

Integrated Innovation and Patent Management: A Capability Perspective

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Abstract

The purpose of this paper is to analyze the elements of an integrated innovation and patent management that support the sensing, seizing of innovation and if necessary the reconfiguring of a business.

We found several organizational and managerial processes, procedures, systems, and structures of an integrated innovation and patent management that represent specific microfoundations for managing innovation.

The importance of an integrated innovation and patent management has grown in today's fast changing environment. The findings in this paper emphasize to demonstrate the fact that management should integrate innovation and patent functions one process as well as on strategic level to develop significant technologies in-house and act and react on competitive markets.

This paper is valuable since it contributes to recent research calls for more qualitative studies on the integration of innovation and patent management and for the identification of specific microfoundations of dynamic capabilities.

Keywords: Case Study; Patent management; Innovation management; Integrated process; Cross-functional; Microfoundations; Dynamic capabilities.

1 Introduction

To ensure the greatest benefit of inventions and novel products, creators, managers and lawyer of different functions need to collaborate and patent management needs to be organized cross-functional (Jell et al., 2014). In fact, "the tight integration of IP management with R&D and marketing is critical for companies that develop significant technologies in-house" (Fisher and Oberholzer-Gee, 2013, p.175). Furthermore, to promote optimal chance of a development to fulfill its intended purpose, companies need to manage their IP process with a strategic emphasis and incorporate it into the innovation process (Lynskey, 2009).

However, despite the recognized importance, practitioners have not yet implemented the integration of IP with innovation management in most companies (Tanaka, 2013) and new product development has not “...addressed the role of the patent function yet, especially its integration with R&D” (Ernst and Fischer, 2014, p.121).

In this paper we attempt to address this gap in literature by studying how patent management and product innovation management can be integrated by deploying different bundles or combinations of resources. The value creation by resource combinations is based on the RBV (Penrose, 1956; Barney, 1991), and its understanding is recognized as one of the central tasks of dynamic capabilities (Somaya et al., 2007; Teece, 2014; Teece et al., 1997). We analyze how patent and innovation management can be integrated by its processes, routines, structures and tools and apply thus a resource-based view. Furthermore, we explore why the two functions are integrated in this manner from a capabilities perspective. This allows us to analyze the microfoundations of an integrated patent and innovation management.

Candelin-Palmqvist et al. (2012) highlight that intellectual property research in innovation management would greatly benefit from more qualitative studies on a firm-level, to answer the “how” and “why” questions and to provide feasible implications for innovation managers of the organizational level. Our paper follows this call by presenting an in-depth case study of a firm that values their integrated innovation and patent management highly for their new product development.

The paper has three major contributions. First, to our knowledge, this paper is the first one describing the integration of the two business functions IP and innovation management. Therefore it contributes to the research of cross-functional integration in new product development (NPD) and innovations management literature. Second, by taking a capability perspective, this paper contributes to the management literature of (dynamic) capabilities by providing insights into the specific microfoundations of innovation management. And third, it demonstrates to practitioners how patent and innovation management can be integrated with the aim to plan and protect innovation in a more successful manner.

The paper is structured as follows. First, relevant literature with regard to innovation and patent management and dynamic capabilities is reviewed. Thereafter, a section on the methodology follows. Then the paper describes the case findings and discusses them from a

dynamic capability perspective. In the final section, implications for practitioners and scholars are described and pathways for future research suggested.

2 Theoretical framework

Innovation is associated with the creation and adoption of something new (Gopalakrishnan and Damanpour, 1997). In general, innovation is a process with the aim of commercializing an innovative product, process or service (Tang, 1998). Literature describes this process mostly as stage models. In the new product development, the most prominent stage gate models are "...the development funnel (Wheelwright and Clark, 1995), the product innovation process (Crawford, 1994), the stage-gate process (Cooper, 1993) and the invention exploitation (Roberts, 1988)" (Tang, 1998, p. 299). Even though their stages are named differently, they agree on the management of a substance of stages: search/ideation, selection/conceptualization, implementation/development, and capture/commercialization (Tidd and Bessant, 2009).

Innovation should be assessed by the patent management (Gopalakrishnan and Damanpour, 1997). Patent management can be seen as a process (Teng, 2007), comprising the stages (see. Gassmann et al., 2012): generation (e.g. idea formulation, prior art search), assessment (evaluation, patent application, filing), exploitation (prosecution). Besides the task of identifying patentable inventions, patent management is furthermore concerned with portfolio management, patent information screening, patent enforcement and defensive measures (Pitkethly, 2001; Granstrand, 1999). Since innovation and patent management function are closely intervened, patent and innovation management can benefit strongly from a cross-functional integration (Jell et al., 2014).

