

Intellectual Property Management in Small and Medium-Sized Enterprises: A Systematic Literature Review

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Abstract

Small and medium-sized enterprises (SMEs) have been prominent in the world economy, contributing significantly to the generation of jobs. Despite the relevance in the economy, SMEs underutilize the mechanisms of protection and appropriation of intellectual property. In order to gather and synthesize strategies, managerial models and good practices related to the intellectual property management in small and medium-sized enterprises (SMEs), this article aims to analyze systematically the literature, as well as to identify important aspects and gaps in existing empirical knowledge. For this, 53 articles from periodicals indexed in the scientific bases Web of Science, Scopus and Science Direct were analyzed. It was verified that there is a pattern of management actions in the scope of SMEs with regard to the protection, appropriation and intellectual property management.

Keywords: Intellectual property; IP management; Small and medium-sized enterprises; SMEs.

1. Introduction

The main resource of an organization in the current economic scenario is intellectual capital, made up of human capital (knowledge, skills and competencies of people) and intellectual assets (covering knowledge that has been encoded in some way). Within the scope of intellectual assets, there is a subset of knowledge resulting from an innovative process called intellectual property (patents, trademarks, trade secrets, etc.), which needs to be strategically managed in order to provide business competitiveness (Harrison and Sullivan, 2011; Agostini, Nosella and Soranzo, 2015).

The intellectual property management is a set of concepts, methods and processes that aligns the actions of protection and appropriation of intellectual assets with the business strategy (Harrison and Sullivan, 2011), involving the planning, organization and execution of related actions to innovative products and processes. It also includes the systematic monitoring of the rights of these protected assets, as well as their commercialization, through contractual agreements that may include technology transfer, licensing, joint ventures, etc. (Kitching and Blackburn, 1998; Tietze, Granstrand and Herstatt, 2006).

The ability of companies to achieve return on investment in intellectual asset development - appropriability - is a major concern of innovation and technology policies in several countries (Leiponen and Byma, 2009). For this reason, the most important goal of intellectual property management is to add value to organizations, maximizing profitability and thereby ensuring competitiveness in the market. In this context, managers make a series of strategic choices to capture investment returns on innovation, including, for example, which appropriation strategy to use and whether or not to patent (Holgersson, 2013).

Considering that the value capture of innovation actions is a key factor for competitiveness, the intellectual property management is fundamental for small and medium-sized enterprises (SMEs), given their characteristics, which include, among others, resource limitations and innovation process (Brooking, 2010; Agostini and Nosella, 2017). In addition, because they exist in greater quantity in the market (when compared with the number of large companies), the SMEs are responsible for the generation of significant number of jobs, configuring themselves as inducers of the economy of several countries, mechanisms that make them increasingly solid (Klapper, Love and Randall, 2015; Bijaoui, 2017).

Despite the growing importance of SMEs in national economies, research on intellectual property management is mainly focused on large firms (Holgersson, 2013; Thomä and Zimmermann, 2013; Brem, Nylund and Hitchen, 2017). In addition, several researches point out that SMEs underutilize the mechanisms of protection and appropriation of intellectual property due to two reasons: first, the high costs of protection and execution; and, secondly, the lack of awareness of the importance and functioning of the means of protection, especially the formal instruments. In this scenario, gathering the literature on how these companies manage IP is fundamental to systematize concepts, practices and methodologies that can be improved by the scientific community and applied in the corporate environment.

In view of the above, this article aims to gather and synthesize strategies, management models and performance indicators related to the intellectual property management within the framework of (SMEs), through a systematic literature review (SLR). To achieve the proposed objective, the paper is structured as follows: besides this introduction, which provides a brief elaboration of the concept of intellectual property management and its importance for SMEs; in section 2 the fundamentals and steps performed in the SLR are exposed; the results and discussions are found in section 3; and section 4 presents the final considerations.

