This paper illustrates the development of intellectual property (IP) as a management discipline over time. It starts by providing a brief historical overview of the role of IP in research and managerial practice. Changes that have caused the emergence of IP as a new discipline in management research and education are outlined subsequently. After that, the paper introduces a new framework to strategically manage IP within the broader context of technology management. The framework highlights the new and upcoming strategic roles and tasks of the “IP function” within firms. The paper concludes with a discussion of implications for the proficient management of IP in firms today and in the future, which stands in sharp contrast with how IP was valued and handled in many firms in the past.

Key words: Intellectual property; Patents; Management; Strategy; IP department

INTRODUCTION

Technology-based innovation has been a major driver of competitive advantage across multiple industries (1-3). Due to its high strategic relevance, the effective and efficient management of technology-based innovation has become of vital importance to many organizations (4,5). Klaus Brockhoff, in his contribution to this special issue, has outlined the emergence of technology and innovation management as a managerial discipline. As of today, the management of technology and innovation has become a core element in the field of management education and has established itself as an important and fast-growing research discipline (6-9).

Patents are by their nature very closely related to technology-based innovation. They are supposed to legally protect the inventor from imitation. Hence, patents are viewed as an important incentive for inventors and entrepreneurs to take risks and to make investments into research and development (R&D). Historically, the debate on the role of patents has been dominated by scholars in the fields of law and economics. The debate has been mainly focused on the effectiveness and usefulness of patents to spur innovation and growth. Only very recently, with some notable exceptions (10-13), has the management of patents and other forms of intellectual property (IP) received more attention in management research and education (14-16).

The objective of this paper is to illustrate the development of IP as a management discipline. I will start with a brief historical overview of the role of IP in research and managerial practice. I would like to point out at this stage that, within the scope and limits of this paper, I cannot possibly do justice to all work published in this area. I will, therefore, present only a limited view. I will then explain the changes that have led to the emergence of IP as a new discipline in management research and education.
While doing so, I will place special emphasis on the roles and tasks of the “IP function” within firms, which has changed substantially in recent years and will continue to change in the future.

A BRIEF HISTORICAL OVERVIEW

Patents are a legal means to exclude third parties from using the claimed invention. Therefore, they are considered an important legal mechanism to temporarily protect the innovator from fast and cheap imitation. Many famous examples show that inventors have successfully built their businesses based on their patents (17). This reinforces the fundamental idea and the intended positive outcome of the patent system incentivizing and rewarding inventors who take risks and make investments in innovation (18). In turn, it is assumed that this inventive activity creates wealth and prosperity for the society (19). This is further enhanced by limiting the monopoly right of a patent to a certain time frame and the requirement to disclose the invention so that others can build on and improve the initial discovery. This spurs overall technological progress, competition, and economic prosperity.

Historically, there are two streams of literature looking at fundamental propositions of the patent system: First, there has been an intensive debate among scholars, especially from the field of economics, on if and under what circumstances patents are an effective instrument to secure the appropriability of new technical knowledge (12,14,20). The degree of appropriability depends on many factors, such as the regulatory environment in a particular jurisdictional area, the speed of technological change, the complexity of a specific technology, product vs. process technology, industry characteristics (discrete vs. complex), the level of competition, and the existence of other means of protection (12,18,21). A very often cited work by Levin et al. (22) found that patents a) are an effective means of protection in specific, discrete industries such as pharmaceuticals; b) are the preferred option to secure technical knowledge compared to other means of legal protection for products rather than process; and c) are less important to secure competitive advantage compared to other managerial tactics, such as marketing and sales efforts, lead time, cost advantages, etc. (22).

Empirical research on the relationship between patenting activity and performance at the firm level has shown, at best, a weak correlation between patenting activity and subsequent performance, suggesting that the economic benefits of patenting are rather limited in most circumstances (23,24).