In the innovation process patents are seen as a milestone (Somaya et al., 2007), providing potential for competitive advantage (Hall, 1993). However patents gain attention not only because of their defensive importance in the development of new products (Shapiro, 2001; Pisano and Teece, 2007) but also because in today's competitive landscape, litigation against patent infringement has become an enormous cost factor for many producing companies (Henkel and Reitzig, 2008; Bessen and Meurer, 2014). Due to this reasons patent strategy has become an important part of the corporate strategy (Somaya and Smith, 2003; Granstrand, 2000; Reitzig, 2007; Lynskey, 2009).

It is clear that today the success of a newly developed product is strongly dependent on the innovation protection through patents (Ernst and Fischer, 2104) and that the importance of the patent management function in innovation and R&D highly increased within the last decade (Tanaka, 2013b).

Even though research found already more than a decade ago that the collaboration between innovation and patent functions is relevant in new product development (Tsuji, 2002; Blomqvist et al., 2004), research has rather extensively studied the integration of innovation functions with other corporate functions such as marketing and sales (Song et al., 1997; Ernst et al., 2010; Troy et al., 2008; Griffin and Hauser, 1996; Kahn, 1996; Katz and Allen, 1985), and purchasing (Nijssen et al., 2002), and widely neglected the cross-functional integration of patent management (Ernst and Fischer, 2014). It is only recently that academia seems to have taken the integration of patent management with innovation management onto their research agenda. Recent works found that cross-functional patent management in family-owned firms is more developed than in non-family owned firms (Jell et al., 2014) and that the integration of the two departments leads to a strong patent portfolio that avoids costly lawsuits, and secures freedom to operate. Furthermore they found a positive relation between the level of cross-functional collaboration and new product performance (Ernst and Fischer, 2014). Despite the undeniable consensus of academics and practitioners about the relevance of an integrated innovation and patent management, research on its implementation is underexplored (Ernst and Fischer, 2014) and collaboration between patent function and other departments is still underdeveloped in most entities (Tanaka, 2013a).

Since the resources of both departments are critical to innovate and develop a new product, capabilities for a close collaboration between the functions are required (Ernst and Fischer, 2014; Reitzig and Puranam, 2009). In line with Helfat and Winter (2011) we understand that operational capabilities enable to perform an ongoing activity and to maintain the status quo, whereas dynamic capabilities (Teece et al., 1997) enable a firm to extend or modify the status quo. Dynamic capability deals “with mechanisms for change, it links to innovation and organizational learning...and processes” (Easterby-Smith et al., 2009, p.1). They are a firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Teece et al., 1997). Teece (2007) adds further that dynamic capabilities can be decomposed into the capacity to sense and shape opportunities and threads, to seize

opportunities and to maintain competitiveness through altering, combining and protecting the intangible and tangible assets of a firm. According to Teece (2007) a capability is dynamic when it enables to adopt and influence dramatic environmental change. Helfat and Winter (2011) furthermore highlight that a capability is also dynamic, when change seems not dramatic at first sight. They argue that the question of if a change is radical or not and thus if the capability is dynamic or operational is only a matter of granularity.

Routines of new product development, of knowledge and technology transfer as well as cross-functional R&D teams were identified by Eisenhardt and Martin (2000) as elements of dynamic capabilities. In general such elements of dynamic capabilities are organizational and managerial processes, procedures, systems, and structures that support "...the capacity (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets" (Teece, 2007, p. 1319). Teece (2007) classifies such elements as microfoundations of dynamic capabilities.

Scholars called for more studies to identify the microfoundations through which firms develop dynamic capabilities (Argote and Ren, 2012; Argote and Ingram, 2000; Easterby-Smith et al., 2009; Spender and Grant, 1996; Teece, 2007).

This paper aims to follow the research calls for more qualitative studies on the integration of innovation and patent management and for the identification of specific microfoundations of dynamic capabilities. Therefor we analyze the organizational and managerial processes, procedures, systems, and structures of an integrated innovation and patent management that support the sensing, seizing of innovation and if necessary the reconfiguring of a business, and formulate our research question as follows: What are the microfoundations of an integrated innovation and patent management?

3 Methodology

3.1 Research Design and Case Selection

In order to examine the research question a qualitative research approach was found to be appropriate. The qualitative research approach is ideal if a phenomenon is little known, when existing aspects are incomplete or fragmented (Eisenhardt, 1989). Furthermore, it allows for a

selection of specific cases to provide an understanding of how and why something occurs (Meyer, 2001; Yin, 2009). Since we provide the first attempt to describe how innovation and patent management can be integrated, we found an explorative single case-study a suitable methodology. The exploration of an integrated process is likely to generate in-depth insight into how firms apply cross-functional integration and what specific microfoundations of dynamic capabilities might be.