2. Methodology

A systematic literature review aims to provide an overview of existing research on a given subject by identifying, selecting and analyzing relevant studies in order to allow for audit. It is an essential scientific activity, particularly suitable for the understanding of a specific phenomenon in which the literature is fragmented or presents mixed results (Kitchenham *et al.*, 2009; Vázquez-Carrasco and López-Pérez, 2013; Briner and Walshe, 2014). In order to efficiently and effectively organize and execute the processes of Systematic Literature Review (SLR), the present study was divided into three stages: (1) planning; (2) execution; (3) classification and synthesis of the results

2.1 Planning

The planning consists of the formulation of the guiding questions of the research and the definition of the procedures to be followed in conducting the SLR. These procedures were organized in a document called "SLR Protocol". The present review focuses on the following guiding questions: what are the management models, strategies and good practices of intellectual property management adopted in small and medium-sized enterprises (SMEs)? To the extent that these managerial models, strategies and best practices have been identified, can one discern a structure or pattern of managerial actions within these companies?

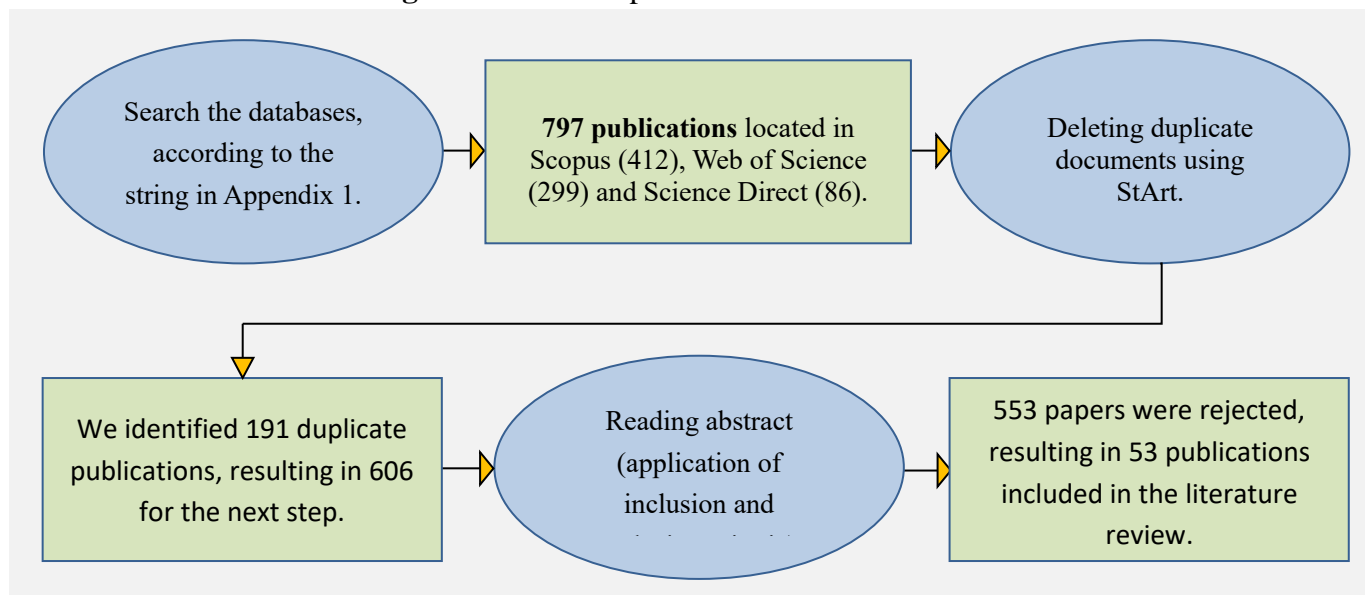
In order to find the answers to the questions presented above, three databases have been selected: *Scopus*, *Web of Science* and *Science Direct*. The choice of these bases is justified by the breadth, quality of indexed journals and their search functions. We opted for the inclusion of papers in the format of article, proceedings paper and review. Each database was queried according to the search string presented in Appendix 1, which included as many combinations as possible, in order to make the result more precise. The temporal cut of the search contemplated 32 years, from 1986 to 2018. The data obtained were treated by means of the software of *StArt* (State of the Art through Systematic Review), available in the portal <http://lapes.dc.ufscar.br/>.