Second, considerable research has been devoted to the role of patents in fostering economic growth and prosperity in industries or countries. Schmookler (19), in his seminal work, established a strong correlation between patenting and indicators of growth and prosperity without, however, controlling for cause and effect in his analyses. Since then, we have witnessed an ongoing debate on whether the patent system fosters or prevents innovation activity and hence overall growth and economic development. Research in this domain aims at making recommendations with regard to changing or even abandoning the patent system altogether. For example, the recent emergence of so-called “patent trolls” or “patent sharks” has fueled the discussion as to whether the existing patent system is beneficial or not (25). Debates with regard to certain new and upcoming inventions in the fields of software, biotechnology, business methods, internet of things, etc., have led to ongoing challenges for the patent systems. As a result, the rules of the patent system have been changing to rebalance market powers arising from these new developments. These changes in the patent system are not consistent across regions, which affects the possibility of obtaining and enforcing patent rights globally. In sum, this stream of literature focuses on the regulatory side of the patent system, examining under which conditions the patent system either enables or hinders innovation and growth. The outcome of this research affects the effectiveness of patents to appropriate the investments in innovation as discussed above.

Historically, firms have always filed patents. Patenting activity, e.g., in the U.S., was, on average, stable for over more than 100 years (26). The main motive for filing patents was to protect the invention (12). Much of this activity was, to a large extent, inventor-driven, as inventors were motivated to see their inventions converted into patents. In Germany, because of its inventor law from 1957, inventors are legally entitled to receive a financial reward if their
firms use the patented invention in products they sell on the market. This motivates inventors even more to push for patent applications (27). The focus of the patent department in this context was to administer all activities around the patent filings, the corresponding documentation processes, and the reward system for inventors. The patent attorneys in the patent department would focus on filing a legally strong patent or serving as the liaisons with external patent attorneys or agents in case the patent filing process had partially or fully been outsourced. Patent departments tended to react to the filings generated by inventors and were not systematically involved in the research and development work in earlier stages (27,28). Top management exposure was low because patents were not considered to be an important element of a firm's strategy to achieve sustainable competitive advantage, and the contribution of patents to the firm's strategic and financial goals was mostly unclear or undefined. There was hardly any focus on linking patenting behavior with the firm's strategy or to focus on patents that would generate more value for the firm. The focus was largely on patent numbers, and the key metric used by top management was the number of patents filed per year. The enforcement of patent rights through litigation occurred very rarely. Other forms of IP such as trademarks did play as important a role in many technology-based organizations.

To sum up, the research focus has been historically on understanding if and under which circumstances patents constitute an effective mechanism to protect innovations from imitation and how the patent system should be ideally designed to foster innovation and growth in general. Historically, the patenting activity of firms has been stable and has focused on protecting inventions. The patenting activity used to be more inventor- or number-driven without a strategic focus. The role of the patent department was rather reactive and more focused on administrating the patent filing process. Patents did not play a significant role in a firm's strategy, and their contributions as potential value drivers were neglected. Table 1 summarizes the historic approach towards patents in many organizations. Given that this approach towards patents was exercised by many firms, it may not come as a surprise that research has more or less failed to establish a strong correlation between a firm's patenting activity and value creation (29).

Table 1: Historical Approach to IP in Organizations

| Strategy | No explicit patent strategy  
No link of patenting with corporate strategy  
Main motive: protection of inventions |
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Key performance indicators</td>
<td>Number of patents filed</td>
</tr>
<tr>
<td>Accountability</td>
<td>Weak</td>
</tr>
<tr>
<td>Top management exposure</td>
<td>None</td>
</tr>
<tr>
<td>Governance</td>
<td>Mostly part of legal</td>
</tr>
<tr>
<td>Focus</td>
<td>Administration of patent filings, inventor remuneration, litigation (to some extent)</td>
</tr>
<tr>
<td>Orientation</td>
<td>Reactive (mostly inventor-driven)</td>
</tr>
<tr>
<td>Organizational embeddedness</td>
<td>Low (low level of cross-functional involvement, strong internal department orientation)</td>
</tr>
<tr>
<td>Skills</td>
<td>Legal and technical</td>
</tr>
<tr>
<td>Methods/Tools</td>
<td>Use of methods and tools to support the administration of the patent portfolio</td>
</tr>
<tr>
<td>Integration across multiple IP regimes</td>
<td>Low (clear focus on patents)</td>
</tr>
</tbody>
</table>
THE CHANGING IP LANDSCAPE