To maximize the utility of information from a single case, the case is based on an information-orientated selection. The case was selected on the basis of expectations about its information content. This selection method is useful to obtain information on unusual cases, which can be especially good in a more closely defined sense (Flyvbjerg, 2006). Since we found that Alpha is such an unusual case that has an integrated innovation and patent management, we selected the integrated innovation and patent management process of Alpha. Alpha is a major listed firm of the building materials industry.

3.2 Data Collection and Analysis

Empirical data were collected between October 2015 and February 2016. The firm and all employees have been renamed, to protect their identity. The collected data included personal interviews, internal documents, archive materials, quarterly reports and various procedure documents that represented the codified knowledge. Hence, the theoretical mechanisms studied are particularly well documented (Eisenhardt, 1989).

The collection and analysis took place in several phases, which allowed for adjustments between data collection and analysis (Eisenhardt, 1989). In a first phase, a comprehensive literature review was conducted, confirming the significance of the integrated management in general and with regard to innovation and patent management. To gain an initial understanding of the integrated process and the involved functions two innovation and patent management executives of Alpha, a former innovation manager and a former consultant of Alpha were interviewed in a second phase. In a third phase, we conducted interviews based on a semi-structured interview guideline, providing guidance for the data collection and analysis (Yin, 2014). In this phase we conducted four interviews, which took between 60 and 90 minutes. The interviewees hold the positions as innovation manager, innovation field coordinator or patent manager (see Table 1).

Interview phase	Role of interviewee	Length of interviews
Second phase	Patent Manager (1)	0h 42min
Second phase	Innovation Manager	0h 35min
Second phase	Former IP Consultant	0h 10min
Second phase	Former Innovation Manager	0h 42min
Third phase	Patent Manager (1)	1h 32min*
Third phase	Innovation Manager	1h 04min*
Third phase	Patent Manager (2)	0h 59min*
Third phase	Innovation Field Coordinator	0h 54min*
Fourth phase	Patent Manager (1)	0h 10min
Fourth phase	Former Innovation Manager	0h 15min

Total

10

* transcribed

Table 1: Overview of conducted interviews

In a last phase we conducted two additional follow up interviews to confirm and clarify certain results. To lower the potential bias of single respondents (Davis and Eisenhardt, 2011; Gibbert et al., 2008), the collected data from the second phase was transcribed (Mayring, 2010) and triangulated with internal documents such as reports and presentations as well as with publicly available information from annual reports and websites.

4 Findings

4.1 General Case Description

Alpha is the number one company in the building materials industry with more than 2000 subsidiaries in 90 countries. Their business is based on three product categories. Innovation plays a major role in maintaining Alpha's position as a global leader in its industry. Alpha develops high-performance materials in-house and has developed the world's leading R&D center for building materials. By protecting the intellectual property Alpha became in its industry one of the leading firms worldwide.

To maintain its position Alpha is dedicated to foster innovative and sustainably enhanced solutions. Therefore, Alpha conducts a companywide integrated innovation and patent

management process and classifies their integrated innovation and patent management as a cornerstone of their R&D and IP strategy.

4.2 Towards a Strategic Innovation Management

2005 represents a milestone in Alpha's innovation management approach. Before 2005 Alpha's innovation projects were assessed and launched by its research council, internally called 'R&D committee', with regard to their actual importance rather than with regard to a specific innovation or IP strategy. After 2005, innovation became a major focus point of Alpha. Alpha realized that they had no transparency of the innovations as well as of the patents they controlled, neither on corporate nor on local level. In addition, Alpha faced new environmental challenges, such as resource depletion and scarcity, urbanization, climate change, all effecting Alpha's industry heavily, as well as customer challenges, such as unmet and emerging needs. Confronted with these challenges, Alpha realized that they had to manage their innovations more proactively. As a consequence, Alpha's group management took its first strategic decision with regard to innovation. The research council was replaced by an innovation team and the patent management was centralized in a new team at Alpha's head quarter. All patents were consolidated on corporate level in a special purpose vehicle for intellectual property and Alpha's new patent management team decided on an IP strategy. For new innovations two focus areas (product development and process development) were selected, each managed by an innovation team. The new innovation teams were each composed with a dozen technical and legal specialists from the corporate level and local level, as well as with external specialists from the academic community. Each team defined an innovation strategy with regard to their focus area and managed the project portfolios in alignment with this strategy. The teams were supervised by two committees, one for each focus area. Furthermore, from now on the group management actively participated in the innovation management. Each focus area committee was headed by a group management member. In this new structure, regional projects of strategic importance were taken by the committee to a corporate level and partially supported with corporate financial and human resources. The two focus area teams worked formally mainly independent. Interestingly the only interlinking team member was the patent manager. In his role he was part of both committees with the goal to guard consistency in the corporate IP strategy.