It was adopted as inclusion criteria, in this systematic review, works that approach (1) management strategies; (2) management models; and, (3) practices related to intellectual property protection, appropriation and management actions in small and medium-sized enterprises (SMEs). On the other hand, besides duplicate works, those (1) that were not fully available in the researched sources were excluded; (2) that had a very specific approach (which could not be extended); and (3) those outside the scope of research.

2.2 Execution

Execution consists of the development of the research itself. The SLR was performed in the period from February 10th to July 31th, 2018, according to the procedures defined in section 2.1. Figure 1 illustrates the research process.

Figure 1. Research process in scientific databases



Source: Research results (2018), prepared by the authors.

As seen in Figure 1, in total, the first stage of the search process yielded 797 within the three databases. Duplicate documents were then deleted using StArt software and the inclusion and exclusion criteria were applied in order to reduce the list of publications. For this, a content analysis of titles and abstracts was performed to classify the main topic of each publication. When the content of the abstracts was inconsistent, the researchers looked more closely at the introduction, completion, or, if necessary, the full text. After this process, 553 results were excluded because they did not meet the criteria established in the protocol, resulting in 53 publications included in the systematic literature review.

2.3 Classification and synthesis of results

In this phase, a thorough examination of the documents selected in the previous phase was carried out. The following information from each of the 53 publications was tabulated: the title of the journal in which the work was published, the year of publication, the methodological procedures and the main results. Subsequently, from a codification, carried out with the aid of the *Nvivo Software*, the publications were classified.

Although the temporal cut of the revision covered publications from 1986 - year in which the first work contemplated by the string defined for the research was published - only since 1998 they have identified were published that were in line with the inclusion criteria defined for this SLR, as shown in Figure 2. According to the evidence, it is noted that the number of publications increased sharply, especially in the years of 2013 (nine articles) and 2017 (eight articles).

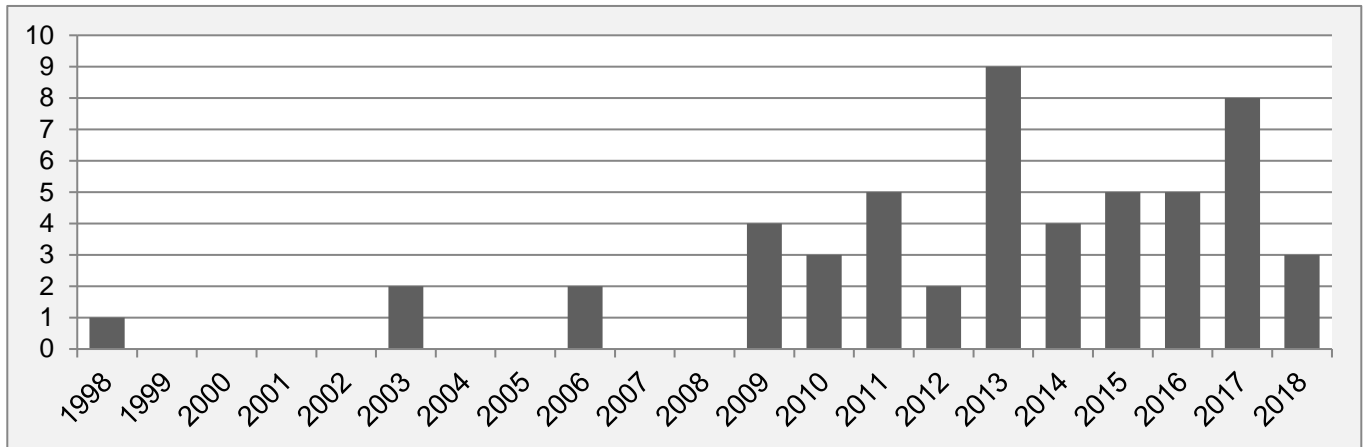


Figure 2. Number of articles published per year

Source: Research results (2018), prepared by the authors.

