategy frequently to adapt their tactics. The frequency of reassessing usually depends on market dynamics (Cantrell, 2009; Rivette and Kline, 1999). A stable and predictable business environment requires fewer adaptations than a market with high rate of technological change and innovation. Also, whenever a firm changes its business and innovation strategy, or when it grows and attains more resources, the IP strategy should be aligned accordingly.

IP strategies were traditionally characterised by their filing strategies in terms of subject matter (quality vs. quantity), their regional filing decisions (e.g., national, multinational, global), and general filing and enforcement practices (defensive vs. aggressive) (Gassmann and Bader, 2007). This approach was in-line with the traditional strategies that merely guided what kind of IP where to file (Cronin and DiGiammarino, 2009). However, the focus shifted from reducing IP strategies knowing which IPR to file in which regions towards IP management that considers IP as a strategic business asset. By shifting the meaning of IPR from a legal perspective to a more strategic perspective, companies can coup more value from IP (Berman, 2009; Cantrell, 2009; Davis and Harrison, 2001; Junghans and Levy, 2006). Accordingly, IP management involves all activities from defining and executing the IP strategy, generating and commercialising new IP, licensing, buying and selling IP, as well as monitoring third parties' IP as part of business intelligence (Gassmann and Bader, 2007). Davis and Harrison (2001) integrate this approach in their IP management hierarchy. It is probably the most widely used typology amongst businesses to categorise current management approaches and to identify ways forward. The IP management hierarchy is divided into the following five levels, beginning with the bottom of the pyramid (see Figure 1).

Figure 1 IP management hierarchy

Source: Adapted from Davis and Harrison (2001)

Depending on the needs and capacities of particular firms, the highest level is not necessarily the most suitable (Sullivan and Harrison, 2008). According to insights into best practices on how to get the most value from their R&D efforts, firms are advised to align their IP strategies with their business strategy and innovation strategy. This involves defining the IP strategy, most preferably in an interdisciplinary team to align different

perspectives from R&D, marketing and sales, as well as from business strategy and patent counsels (Berman, 2009; Cronin and DiGiammarino, 2009). The interdisciplinary approach entails also a higher awareness of IP as business assets across all departments and business units.

However, careful reflection of specific IP strengths and constraints, as well as designing an IP strategy in-line with the innovation strategy, requires skilled expertise. Whereas big corporations set up professional IP departments, SME often lack the appropriate resources and experience to compete (Lanjouw and Schankerman, 2004). Prior research concludes that SME have to patent more carefully as they are unable to acquire broad patent portfolios (Parchomovsky and Wagner, 2005). For example when patenting own inventions, a full assessment of patentability, prior art and FTO is costly. SME rarely possess the necessary expertise in-house to conduct substantive patent searches and correctly judge the gaps in the patent landscape (Arora, 2006). They depend on external advisors and patent attorneys, which are expensive and therefore only used for short periods and when absolutely necessary. Otherwise, they carry out most patent screening, patent monitoring and patent enforcement activities with their own staff. On top of highly restricted resources, SME with few patents are even more exposed to litigation than companies with substantial patent portfolios (Agarwal et al., 2009). Despite all these disadvantages in managing IPR in a professional manner, SME still profit from innovation and are e.g., in the pharmaceutical industry essential sources of innovation (Reepmeyer, 2006; Voet, 2008).

2.2 A practice theory approach

Amongst the theoretical concepts, which focus on furthering the understanding of strategy and management, practice theory appears to promise conceptualising how IP management is constituted. Moreover, it helps to analyse why some practices seem more firmly anchored and influential than others, and how the latter could be improved.

Practice theory is an umbrella term for a multitude of similar research approaches mainly in social sciences (e.g., Bourdieu, 1977; Giddens, 1984), philosophy (e.g., Wittgenstein, 1984), cultural theory (Foucault, 1979), and science and technology studies (e.g., Callon, 1994; Latour, 1987; Knorr Cetina, 1999) that focus on practices in their research. In the last decades, concepts of practice theory also entered the field of economic sociology (Florian and Hillebrandt, 2006). Although there is no unified approach, they all aim to describe and explain phenomena by analysing how activities constitute schemes of perceptions and thoughts, and how ways of thinking are being embedded in, established and reinforced through practices (Reckwitz, 2002; Schatzki et al., 2001). Schatzki describes that the central core of practice theorists "conceives of practices as embodied, materially mediated arrays of human activity centrally organised around shared practical understanding" (2001, p.2). Practices – bundled activities depending on shared understanding and skills – are dynamic processes that are interfering with other practices constantly. In enterprises, they are not limited to shared routines, rules and institutions that entail certain activities, but also include actions on an individual level. In science and technology studies, practice theory is used to conceptualise the creation and dissemination of scientific facts and technologies, taking into consideration not only the human actors but including objects and artefacts (e.g., Latour, 1987). Objects are interwoven with human activities and are crucial components of practices, as objects are usually used in certain ways. Consequently, the