After running the innovation and patent management in this structure for a couple of years, Alpha realized that the restriction on two focus areas does not allow the company to fully sense and exploit the potential of innovation.

“Innovation is more than just product and process development. Realizing this was the start of the innovation strategy developed by the group in 2010” (Interview: Patent Manager).

Accordingly, as of 2010 a corporate innovation strategy was formulated by the executives of the group management. Alpha replaced its former product and process focus areas by six innovation fields – from integrated customer solutions and energy solutions to new product and process development. To guide the innovation efforts in the innovation field, each innovation field defined its own specific innovation strategy that was aligned with the corporate innovation strategy. From this point on, also Alpha’s patent strategy was derived from the business and innovation strategy and in 2013 Alpha’s patent management got fully integrated into the innovation management process.

4.3 Integrated Innovation and Patent Management

4.3.1 INTEGRATED PROCESSES

To integrate the innovation and patent management, Alpha defined a classical stage-gate process for innovation management with an underlying patent management processes. This innovation stage-gate process is purposely defined on a rather generic level with the aim to be applicable for product development as well as all other innovation projects, such as new business model innovation for example.

The first phase in Alpha’s innovation process is the ideation and conceptualization phase. The intention is to collect ideas via an online tool to make them visible in the innovation portfolio and to be able to screen and conceptualize the high potential ideas as soon as possible. The second phase is the development, the third phase the pilot phase and the last phase the launch. All gates have the same overall criteria (strategic fit, risk and benefit). In addition, each gate has specific criteria. For example, to pass from the conceptualization to the development phase an innovation project needs to be checked for its market potential, technical feasibility, customer need and a decision about make or buy needs to be taken. To get from the development to pilot phase innovation projects are checked against criteria such as: acceptance of the market, technical and

operational readiness. Before the launch the project is evaluated with regard to success of the pilot, readiness of operation and production, external market conditions and feasibility of the roll-out plan. When checking for operational readiness it is important to align the business model if necessary. For example, Alpha launched a new product that allowed them to sell the product not in units ordered but in units used. This new product development thus allowed Alpha to apply a new business model, with a new revenue model.

To integrate the patent management into the innovation process Alpha defined three core processes of patent management which are strongly embedded into the innovation process: searching, patenting and clearing. In the searching process two kinds of searches are conducted: a general and specific search. In the general search process the patent management focusses on patent landscape analysis of the ecosystem whereas in the specific search process prior art analysis for specific inventions is conducted. The prior art search is directly integrated into the innovation management as a checkpoint of the first gate in the innovation process. For the prior art search, the patent management provides an easy template to the inventors, in which they describe their idea in their own technical and non-legal words. The patent management team then conducts the first level prior art analysis with the online tools “Thomson Innovation” and the “Patent Intelligence System” to reflect to the inventor in an early stage the potential of the idea.

“Many inventors think the patent application is very complicated and time consuming”
(Patent Manager 2).

The goal of the patent management team is to lower the entry barrier for inventors on one hand by working closely with the developers and project managers in technical and legal meetings, presenting and explaining the patent strategy and processes on the different sites and on the other hand by providing an easy template to the inventors.

In patenting process a patentability check and eventually a patent application are conducted. The results are integrated into the second gate of the innovation process. To apply for a patent a proof of concept is needed. In this process the patent management works closely with the inventor to understand the invention and to decide on the protection strategy. In addition, to choose the best application strategy the patent management works with the head of the responsible business units. The patent management team rates the patentability into excellent, good, bad. Then the decision to patent becomes a business decision. If an invention fulfills the legal criteria patentability (novelty and inventive step) and or a business interest (strategic and

commercial value of the invention is checked with the head of the business segment and cross check with the R&D strategy is done) the patent management team and the inventor prepare together the claim recommendations. The patent management challenges the information in the application template from a technical perspective and translates it into a legal patent claims. To be able to challenge the inventors it is crucial that the patent management team not only possesses legal but also technical know-how. The patent managers all have a technical education in Alpha's industry and worked as developers for several years either in Alpha's process or product development. The final drafting of the patent application is then mandated to an external attorney. Before submission, the patent application form is sent to the patent managers and inventors for review.

In the clearing process a freedom to operate (FTO) and freedom of action (FTA) analysis are the main outcomes, which are checked at the last gate of the innovation process. Therefore a country specific patent search is conducted to make sure that in the meanwhile between the patent application and the launch no new patents were granted to others that could become critical for the successful market launch (freedom to operate check) and if so to decide on the strategy of action (freedom of action check), e.g. prepare for a potential patent infringement claim.