The results of this systematic review are mainly peer-reviewed articles (46), with the exception of seven proceedings paper. Peer-reviewed articles were most frequently published in the following scientific journals: Management Decision (four articles) and Technological Forecasting and Social Change (three articles). These numbers are not surprising, given the subject under analysis. The other articles (39) were published in a wide range of academic journals, whose scope is also related to business management, production engineering, technological innovation and economics.

With regard to the methodology applied in the development of articles, all studies are empirical studies, with the great majority having a quantitative approach (41). Only five articles, out of a total of 53, are qualitative and seven use quantitative and qualitative methods (Table 1). The method applied in the work with quantitative approach covers field research, panel data analysis, case studies (single or multiple) and semi-structured interviews.

Table 1: Methodology of the publications

Methodology	No. of publications
Empirical studies	53
Conceptual studies	0
Quantitative	41
Qualitative	5
Quantitative/Qualitative	7

Source: Research results (2018), prepared by the authors.

The codification of the revised documents allowed the identification of the main thematic groups. Thus, the work was grouped into three categories, according to the content scope of each one, as shown in Table 2.

Table 2: Thematic classification of the revised publications

Category	Number of publications	%
Intellectual property management and its implications in organizational strategy	21	39,6%
Strategy for protection and appropriation of innovation	20	37,7%
Cooperation strategy and management of intellectual property	12	22,6%
Total	53	-

Source: Research results (2018), prepared by the authors.

3. Discussion

This section presents the descriptive results of the study, involving the strategies, practices and propositions related to the intellectual property management in small and medium-sized enterprises (SMEs), according to the classification presented in Table 2.

3.1 Intellectual property management and its implications in organizational strategy

Intellectual property management must be integrated and aligned with the overall strategy of SMEs and adjusting as the business moves through different stages of its development desenvolvimento (Çela and Çela, 2013). This alignment improves the competitiveness of companies, by generating income and increasing market share. According to Brooking (2010), SMEs can accelerate their self-assessment by strategically growing their intangible assets, such as niche clients, brands and intellectual property, by comparing their actions with larger company strategies, describing and constructing scenarios for strategic planning which are easily understood by all employees and business stakeholders.

Based on a study of intellectual property in six German and Swedish companies, Tietze, Granstrand and Herstatt (2006) concluded that the process of defining a property strategy intellectual, aligned with the company's general strategy, should be divided into distinct stages, but did not define what these stages would be, only pointed out six aspects that should be considered to accurately describe these stages: capacity, competence, responsibilities, applied tools, awareness senior management and financial commitments. Eppinger and Vladova (2013), on the other hand, maintain that the steps that should integrate the process of managing the IP of an SME are the following: (1) assessment of the current market situation, technology, company and its environment of business; (2) definition of the desired IP situation to ensure a competitive position; (3) analysis of the options available to move to a more competitive market in terms of IP generation; and (4) decision on the allocation of resources for the implementation of strategies.

Internal knowledge is dominant in SMEs and focuses on the development of innovation activities (Valdez-Juárez, García-Pérez-de-Lema and Maldonado-Guzmán, 2018). For this reason, the intellectual property management in an integrated way to the organizational strategy is the main management challenge in many companies that, in addition to dealing with internally developed IP assets, should be concerned with the acquisition and exploitation of external technology, including an extensive set of tasks. However, Talvela et al. (2016) emphasize that, unlike large corporations, SMEs have limited knowledge about the

strategic IP management, and that to minimize this management deficit, four measures must be taken: (1) raising employee awareness of the invention process; (2) implementation of a compensation policy for employee inventions; (3) impairment of top management; and (4) understanding of the costs of PI protection.

In the view of Maldonado-Guzmán et al. (2016), the competitive market dynamics demand that SMEs incorporate knowledge management as part of their business strategies. For these authors, improving the flow of information sharing between the company and employees is essential in the construction and maintenance of competitive differentials, since it optimizes the production of knowledge that can be transformed into new processes, products and services, requiring integrated strategies of protection and ownership of these innovations. In this context, managers must make a number of strategic choices to capture returns on investment in the innovative process, including which strategy to use, whether or not to patent, among others (Holgerson, 2013).