meaning of actions, human and non-human actors are being constituted within practices (Knorr Cetina, 1999). This approach allows us to focus on ordering constellations of non-human entities in order to understand specific practices as activities that always involve apprehending material configurations (Schatzki, 2001). In sum, we apply the concept of practice as a set of activities and understandings within firms, which are embodied in and constitute order of various human actors and objects. Moreover, the IP management practices are recurrent processes governed by specifiable schemata and prescriptions.

Similar to organisational learning concepts from the field of knowledge management (e.g., Nonaka and Takeuchi, 1995; Rice and Rice, 2005), practice theorists consider organisations as holders of significant knowledge bases that enable to continually learn and recondition their practices (Knorr Cetina, 2001). The approach allows to research, similar to a systems approach, beside the organisational routines (e.g., Dosi et al., 2000) such as meetings, IPR screening and review processes, also performances which are not repeated such as incidences as specific contacts and conversations, as well as employees and business partners outside of the firm, tangible and intangible artefacts such as IPR, believes, values and perceptions, machinery, strategy papers, books, articles, software and other management and communication tools. With the focus on practices rather than on systems, institutions, organisations or actors, guides the analysis on entry points of changes on each level of the constituents – employees, external people, as well as tangible and intangible artefacts. Consequently, practice theory appears to be a promising approach to not only analyse the people and their organisation, but also the actions, perceptions and artefacts involved in the constitution and reinforcement of IP management.

3 Research methodology

We collected data during the three year project 'Open innovation in life sciences', in which two university partners explored with three pharmaceutical SME the opportunities to improve innovation management practices and to identify and apply suitable open innovation approaches. The three enterprises were selected as they were all keen to improve and open up their innovation processes. Within the project, we identified with them that IP management hold a high potential to improve their competitiveness. Accordingly, they were extremely committed to analyse and improve their IP management. Moreover, they operate in the same industry and have about the same size in terms of employees and turnover, but occupy different positions in the value chain:

- Company A is a partner for healthcare market services and offers the complete value chain from product development up to market supply. The main focus is development and product approval in the EU, and specific drugs sold directly to hospitals. The company employs around 180 employees, owns 18 patents and about 11 trademarks.
- Company B is a manufacturer of different types of healthcare offers such as pharmaceutical and medical products, dietary supplements and cosmetics. Consequently, they develop next to pharmaceuticals also products for a consumer market sold prescription free. The company employs around 200 employees, owns six patents and about 42 trademarks.

- Company C's main business area is the production of solid and liquid pharmaceuticals. The main business divisions are contract manufacturing and proprietary pharmaceutical products. The company employs around 125 employees, does not own any patents but three trademarks.

In our research, practice theory serves as a theoretical framework guiding our analysis of IP management in the following way: first we map the IP strategies and the IP management practices including the relevant

1 employees (from R&D, marketing, sales, management, etc.)

2 external actors (such as customers, suppliers, patent attorneys, advisors)

3 artefacts (e.g., IPR, communication and management tools, perceptions and values)

whereas within the IP management activities the IP strategy is also an important artefact. As we wish to gain understanding of why certain IP management practices prevail in firms, we focus on how the practices are embedded and what it takes to substitute them with competing practices. The analysis covers organisational structures and processes, by which IP is generated, valuated, stored, shared, communicated, enforced and commercialised, including all formal and informal decisions on any of the above mentioned activities. Because of the three year period of the project and the high commitment of the firms, we could identify several approaches of improving IP practices and consequently observe what it takes to change them. In the following, we will briefly present our research methods and reasons for the choice of these methods in the course of our study:

3.1 Action research, including in-depth interviews and workshops

The research work within the project is designed as an action research study, due to the possibility of close collaboration between researchers and the firms. The exploratory character of the empirical investigation on the one hand and the shared interest of researchers and practitioners on the other hand make action research well-suited to the collaborative research approach. Action research assists practical problem solving and expands scientific knowledge at the same time by working collaboratively and using prompt data feedback in a cyclical process (Hult and Lennung, 1980). The potential disadvantages of action research such as little distance to the research subjects or specificity of the practical problems have to be minimised in order to profit from the advantages (Coghlan, 2004). Nevertheless, it represents the method of choice for strongly application-oriented research projects. As with most action research projects, this study is structured around a series of work cycles (Maklan et al., 2008) with an evolving research agenda.