"For example we once launched a product where we knew its patents were very close to a competitors'. He launched the product a year later. During this time we prepared our argumentation for non-infringement and invalidation of the competitor's patent" (Patent Manager 2).

Alpha's patent management main responsibility is to support the inventors and to provide input to the company's innovation strategy. Therefore, all knowledge from the search processes such as prior art, patentability checks and clearing, is secured by are purposely kept this processes in-house. This has its origins in the mindset of Alpha where people believe technology scouting and catching trend is essential to the company's business success. In contrast, administrative patent management task, such as patent application, maintaining and enforcement is mostly outsourced to law firms.

4.3.2 STRUCTURES

The innovation department is responsible for innovations to respond to changing and new expectations. In this department, cross-functional teams from innovation, commercial transformation and patent management functions work structurally close together.

The separation of the innovation projects into six innovation fields allows better coordinating and administering of innovation projects. Each innovation field is supervised by a steering committee. These field steering committees supervise project progress; decide if goals are reached and if a project shall further be developed. The field steering committees of the six innovation fields meet on a regular basis, to update each other about the innovation projects of the other fields. Each field steering committee consists of a board member, an innovation field manager, a coordinator supporting the exchange between R&D and innovation department, a patent manager and an innovator from the “Innovation Network” integrating the subsidiaries’ perspective.

The “Innovation Network” connects more than 300 innovators from Alpha’s subsidiaries via an internal online communication platform. The network has three major purposes: first, it facilitates information exchange and ensures cooperation between Alpha corporate and its innovators from different subsidiaries. Second, it facilitates the information exchange and cooperation between the different subsidiaries and third, it is used to diffuse innovations in the different countries.

“For example, if a solution is developed in India, that might be applicable also in Latin America, mostly Latin America would not know about this solution. However through the Innovation Network they can connect and exchange information about the solution and multiply it” (Innovation Field Coordinator).

To further push exchange between employees on corporate and subsidiary level, Alpha conducts so called “Innovation Exchanges”. It is yearly event, where employees, working in the innovation areas, are invited to update everyone about the developments in the subsidiaries.

At Alpha innovations are developed centrally as well as locally. The “Innovation Fund” is an integrated part of the innovation and patent management. Regional subsidiaries of Alpha can access the corporate “Innovation Fund” to conduct innovation projects, which the subsidiaries are not able to process due to financial constraints or due to a high project risk. The fund supports whole innovation projects or single project phases. Projects applying to the fund are first

allocated to one of the six innovation fields and then evaluated by the steering group of the projects' innovation field according to the stage-gate process criteria.

“Assumed an idea and a concept are being submitted, the project will be evaluated according to the criteria of gate one - such as: benefit for the group or strategic fit” (Innovation Manager).

Based on the evaluation results, the steering group makes a recommendation and board management members take the decision about the financing. The fund furthermore is actively used to foster innovation with regard to certain trends or specific market and client needs.

4.3.3 TOOLS

Innovation Intelligence

Alpha's so called “Innovation Intelligence” analyzes megatrends and new technologies with the aim to translate them into implications for Alpha's business. The results of the Innovation Intelligence, highlighting specific trends as well as the competitor's position with a focus of 5 to 10 years, are actively distributed electronically to the “Innovation Network” and to representatives on the corporate level. The results are meant to influence the first phase of a stage-gate process, the ideation phase, to deliver ideas matching the trends. To ensure that ideas are generated for all identified trends, Alpha plans to further formalize the process by not just identifying and sharing current trends but by conduction ideation workshops focusing on specific trends and filtering corresponding ideas pro-actively into the stage-gate process.

Patent Intelligence

Another tool to support the new product development is the “Patent Intelligence” system. In the “Patent Intelligence” system new patent applications and grants from Alpha's suppliers, major customers and competitors are gathered systematically with a search script in Thomson Innovation.

“The Patent Intelligence System is managed by people with technical background since the analysis requests deep technical know-how” (Patent Manager 2).

The collected data is evaluated and a shortlist of new patents for every business area is distributed to the corresponding technical experts of Alpha on a monthly basis. These technical experts rate the patents in an alert system covering the alerts: risk, opportunity, non-relevant. This rating is consolidated by the patent management team allowing Alpha to take action if necessary.

Furthermore the information is fed back into the Patent Intelligence System, making the expert knowledge available for every future search.

To make the information available to the entire group, Alpha's regional subsidiaries are provided with a newsletter on their internal communication platform, which includes all relevant Patent Intelligence results. The newsletter intends to serve as an idea pool for future innovation projects.