Patenting activity has significantly increased in recent years. According to the World Intellectual Property Organization, approximately 2.7 million patent applications were filed globally in 2014. The growth of patent applications has been, on average, 6.5% per year over the last 10 years. This growth does not only come from well-established regions such as the U.S., Europe, and Japan but increasingly also from emerging economies such as China and Korea. This development reflects the increased relevance and speed of technology-based competition and the gaining importance of patents in this context.

The following main developments have caused a fundamental shift with regard to the relevance of patents:

First, patent holders are increasingly enforcing their patent rights. This has increased awareness among top management with regard to the relevance of patents to secure and to defend competitive advantage and the severe consequences of neglecting patent issues. Second, multiple market transactions have occurred that explicitly show the strategic and financial value of patents. For example, Google bought Motorola for $12.5 billion in 2011 to acquire its patent portfolio in order to defend its Android operating system in a very competitive telecommunication space. These prominent cases further increased top management awareness of the strategic and financial relevance of patents. Third, firms have become more aware that patents can be commercialized by means of licensing. The external commercialization of patented technology has become an important element of outbound open innovation strategies, and the establishment of technology markets for these transactions has further enabled new business models based on patents. In sum, these trends have caused top management to pay more attention to patent-related matters because the strategic and financial relevance has grown. This development has fundamentally changed how firms manage their patent portfolios today.

Research has shown that firms do not file patents only to protect their innovations. Other motives, such as licensing, cross-licensing, freedom to operate, patent pooling, investor relations, etc., have become increasingly relevant. In this context, it has become relevant to assess the value of patents. It has been established that the value of patents is skewed. Only a few patents are highly valuable, whereas the vast majority of patents are either limited or of no value at all. A growing stream of literature has focused on identifying and validating indicators that help to assess patent value. Firms have begun to switch their focus from quantity (number of patents filed) to quality (value of patents) in their strategies and investor communications.

Recent research has emphasized that the view on patents as the only significant IP regime is too narrow. Instead, strategies that integrate multiple IP regimes are most effective in securing and defending competitive advantages over time. Conley, Bican, and Ernst show, e.g., that a combination of patents and trademarks over time (value transference) can help to extend monopoly position beyond patent expiry, thus increasing appropriability and market share across multiple industries.

Another stream of research has suggested that the vast amount of information that is contained in patent documents can be used by decision makers in multiple areas, especially competitor monitoring, trend analyses and forecasting, R&D strategy assessment, identification and assessment of mergers and acquisitions (M&A) targets, portfolio optimization, identifying licensing opportunities, etc. A recent study shows that firms that systematically use and analyze information contained in patent documents for these purposes achieve higher overall firm performance (profitability) and extract higher strategic and financial value from their patent portfolios. Given the vast amount of patent data available globally, it has become important to use professional analytics tools that allow companies to effectively analyze patent data and to help decision makers elicit relevant insights.

In light of these developments, scholars have suggested that firms need to follow a different management approach towards patents and other forms of IP. Recent research, based on a sample of 158 technology-based firms from the U.S. and Germany, reveals that it is not the size of a firm's patent portfolio, but rather the proficiency of management of this portfolio, that impacts the amount of value that can be created via patents. Firms with higher levels of patent management proficiency exhibit higher levels of overall firm performance and
own a more valuable patent portfolio in terms of accessing important technologies (e.g., by means of cross-licensing), attracting strategic partners, attracting investors, and effectively constraining competitors (29). The strategic management of IP has thus become a critical firm capability to achieve and sustain a competitive advantage (15,16,48).