The project started with specifying – in close collaboration between the research team and partnering firms – the relevant open innovation strategies and processes while the various opportunities and risks were elaborated during the subsequent phases of the project. Having identified IP management as one of the challenges and opportunities, we focused our study on this research topic. Thus, we organised workshops on the topics innovation, IP management and collaboration. In these workshops, we jointly reviewed current strategies and practices, and improved them accordingly. While the workshops are a solid base for the collaboration and the joint development of applicable IP

management concepts, they were carefully prepared and followed up by conducting in-depth interviews with relevant personnel, analysing applicable documents as well as theoretical concepts and best practice examples. The broad data collection of about 80 documents and 50 interviews with personnel from management, R&D, strategy, marketing, sales and manufacturing are necessary to capture different perspectives on IP management practices, and to assess the relevant actors and artefacts involved in formal and informal IP management activities.

3.2 Knowledge modelling and description language (KMDL)

We analysed the current situation in the project partners' organisations by using KMDL – a method for analysing knowledge activities in business processes which primarily addressed the need for an adequate method of knowledge-intensive business process modelling (Bahrs and Heinze, 2009). KMDL facilitates two interrelating views: the process view and the activity view. The process view aims to describe the logical sequence of knowledge intensive business processes, like the innovation process. The analysis focuses on aspects of these processes in every partner organisation from the perspective of the process steps in order to show how they are related, which actors are involved and which alternatives exist. The activity view provides a more detailed description and analysis of the actions by departments and individuals in selected process tasks (Bahrs and Heinze, 2009). The models of the process and activity views result from a close collaboration between the researchers and the partnering companies, whereas they also serve as a discussion basis to explore different management modes.

The first step was the modelling of the current situation in the partnering companies by using the KMDL process view. On the basis of the process models and in constant collaboration with the partnering companies, process tasks for closer investigation were identified, e.g., tasks including knowledge activities aiming at idea creation and idea development as well as internal and external knowledge transfer. These tasks were a subject of the further intensive analysis in the KMDL activity view as a next step. The aim of the detailed analysis in the activity view is the visualisation of weaknesses within business processes, e.g., knowledge monopolies, unsatisfied knowledge demand or existing risks regarding the knowledge transfer practices in the company. Given the openness of the innovation processes as a project aim, the analysis focused on the importance and the impact of the external sources in these processes.

The analysis of the models in the KMDL activity view visualised the existing knowledge and information flow and established the basis for the process improvement, especially regarding the structured (IP) activities in the project tasks and the weaknesses within established managerial implications and IP management concepts. Using KMDL as a framework for our empirical investigation we could research and visualise IP management practices such as IP generation, valuation, storage, communication practices, sharing and commercialisation of IP, as well as enforcement and decision practices. With the KMDL models we account for knowledge and information flows and can identify risk for involuntary trade secret loss. The visualisation of the resource allocation to IP management and the identification of the relevant experts and artefacts in the company, as well as external actors are also the starting point for identifying necessary conditions under which IP management practices could be improved.

4 Results and discussion

In the following, we describe the findings of the analysis, informed by the KMDL models and various discussions with the firms. In order to analyse the most relevant IP management activities, we structured the IP management practices into the following modes of action (Cantrell, 2009; Sullivan and Harrison, 2008):

a IP strategy and general management practices: assessing current IP situation and defining strategies, allocating resources and executing the strategy, using IP strategically (e.g., attracting business partners), business intelligence through IP monitoring, filing and application of IPR, securing of trade secrets, communication practices

b IP generation practices: creating in-house new IP, in-licensing, cross-licensing and buying, hiring new personnel, using third party IP as source for own innovation

c IP commercialisation practices: own usage, direct monetisation, selling, licensing, cross-licensing, ways to identify suitable commercialisation channels, marketing of own IP

d IP enforcement practices: monitoring possible infringement, enforcing own IP, litigation and arbitration.