On a corporate level the patent intelligence system is used as tool to

"...answer the question do we have to adjust the innovation strategy of that innovation field?"
(Patent Manager 1).

It includes a dash board with information about new patents, patent trends in technological fields, competitor patent analysis and geographical patent analysis. In yearly meetings or upon request it is used to decide if the findings of the analysis might influence the innovation strategy of Alpha. The patent intelligence system's major output is to put data in a management context.

"For example, when the industry was forced by regulations to reduce their CO2 footprint, the "Patent Intelligence" system was heavily used to monitor the market and competitor movements. The innovation strategy was adjusted accordingly and specific innovation projects were launched" (Interview, Patent Manager). *"The corporate management wanted to develop more in the remote sensors. Our patent search showed that all the technology is already patented by suppliers and that the patenting peak was reached a couple of years ago. So we concluded that if we want to go there we should rather partner than develop ourselves"* (Patent Manager 2).

Communication Tools

The "Portfolio Innovation Management Tool" is implemented to ensure transparency and reportability of all innovation projects. It is an online tool, where project managers have to update their project status every six month. This data is used to report the innovation portfolio of Alpha to the chief innovation committee.

Furthermore, as stated above, an internal "Collaboration Platform" is used to share information but also to work mutually on projects. From an integrated perspective it connects inventors and patent managers. The platform provides e-learning videos about patenting, makes patent landscape and application relevant information and documents available and allows patent

managers and inventors to work mutually on documents, e.g. an application draft review. Working mutually on a document, replaces the e-mail traffic, saves time and reduces modification errors.

“Important is that our patent management does not see itself as a team mainly conducting administrative tasks but as a team that is part of the business development. All administration related tasks are outsourced” (Patent Manager 2).

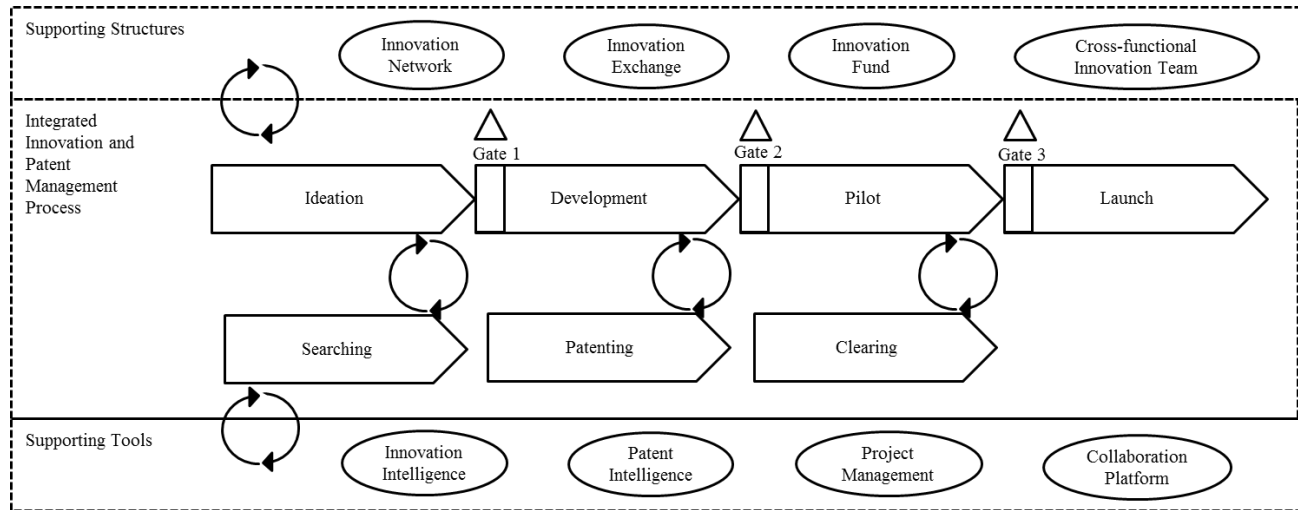


Figure 1: Integrated innovation and patent management of Alpha

The case of Alpha demonstrates that the capability to manage innovation opportunities is not only depend on an integrated innovation and patent management process, but also on the structures and tools supporting this process (Figure1). These findings provide evidence for Teece’s (2007) perspective of microfoundations.

5 Discussion

From our in-depth case study results we find that several specific microfoundations for sensing and seizing innovation opportunities and for business reconfiguration in an integrated innovation and patent management (Table 1).

Sensing opportunities

The sensing of opportunities and threads (Teece, 2007), at Alpha does not take place at a specific phase of the integrated innovation and patent process. Rather, it is a continuous task of the innovation and patent management teams.