**THE IP MANAGEMENT FRAMEWORK**

The IP department, with its functional expertise, has emerged as an important actor to build up new capabilities (15). Table 2 illustrates the roles and contributions of the IP department.

Technology-based innovation requires the acquisition and implementation (use) of new technological knowledge (4). The acquisition, as well as the use, of new technological knowledge can either be organized internally or externally (4). The external part of new knowledge acquisition is often referred to as inbound open innovation and the external use of new knowledge is often referred to as outbound open innovation (49). In the following, the contributions of the IP department to this technology-based innovation process will be outlined. A distinction will be made with regard to the strategic vs. operational-tactical contribution of the IP department to the process of new knowledge creation and use (4).

### Internal Technology Acquisition

A key strategic task of technology management is to decide which, and in what intensity, internal R&D tasks should be pursued (50). These important R&D investment and portfolio decisions affect both the strategy and ultimately the success of firms in technology-intensive industries. False decisions may lead to crisis or missed growth opportunities (e.g., 51). Thus, these decisions require careful analyses, which include a) the early detection of technological changes, b) the assessment and forecasting of their effect on the competitive positions of firms, c) the awareness of R&D strategies of current and future competitors, as well as d) an understanding of alternative technological solutions with their respective advantages and disadvantages (4).

### Table 2: IP Department’s Contributions to Technology Management

<table>
<thead>
<tr>
<th>Technology Creation</th>
<th>Technology Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal</strong></td>
<td><strong>External</strong></td>
</tr>
<tr>
<td><strong>Strategic Contributions:</strong></td>
<td><strong>Strategic Contributions:</strong></td>
</tr>
<tr>
<td>- Forecasting</td>
<td>- Long-term safeguarding of competitive position via an integrated IP strategy over the product life cycle (including freedom to operate)</td>
</tr>
<tr>
<td>- Competitor analysis</td>
<td>- Creation of a strong brand position</td>
</tr>
<tr>
<td>- Technology assessment</td>
<td>- Protection of the unique selling proposition (USP)</td>
</tr>
<tr>
<td>- Portfolio decisions</td>
<td>- Infringement monitoring and litigation</td>
</tr>
<tr>
<td>- Protection of technological position and securing freedom to operate</td>
<td>- Innovation controlling and communication</td>
</tr>
<tr>
<td><strong>Operational-Tactical Contributions:</strong></td>
<td><strong>Operational-Tactical Contributions:</strong></td>
</tr>
<tr>
<td>- Patent applications</td>
<td>- Identification of exploitation options</td>
</tr>
<tr>
<td>- Inventor support</td>
<td>- Assessment of exploitation options</td>
</tr>
<tr>
<td>- Information provision</td>
<td>- Selection of exploitation options</td>
</tr>
<tr>
<td><strong>External</strong></td>
<td><strong>Internal</strong></td>
</tr>
<tr>
<td><strong>Strategic Contributions:</strong></td>
<td><strong>Strategic Contributions:</strong></td>
</tr>
<tr>
<td>- Target identification</td>
<td>- Identification of exploitation options</td>
</tr>
<tr>
<td>- Target assessment (quality, strategic fit)</td>
<td>- Assessment of exploitation options</td>
</tr>
<tr>
<td>- Assessment of different sourcing options</td>
<td>- Selection of exploitation options</td>
</tr>
<tr>
<td>- Creation and expansion of absorptive capacity</td>
<td><strong>Operational-Tactical Contributions:</strong></td>
</tr>
<tr>
<td><strong>Operational-Tactical Contributions:</strong></td>
<td>- Contract management</td>
</tr>
<tr>
<td>- Contract management</td>
<td>- Identification of potential users</td>
</tr>
<tr>
<td>- Identification and management of important persons with knowledge (key inventors)</td>
<td>- Assessment of technology value for potential users</td>
</tr>
<tr>
<td>- Price management</td>
<td>- Process management</td>
</tr>
</tbody>
</table>