For each practice, we identified the actors such as the employees, external actors, artefacts, as well as the constituents, such as the relevant personnel and external advisors, and through which artefacts they are connected, their regular meetings, operational rules and procedures, informal knowledge exchange within firms and with external parties, the metaphors, and sense making, prior experiences and knowledge of competitors' practices, strategy papers, as well as existing IPR and IP. At each set of practices (a–d), we also identified as relevant processes how decisions were taken and followed. We investigate whether the practices serve a potential competitive advantage by analysing if the practices result in a high level of IP awareness amongst relevant employee and if IP is treated as a business asset rather than a legal asset. The underlying rational is that firms capture more value from their IP when they use it as strategic assets (e.g., Rivette and Klein, 1999). Moreover, conscious decisions on whether to patent new inventions or keep them secret also encompass managerial capabilities securing competitive advantage. The actual competitive advantage can only be identified retrospective in reviewing whether certain practices provided economic benefits. In the following, we present our main findings relevant to understanding the recommendations that we provide in the last part of this section.

4.1 IP strategy and general management practices

We analysed whether firms define an explicit strategy or not including actions and resource allocation, how stringent they are in the execution and how regularly they review the strategy. The process of defining an IP strategy can be divided into four basic steps. First, assessing the current market, technology and IP situation of the firm and its business environment. Second, defining the desired IP situation to secure a competitive position. Third, addressing the available options to move to a more competitive market

position in terms of IP generation, commercialisation and protection. Fourth, while reflecting uncertainties and obstacles on the way to achieving the desired outcome, firms decide on a course of action and allocate appropriate resources to execute the strategy decisions (Cantrell, 2009). We found that all three SME lack an explicit IP strategy and coherent IP management practices to define a strategy. None of them assesses the IP landscape, neither are the views within the enterprises aligned. However, all three perform parts within their innovation process such as assessing their current IP situation, defining their IP objectives in terms of innovation goals, evaluating possible options to achieve the objectives, and deciding on the course of action.

We found that the more patents and trade secrets they have, the more they engage in IP management activities. Firms A and B own a few patents, consequently engage with patent attorneys. The firms diverge in their ability to integrate the patent attorneys' strategic IP knowledge. Firm A is keen to expand current practices and has personnel in business development allocated to IP management. They even have professional development plans in order to improve. As their CEO stated:

> "We are well aware that we can improve [our IP strategy and management]. But, you know, we have to spend our time and money wisely. Mr. X from business development (BD) is doing currently courses at the X-university to study European patent law. Also, we have next month a two-day workshop on development contracts for everyone. All employees from BD, R&D, strategy and general management who are interested will join." (CEO-A)

Firm B wishes to improve, but holds the view that it lacks resources to do so. Accordingly, it does not have the capacity to integrate managerial advice. Firm C considers itself to be too small and not innovative enough to increase its IP management skills and does not believe to be able in the near future to define a clear IP strategy:

> "[…] so that's why we don't have a patent strategy, because we really do not need one, I would say. Maybe we could patent some of our inventions, but we are just too small and neither have time-resources nor money to do so." (Production Manager-C)

Neither A nor B have clear filing strategies for their patents but investigate it on a case to case basis.

4.2 IP generation practices

Assessing how and through which channels firms generate new IP, we found that this is done in a rather structured way with clear responsibilities. However, patents are not considered to be an integral part of their innovation activities. Patents are treated as legal assets and only taken out for developed products with high levels of innovation. While all three companies attempt to innovate without infringing the IPR of others and focus on patent free regions and technologies, they do this in different ways. Patents of third parties are used as knowledge sources in a regular process only by firm A. On the basis of the regular screening they take strategic decisions whether to develop a new product in-house or with a business partner in a patent free region. The third party patents are also decisive for timelines as to when to bring a new product onto the market. B monitors patents of third parties only for infringement clearance when attempting to patent own developments.

> "We have only few real innovations. So that is basically the only time when we ask external patent attorneys perform patent searches for us and discuss then with him what we can patent and if we have freedom to operate. Otherwise, I don't think that anyone looks at patents. You know, that is just time-costly." (Development Project Manager-B)

C does not assess third party IPR while relying on screening activities by customers and on being too small to attract attention.

> "Well, I think our customers are responsible for that. They ask us to manufacture products for them, and they will market it. So they would also be the ones to blame. We never got a complaint that we infringe someone's patents so far." (Sales and Marketing Manager-C)

To a certain degree, all three firms exploit the uncertainty of value and protection level of others' patents, although this is not done consciously. Being too small to attract serious attention by big players who can afford litigation procedures, in grey zones they maintain low profile in order to avoid conflicts.