We found that to better understand the trends and developments in their market and in other industries Alpha uses its Innovation Intelligence system. Understanding the market development and latent demand is found to be a crucial element for sensing new opportunities (Teece, 2007). At Alpha this sensing of innovation opportunities is conducted systematically and the results are used to influence the ideation phase outcome and thus to direct innovation.

We furthermore found that trend and opportunity search at Alpha is enhanced by extending the Innovation Intelligence with a Patent Intelligence system. The Patent Intelligence displays mature technologies, identifies white spots and subsequently helps to identify target technologies. This tool searches systematically for new patent applications of competitors, suppliers and customers with the aim to draw insights from the results with regard to their technical status and direction of evolution. This is in line with argument of Teece (2007) managers must assess the evolution of technologies, competitors, suppliers, and customers to sense opportunities and threads.

The systematic screening of the market evolution on basis of the Innovation Intelligence as well as Patent Intelligence tools is found to be a microfoundation to the capability of Alpha's managers to take R&D investment and market segment decision. The capability of managers to make decisions about the uncertain path ahead must be information-based (Teece, 2007). With its "intelligence" Alpha aims to foster decision-taking based on information and tries to prevent decisions based on pure assumptions. However using such systematic search tools might involve the risk of becoming a "...prisoner of the deeply ingrained assumptions, information filters" (Teece, 2007, p. 1322), especially when applying a narrow search approach. To prevent this Alpha follows a broad search approach, sensing opportunities in the whole ecosystem, including other markets and industries.

Furthermore the results of the Innovation Intelligence and Patent Intelligence not only serve as a decision basis for managers but also as a source of ideas for inventors. The results of the Innovation as well as the Patent Intelligence system are visualized and electronically diffused to innovators of the organization. From a dynamic capability perspective this is important since opportunities should be sensed by a wide range of employees and not only the management. The capability of employees to recognize opportunities is dependent on their capability and their access to information (Teece, 2007). Kang and Motohashi (2014) found that especially patents can be an essential knowledge input for R&D. Alpha provides filtered information its employees that are part of the so called "Innovation Network". The Innovation Network assembles more

than 300 employees from all over the world working to enhance new product development. Because these experts are most likely to make sense of the information provided, distributing the information to this selected group is leveraging the chances of identify new opportunities (Teece, 2007). From a dynamic capability view the Innovation Network of Alpha can be seen as a structural microfoundation of its sensing capabilities. This network structure is an important base for information and knowledge exchange between the subsidiaries in the decentralized organization Alpha. The advantage of such a decentralized organization is surely the sensing for local market and technological developments. Furthermore local developers understand the local customers' needs. This is positively correlated with the probability with a successful market introduction of an innovation (Freeman, 1974). However decentralization on the other hand bares the risk of information decay (Teece et al., 1997). The Innovation Network and the Innovation Exchange of Alpha are mechanisms that allow keeping the employees in the different locations as well as the corporate management informed. As the above description of the innovation management development of Alpha showed, such mechanisms were not in place at the beginning, with the effect that the corporate management was isolated from the subsidiaries' developments and markets.

Seizing opportunities

The seizing of opportunities, i.e. the addressing of opportunities through investments into new product development (Teece, 2007), takes place at each innovation process gate of Alpha. In our case the decision of investing into a particular project is information based. The project team must demonstrate to the cross-functional steering committee that the project fulfils the overall and the gate specific criteria as described. The committee than has to take a make or by decision. At this point the patent management plays a crucial role in the innovation process. At the first gate, after the ideation phase, the patent management advises, on basis of the Patent Intelligence Prior Art Search and Patent Landscaping results, the committee to take a make or buy decision (e.g. if according to the patenting landscape a technology is already mature, it might make more sense to partner instead of investing into the development of a own technology). In addition the patent management decides how the innovation should be protected and if a patent application should be filed or not. From a capabilities perspective the structured patent search in this innovation process phase is a microfoundation to the seizing capability of the management to take investment-decisions.

To foster innovation in subsidiaries and not to starve new projects of financing, subsidiaries are supported by the Innovation Fund of the corporation. This funding structure is reducing the financial risk of innovation to the subsidiaries. Since especially incumbent firms tend to be risk-adverse (Teece, 2007) such an innovation funding structure can leverage the seizing of opportunities in local subsidiaries. During the pilot phase and before the launch the presented case demonstrates that the clearing process's check for freedom-of-action is a further crucial microfoundation of seizing opportunities as well as of managing threads. In this process, the patent management outlines if competitors have applied for similar patents. In the case critical patents are found, assumptions about the competitors' behavior can be made and reaction strategies determined.