Source: Based on Ernst (2014)
By means of systematic patent analyses, the IP department provides decision-relevant information. Tools and methods specifically designed for this purpose have been developed and are applied (11,39,40,50). Ideally speaking, the IP department possesses the necessary content and methodological knowledge to conduct meaningful patent analyses of the firm. The early integration of the IP department in firms’ strategic planning processes is advantageous because it can highlight options to build a sustainable technology and patent position, and it can identify white spaces that can be exploited. This information is important for formulating R&D strategies, as they allow for the effective protection of chosen technology strategies and prevent blocking by third parties. The IP department becomes a core element of strategic decision making, influencing the formation and execution of firms’ business strategies. The effective implementation of these activities requires the cross-functional integration of the patent and R&D departments (47,52) and other functions as needed.

In addition to these strategic aspects, the IP department contributes operationally and tactically to the process of internal technological knowledge generation. The IP department is an important point of contact for inventors to develop highly valuable patents. Based on their knowledge of the corporate strategy and the corporate patent situation in the relevant areas, as well as what is required to generate valuable patent applications, the IP department facilitates the alignment of inventive activity with strategic goals. As the IP department also possesses an overview of all R&D projects within the firm, it can establish connections and craft a concept out of the individual ideas. Redundant work is prevented, and R&D processes are facilitated. The IP department is able to provide this information prior to the R&D project start. However, the information remains relevant throughout the R&D projects, as it serves to develop solutions or points to potential challenges and problems of intended technical solutions. Therefore, close integration of the patent and R&D departments is recommended (47,52).

**External Technology Acquisition (Inbound Open Innovation)**

Firms have various options to generate technology externally, e.g., by means of licensing, R&D contracting, R&D co-operations, acquisitions, or corporate venturing. The motives for external technology generation are access to superior technological know-how, the realization of synergy effects, improved market knowledge, the reduction of R&D times and cost, and risk minimization (4). For strategic technology management, a key task is the decision if and how external technology should be generated (4).

The IP department provides a solid base to make these decisions (11,29,39). Based on their patenting activities, owners of interesting technologies are identifiable. Additional options may be established, e.g., by determining the target firms’ patent portfolio qualities. To determine the patent quality, various methods have been developed (39,40). Additionally, it is possible to determine synergies and overlaps with the focal firms’ patent portfolios, thus aiding in the assessment of strategic fit between acquirer and target, the choice of technology generation form, and target object selection (53). Overall, the IP department delivers decisive input to successfully generate external knowledge. It is, therefore, an important element of leveraging a firm’s absorptive capacity (54).

In addition to these strategic aspects, the IP department contributes operational and tactical tasks to the process of external technological knowledge generation. It is often involved in contract management, deciding on the success of targeted technology and knowledge transfer. It ensures the inclusion of all relevant intellectual property rights, including the transfer of required tacit knowledge. As a prerequisite, knowledgeable persons working in target firms, frequently termed key inventors, need to be identified (55). Particularly, the success of technology-motivated acquisitions depends on key inventors staying in the acquired firms (56). The IP department is able to pinpoint key inventors and help retain their valuable knowledge (55).

Another difficult task in technology transactions is pricing, particularly if technologies are not yet established in markets (57). With its qualitative and strategic assessment of the respective patent
portfolios, the IP department provides important information about the value of patented technologies. This helps to make better pricing decisions, especially since patents can be a reliable and objective proxy metric for valuation.

**Internal Technology Use**

The classic internal use of technologies is the development and launch of technology-based products, processes, and services (4). The core operational task of the IP department is the protection of these innovations by means of intellectual property rights. Innovations perform well on the market if they offer clear benefits for the customer, a so-called value, or unique selling proposition (USP). It is, therefore, critically important that this value aspect of an innovation is protected by IP (46). Thus, the IP department should work closely not only with R&D but also with the marketing department to better understand and to effectively protect an innovation’s value proposition. The resulting patents create a sustainable competitive advantage that allows firms to achieve revenue growth and charge higher prices, making these patents, in turn, strategically and financially important.