4.3 IP commercialisation practices

Nowadays, firms have a variety of channels and routes to exploit both newly obtained and old IP externally. However, regarding IP commercialisation practices at the organisational level, we found that the researched SME lack experience in fully assessing their options available for generating value through patenting. Restricted by known practices, they do not sell or license out patented inventions, although in-licensing is common.

> "Yes, we in-license several patents, often for applications and markets where the patent owners have no business. […] Why don't we out-license patents? I would say it is simply a question of time. We have so much to do that no one can really look for opportunities. Firm X asked us for a license of our X-product, but that was of course out of question. Why should we license that out?" (R&D manager-B)

Their fear of underestimating the value of certain patents results in a decision against external commercialisation of the product or technology in question. This objection is, however, on individual level rather than on firm level. With no other licensing process in place, general manager are supposed to suggest to the CEOs which patent to license, however they are hold responsible if competitors obtain high revenues with this patents. Consequently, they usually refrain from making mistakes as the incentives for out-licensing are low.

4.4 IPR enforcement practices

The level of patent protection and enforcement measures are low. Also, none of them have engaged in trying to invalidate or actively infringing the patents of others. But protection measures to secure trade secrets are high. All three focus on niches to stay competitive with the benefit that it is possible to overview market dynamics and possible infringers. Patenting only exceptions entails that patent enforcement can be left at a low level with few expenses.

> "I don't know how much we spend on patenting and patent enforcement in general. But it cannot be much, otherwise, I would know it. We never had to defend our patents in court. Let's hope that it stays like that." (General Manager-B)

Trade secret protection is not costly. It is, however, an ongoing process to keep awareness high at the relevant personnel to enable them to judge correctly how to treat specific information. Consequently, avoiding active patenting and regular patent screening can keep costs down.

Comparing actual IP management practices and strategies with the IP management hierarchy by Davis and Harrison (2001) we found that SME rarely make it into the first level. The general level of IP awareness is low. All three treat patents as legal assets rather than as business assets, although one firm already has in-licensing experience. While firm B has a defensive approach, moving currently to the cost control level, firm A and C are more difficult to characterise according to the hierarchy. Firm C neglects patenting and assessment of third party IPR to clear possible infringement. It only reacts when being confronted by others. Interestingly, when engaging in business collaboration and with customers, they do use their process and product related trade secrets to strengthen their business relationships. However, this is not done consciously. Consequently, the IP management hierarchy should include a reactive level at the bottom, conceptualising practices that are not done defensively but only on a need to react basis. Although it may appear at first glance rather unwise, it does create competitive advantages for firms to just neglect taking out IPR and screening for potential infringements. As long as they are too small to seriously disturb more powerful players, it appears to be an effective and cost efficient approach.

The firm's management practices are the basis for another proposal: the levels of the hierarchy could be divided into an explicit and an implicit part. As for example, in contrast to patents, all three use trade secrets implicitly as real business assets. They utilise them to attract customers and cooperating business partners strategically. This is done in routines and practices within their innovation processes. It does not entail that firms define IP as strategic assets consciously.

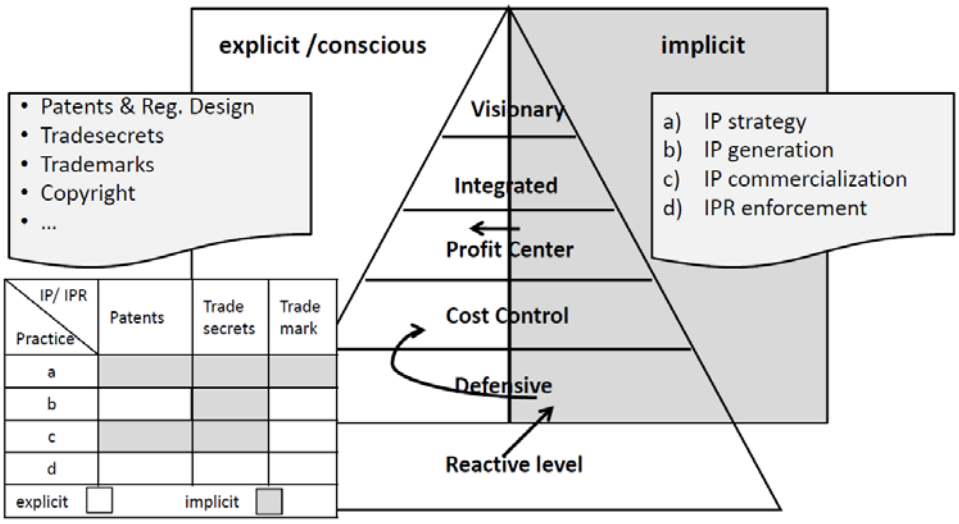
> "[Why do firms chose to work with you?] Well, I think simply because they know or heard that we are very good at manufacturing XY. They know that we can also work out tricky recipes and keep the processes stable to get perfect quality. You know – quality is everything at the manufacturing of pharmaceuticals and everyone can buy the same machines but you have to know how to operate and modify them." (Production Manager-C)