Microfoundation	Activity	Aim	Dynamic capability
Cross-functional Innovation Team	Improving of innovation processes, structures and routines	Become more efficient, effective and sustainable in innovation, prevent management from being isolated	Sensing, seizing and reconfiguring
Innovation Intelligence	Analyzing trends and environmental change	Detect relevant trends and threads	Sensing, seizing and reconfiguring
Patent Intelligence	Screening competitors, suppliers and customers	Identification of white spots and technologies research potential to support investment decisions and to serve as ideation pool	Sensing and seizing
	Prior Art analysis	Identification conflicting innovations	Seizing
	Freedom-of-Action analysis	Identification of potential threads and development of action strategies	Seizing and reconfiguration
Innovation Network	Exchanging information between experts about trends, innovation, market demands	Group wide knowledge diffusion	Sensing
Innovation Exchange	Exchanging information in workshops including non-experts	Group wide knowledge diffusion	Sensing
Innovation Fund	Financially supporting subsidiaries in their projects	Incentive for innovating and possibility to "direct" internal R&D	Seizing

Portfolio Management	Collecting projects and statuses	Project control and assessment	Seizing
Collaboration platform	Exchanging project information	Facilitate exchange and collaboration between cross-functional employees	Seizing

Table 1: Microfoundations supporting dynamic capabilities in an integrated innovation and patent management process

Reconfiguring

The seizing of new opportunities might cause the need for reconfiguration of the existing business (Teece, 2007). Our case showed that the triggers for reconfiguration can come from opportunities as well as from threads. In the case presented, the company faced the thread of having developed structures and rules that constrained the innovativeness of the company. At a later stage, regulatory changes did put the company's existing business into imminent danger. To avert these threads the company had to change and realign its innovation strategy, structures and processes. However, as mentioned the reconfiguration can be triggered by opportunities as well. When a new product development provided the opportunity for new revenue mechanism, the company in the case presented adjusted the business model accordingly. Managers seizing an opportunity must decide on the "...business model that defines its commercialization strategy and investment priorities. Indeed, there is considerable evidence that business success depends as much on organizational innovation" (Teece, 2007, p. 1327).

6 Conclusion, Implications and Future Research

Despite management research acknowledges the significance of patents for innovation (Mahoney and Pandian, 1992; Wernerfelt, 1984) and recently highlighted the importance of the alignment of intellectual property strategy with corporate strategy (Pisano, 2006; Reitzig, 2007; Tao et al., 2005) as well as with structures (Granstrand and Holgersson, 2013), research has widely neglected the integration of innovation and patent management (Ernst and Fischer, 2014). Due to emerging calls for research in this area, this paper analyzes how patent management and product innovation management can be integrated by deploying different bundles or combinations of resources. Furthermore, we explored the microfoundations of the integrated patent and innovation management. In doing so, we not only constitute one of the very first approaches to explicitly describe how the innovation and patent function of a company can be

integrated but are likely among the first to develop a dynamic capability view of an integrated innovation and patent management that offers several contributions for practitioners as well as for scholars.

This research focusses on the importance of processes, structures and tools for an integrated innovation and patent management. Practitioners profit from the results because guidelines for managers on how innovation and patent functions can be integrated and how they can strengthen their dynamic capabilities are offered. The case study confirms that innovation and patent strategies need to be aligned with corporate strategy. Furthermore, what matters for firms to be successful in the long run is not only being able to launch an innovation once, but to be able to adapt to their changing environment introducing and exploiting innovations repeatedly (Hertog et al., 2010). Adapting and reacting to the changing environment requires management activities and decisions (Teece, 2014). A major result of our research is that these activities and decisions can be supported by structures and tools assessing the current situation and the market development.

Scholars might find our results particularly valuable because it offers a grained view of microfoundations of dynamic capabilities and the collaboration mechanisms for the integration. By taking a capability perspective, this paper contributes to the management literature of (dynamic) capabilities by providing insights into the specific microfoundations of innovation management and thus follows the research calls for more studies to identify the microfoundations through which firms develop dynamic capabilities (Argote and Ingram, 2000; Spender and Grant, 1996; Teece, 2007). Furthermore, it contributes to the research of cross-functional integration in new product development and innovations management literature.

For researchers, our findings aim to spark future investigations. The following directions might be of particular interest. First, the integration has been emphasized to benefit enterprises' business (Tanaka 2013b). Recent studies found that the integration of the two departments leads to a strong patent portfolio, secures freedom to operate and has a positive effect on new product performance (Ernst and Fischer, 2014). Future research might further substantiate on and differentiate potential benefits. Second, due to the qualitative character of our study, we would like to encourage further confirmation of our results. And lastly, since "...the identification of microfoundations of dynamic capabilities must be necessarily incomplete, inchoate and

somewhat opaque...” (Teece, 2007, p.1321), future research should address the identification of additional microfoundations.

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