The IP department has to further ensure the maintenance of these patents, including enforcement against third parties when necessary. Furthermore, patent-based performance indicators can be used for innovation performance assessment and controlling purposes, as successful innovations usually possess higher-valued patents compared to competitors (11). Innovation leaders should therefore have high-value patent portfolios, which can be identified via benchmarking patent portfolios against the relevant peer group (40). Objective patent indicators can further be employed for investor relations purposes in order to signal innovation leadership to important stakeholders (40).

The key importance of the USP highlights another important property right: the trademark. The USP of new products often plays a major role in establishing a new and strong brand (46). Through an integrated communications strategy, the patent-protected functional aspect of a product can be transferred via trademarks into a strong brand that identifies the source of the initial innovation. This effect becomes particularly important when patents expire. The brand takes over the protection of the reputational aspects of the original innovation independent of the existence of patents. These elements of IP strategy have to be used in combination over the product life cycle. At first, the functional protection of an innovation by patents is important so that the firm is exclusively able to create a brand via its branding efforts. Through a strategy that integrates patents and brands, firms become able to prolong their strategic competitive advantages beyond the expiration of patents. The implementation and success of such integrated intellectual property strategies, termed value transference, has been illustrated by case studies in various industries, including pharmaceuticals, electronics, fast-moving consumer goods, and chemistry (46). In formulating these integrated IP strategies in collaboration with other functional areas, the IP department enhances the benefits from using technological knowledge along the entire product life cycle.

**External Technology Use (Outbound Open Innovation)**

In addition to internal technology use, there is increasing external technology use, including licensing, technology sales, and spin-offs (57). Knowledge markets have emerged, and best practice examples lead firms to aim at commercializing and using internally-generated knowledge externally also (34,36,41). Strategically, the IP department supports identifying, assessing, and choosing opportunities for external technology use (29). Successful technology marketing requires knowledge about entire patent portfolios since single patents are more challenging to be sold (41). Thus, each IP department needs to know its own patent portfolio, including its gaps, to strategically purchase and out-license patents, thereby creating a comprehensive portfolio that can best be marketed. In addition, knowledge of the competitive advantages generated by potential buyers’ application of the patented technologies is required (57). The IP department can identify potential users and assess the value technologies may have for them via strategic patent analyses. For example, strategic value may be generated from closing a strategic gap in the portfolio. Understanding the strategic relevance
of patent portfolios has implications for pricing the respective patents (41). In addition, contracts have to be prepared that include licensing agreements and, similar to external technology generation, other aspects of the transfer of tacit knowledge and the role of key inventors (55). Prior research on the external use of technological know-how shows that successful technology marketing is influenced by various aspects, including a firm’s corporate culture, strategy, organization, processes, teamwork quality, and incentive systems (57). Usually, these tasks are beyond the scope of the IP department. Thus, the IP department either needs to collaborate with other organizational functions for the purpose of external knowledge use or may even strive to develop the necessary additional competencies and capabilities to become the key driver in these important external technology commercialization processes. That would require the existence of more business-related and entrepreneurial skills in the IP department.

**MANAGERIAL IMPLICATIONS**

In order to make the contributions effective, research has begun to address the managerial requirements of the IP department in light of these new market realities. Scholars have started to address the interactions between the IP department and other functional areas in the organization, especially R&D (47,52,58). This research shows that the level of cross-functional collaboration between the IP department and R&D is critical for success. The role of the IP department and its alignment with R&D is particularly important for performance in the case of very innovative products or solutions (52). The integration is achieved by top management engagement, the explicit integration of IP-related aspects into the new product development process and milestones, and an IP-centric culture in the firm (28). Interactions of the IP department with other corporate functions, such as marketing, design, branding, and advertising, become very important for designing and implementing integrated IP strategies over the life cycle of a product (46).