The determinants of the implementation of ownership strategies depend on a number of factors. Holgerson (2013) interviewed managers of 26 entrepreneurial SMEs and found that the propensity for patents, for example, is lower in SMEs compared to large firms and that patenting as a means of ownership is of minor importance among SMEs. Patents were used by these companies to attract customers and venture capital, which is of paramount importance for competitiveness. Already Delerue and Lejeune (2011), when analyzing the determinants for the strategic use of business secrecy, from a sample of 297 SMEs operating in 19 countries, pointed out that attributes of the institutional environment, such as cultural values that shape organizational behaviors and managerial decisions, explain managerial use of this protection mechanism.

A study by Batra et al. (2015), together with 162 manufacturing SMEs in India, revealed that small and medium-sized manufacturing enterprises, because of their limited resource base, tend to be especially sensitive to the conditions of appropriability in their industry, and this influences the capacity for innovation companies. In addition, the results also highlight the technological orientation as a specific characteristic of the company that allows to overcome the adverse conditions of appropriability posed by the industry. Even when the patent regime is unfavorable, technology-oriented companies are able to innovate and perform better. Technology orientation includes a strong commitment to R & D, the use of improved technologies for decision making, the development of technologically advanced products, recognition of employees' efforts to acquire skills aligned with organizational strategies and adaptation to the environment in ever changing, in order to exploiting new opportunities (Batra *et al.*, 2015).

Small and medium-sized enterprises (SMEs) have difficulty identifying appropriate technological opportunities under severe constraints on capacity and resources (Lee *et al.*, 2014). For this reason, the intellectual property management has become crucial for these companies, which need to adopt different strategies to develop and exploit knowledge. In this context, several researches have been developed to provide SMEs with increasingly sophisticated IP management mechanisms. In Table 3, the main propositions of methodologies and strategies extracted from the documents that integrate the present systematic literature review are presented, divided into six thematic areas, according to the scope of the

research: (1) market intelligence; (2) financing capacity; (3) performance evaluation; (4) knowledge management; (5) support for decision making; and (6) operational efficiency.

Table 3 - Proposition of methodologies and strategies intellectual property management

Scope	Proposition	References
Marketing intelligence	Methodology for the identification of opportunities through the correspondence of multiple keywords, through the collection of relevant patents of the existing technology of an SME, using a patent citation process in two phases: (1) creation of a table of applications and technological attributes; (2) classification of patents collected in basic opportunities.	(Lee <i>et al.</i> , 2014)
	Logical Model of Strategic Patent Deployment Thinking (SPDT) to systematically collect and analyze market information in order to identify significant factors of consumer demand as well as current trends in the state and technology development, facilitating allocation assessments and solutions based on the technological resources of SMEs.	(Clarke and Turner, 2003)
	Methodology, based on the TRIZ theory, to support SMEs in the intellectual property management autonomously, through the monitoring of relative patents to the chosen technology, as well as analysis of the competencies and structure of the company to protect intellectual property through patents and trademarks.	(Regazzoni, Rizzi and Nani, 2011)
	Development of methodologies, aimed at identifying new business opportunities based on market demands, through design thinking and patent information as the basis for a set of operational processes.	(Fang-Pei Su <i>et al.</i> , 2015)
Financing capacity	A model for assessing the capacity of financing intellectual property for small and medium-sized technology enterprises, in order to assist them in the definition of strategies for raising funds from financial institutions.	(Shang, Qiu and Wen, 2017)
Performance evaluation	Methodology for the creation of the maturity curve, in order to show the evolution of SMEs in terms of performance in the management of intellectual property, based on two approaches: IIP - Innovation Index (A = Attention - knowledge; I = Interest - protection; D = Desire - management; A = Action - exploitation).	(Enjolras <i>et al.</i> , 2014)
	Diagnostic tool (intellectual property questionnaire), based on the adaptation of the AIDA model, to classify the practices and uses of IP on a progressive scale of four levels: (A = Attention - awareness about IP; I = Interest - IP protection; D = Desire - IP management; A = Action - IP exploration)	(Petit <i>et al.</i> , 2011)
Knowledge management	Framework for the analysis of knowledge management practices in the biotechnology sector, aiming to demonstrate that the knowledge-based view (KBV) should be modified and expanded to incorporate intellectual property, considering the sources competitive advantage as complementary and not mutually exclusive.	(Chen <i>et al.</i> , 2013)
	A method to aid decision-making on the most appropriate IP strategy for innovations in medical nutrition SMEs through a seven-step process of analysis, answers to the	(Weenen <i>et al.</i> , 2013)