> "Many firms approach us to do developments in cooperation because they know our products. So that is, I think, the main reason, why they come to us. But we also tell the industry that we can do now this or that we developed a new process for that. I mean, the pharmaceutical industry is really a village. So you meet the others at trade shows and committees of trade organisations. It is important to talk to the others during breaks" (Business Development Manager-A)

Especially firm A could be characterised as being in the explicit cost control level with its patents and at the same time with its trade secrets in the integrated level. In order to identify ways to improve IP management, it is helpful to assess the already existing

practices. When identifying to firms the areas where they already implicitly use IP as strategic assets, it is much easier for them to build on these insights and move from an implicit to an explicit strategic level (see Figure 2).

Figure 2 Extension of IP management hierarchy with analytical frame



Revealing how IP management practices are embedded in activities constituted by several human and non-human actors enables the visualisation of opportunities to change and improve these practices. According to our findings, several actors, artefacts, organisational structures and processes should be considered when identifying options to break up and adapt practices. We found that especially the understanding and explanation has to be changed to embed new practices in firms. Consequently, it is advisable to engage simultaneously with several practice constituting components such as relevant personnel and external advisors, meetings, operational rules and procedures. Even informal knowledge exchange should be utilised to focus on new metaphors, and sense-making of competitors' practices to further the own knowledge base. If firms, for example do not consider commercialisation options such as selling and out-licensing as real opportunities, they are not open to them. To enrich their set of alternatives with new channels, their IP management practice requires a crisis to disrupt current practice structures, which will allow new practices to evolve. We found several internal and external events that constitute such breaking points to improve management practices. These disruptions can be initiated internally by employing new personnel with respective experience and knowledge, increasing buying and in-licensing activities in order to gain experience with negotiation and contractual options to license out own IPR, buying or merging with small companies that hold IP, and of course seeking consultants to guide the IP strategy process. Even a regular meeting or a patent management tool that focuses merely on renewing fees in-time helps in order to be confronted with IP aspects on a regular basis and consequently raises the awareness.

5 Conclusions and further research

In this study we have assessed how IP management is embedded in practices, and how SME navigate the IP landscape despite lack of resources. They all lack skilled in-house personnel and, what scholars consider 'professional' IP management practices (e.g., Gassmann and Bader, 2007). Only one firm dedicates clear personnel to IP management and the two that hold a few patens clear FTO, but do not have clear filing strategies. By exploring how the three enterprises innovate, we found that trade secrets are their most valuable IP to appropriate R&D investments. While uncertainty of patent value hindered the firms to engage in out-licensing and selling as the fear of underestimation is too high, the uncertainty of others' level of patent protection is capitalised on by neglecting to screen carefully for FTO. Moreover, we found that SME do not require professional IP strategies and management practices, depending on their size and the market dynamics within their business environment.

We propose an extended concept of the IP management hierarchy. This includes a reactive bottom level and the division into explicit and implicit management. As explained in the discussion section above, this could serve to hasten improvements by helping firms to analyse that they use their IP already strategically on an implicit level. Hence, this metaphor could enable using IP also more explicitly as strategic assets.

The contribution of a practice theory approach is the focus of our analysis on shared and individual IP management practices including human actors and non-human artefacts as well as formal and informal processes and organisational structures. Accordingly, to raise IP strategies beyond traditional practices, the change should be initiated at several points simultaneously.

Our study is limited in several ways. We propose that no professional IP management is required when firms do not disturb their competitors in a significant way. But there is certainly a limit to this, depending on the business environment. Also, IP management studies usually focus on patents and trade secrets only. However, including trademarks is important as well, as the management of trademarks can have significant effects on risk of patent litigation and trade secret loss. Given that a strong trademark can attract attention from competitors but also from respective collaboration partners, the visibility in the market can entail higher litigation risk. We propose to overcome these limitations by further research on IP strategies and management including trademarks. Moreover, insights from change management could complement the concepts of how to manage the change of IP management practices towards more successful ones.

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