<table>
<thead>
<tr>
<th>Table 3: Modern Approach to IP Management in Organizations</th>
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<tbody>
<tr>
<td><strong>Strategy</strong></td>
</tr>
<tr>
<td>Link to IP strategy with corporate strategy</td>
</tr>
<tr>
<td>Motive: Maximizing strategic and financial value to the firms</td>
</tr>
<tr>
<td><strong>Key performance indicators</strong></td>
</tr>
<tr>
<td><strong>Accountability</strong></td>
</tr>
<tr>
<td><strong>Top management exposure</strong></td>
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<td><strong>Governance</strong></td>
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<td><strong>Focus</strong></td>
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<td><strong>Orientation</strong></td>
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<td><strong>Organizational embeddedness</strong></td>
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<tr>
<td><strong>Skills</strong></td>
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<tr>
<td><strong>Methods/Tools</strong></td>
</tr>
<tr>
<td><strong>Integration across multiple IP regimes</strong></td>
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</table>
Table 3 summarizes the modern approach to IP management in contrast to the past (see Table 1). Firms have started to integrate their IP and business strategies (59-60). The motives for filing patents have expanded beyond protection and include licensing, cross-licensing, alliances and acquisitions, new business creation, freedom to operate, investor relations, etc. The ultimate aim is to increase the strategic and financial returns from investments into innovation and IP. Hence, the key performance indicator is not the number of patents filed but the quality and impact of patents with regard to generating these returns. Given the higher strategic priority given to IP, top management exposure of the IP department is much higher (61). This also involves a higher level of accountability, in which investments can only be justified in case of adequate returns. This has led in some organizations to the establishment of independent IP organizations with profit and loss responsibility. The modern IP department is proactive and is actively engaged along the entire innovation process, or life cycle, of the product. It focuses on multiple IP regimes and manages these properties in order to maximize the value contribution of these intangible assets to the firm’s goals (59,60). It has to interact and communicate with multiple functions, such as R&D, new business development, innovation, marketing, design, strategy, finance, etc. It is, therefore, moving away from a functional and internal orientation towards being embedded with many functions and processes inside and outside the organization (46). It uses a variety of tools and methods, especially those based on smart analytics solutions, which provide valuable information to decision makers, e.g., on strategy, trends, or M&A opportunities (61,62). The IP department, therefore, becomes a strategic consultant to many parts of the organization, where it needs to speak the language of the business and senior executive decision makers (61). As the IP department transitions towards this level of IP management sophistication, it will have to acquire a set of new skills beyond the legal and technical domains (46).

**SUMMARY AND OUTLOOK**

Overall, it has been shown that the roles and responsibilities of the “IP function” have dramatically changed over time and are expected to continue to change in the future. IP is increasingly considered an important enabler for securing sustainable competitive advantage. Top management has understood that the right management of IP is the key to maximizing the strategic and financial returns from investments in new technologies and innovations. Top management focus on IP-related matters will, therefore, continue to increase. In order to leverage IP as much as possible for the organization, the IP department will need to change from administrating patents to a modern IP department that proactively and strategically manages a firm’s IP portfolio to maximize returns and impact. The key metric for the IP department will shift from the number of patents filed to the generation of a high-quality patent portfolio that can be exploited in multiple ways as outlined above. This development will imply that the importance, visibility, impact, and accountability of IP departments will significantly rise in their organizations. That may even lead to the establishment of Chief Intellectual Property Officer (CIPO) positions. The role of the IP department will therefore transition from being, historically, a mainly legally and technically oriented corporate function to a more strategic and management-oriented corporate function (46). This requires employees in IP departments to have additional skills and qualifications. Some leading universities have, therefore, integrated classes on the strategic management of IP management into their curriculum. Overall, I anticipate an even broader diffusion of IP management in research and practice as an important and independent discipline with strong ties to technology and innovation management (63).
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