	following questions: (1) Is innovation radical? (2) Is it easy to enter competitors? (3) is reverse engineering? (4) is the cost of development and testing high? (5) what is the expected return on investment? (6) is a complicated platform technology; and (7) is it a single composition of matter?	
Support for decision-making	Methodology to support decision making, which consists of dividing the portfolio of patents of SMEs into four quadrants: (1) patents with high market value but low value of the company; (2) patents with high market value and high value of the company; (3) patents with low market value and low value of the company; and (4) patents with low market value and high value of the company. For each of these quadrants, a set of generic strategies was assigned.	(Littmann-Hilmer and Kuckartz, 2009)
Operational Efficiency	Modeling the Activity table to increase the efficiency of the management of intellectual property at reduced costs by examining the actions of individual agents (resources or entities) in order to identify "bottlenecks" which hamper IP processes in the exploration phase.	(Modic and Damij, 2017)

Source: Research results (2018), prepared by the authors.

Analyzing the mechanisms of support to the intellectual property management presented in Table 3, it is observed that, although the focus of some propositions is for operational practices, there is convergence in the alignment between actions related to intellectual property for the organizational strategy of SMEs. Actions related to competitive intelligence, financing capacity, performance evaluation and knowledge management have a significant impact on the competitiveness of companies, as they provide the favorable conditions for the creation and delivery of value to customers.

3.2 Strategy for protection and appropriation of innovation

Small and medium-sized enterprises can apply various mechanisms to protect the results of their innovative effort as some methods complement or replace others. Different methods can be used in complementarity when inventions or technological innovations are composed of separately protectable components. In other words, protection mechanisms are not mutually exclusive (Landry, Amara and Saihi, 2009; Sey, Lowe and Poole, 2010; Hall and Sena, 2017). In the revised articles, the authors present two categories of protection methods: (1) formal protection mechanism (characterized by having a legal basis), which includes patents; industrial designs; trademark registration, copyright, etc.; and (2) mechanism of informal protection (extralegal), contemplating lead time advantage; trade secrecy, product quality maintenance, design complexity, etc. (Kelli *et al.*, 2010; Mol and Masurel, 2011; Thomä, 2013).

The choice of the method of protection and appropriation is conditioned by factors such as the degree and type of innovation, the organizational model and the general market environment. In other words, it depends on the context and organizational process, corporate objectives and technology characteristics of SMEs (Willoughby, 2013; Hall and Sena, 2017). For example, an expressive part of the operational knowledge in small companies tends to be tacit, functioning, therefore, as a method of effective

appropriation. In addition, patents may not be available to a large number of small enterprises, precisely because their tacit knowledge base can not be reduced to coded information (Thomä and Bizer, 2013).

The study by Leiponen and Byma (2009) other aspects, the relationship between firm size and the use of innovation protection mechanisms. According to these authors, the appropriation strategies adopted by SMEs differ in qualitative terms from the strategies applied in large companies. In research on Finnish SMEs in the manufacturing and services industries, it appears that many SMEs prefer informal protection practices to the detriment of formal protection mechanisms. Only small, R & D-intensive companies, in cooperation with universities and research centers, have seen patents as the most relevant protection instrument. The research also shows that cooperation actions related to innovation influence the type of appropriation strategies chosen by SMEs.

In general, SME managers do not notice, in formal protection mechanisms, a way to profit from innovation and do not have specific know-how in relation to these mechanisms (Agostini, Nosella and Soranzo, 2015). For this reason, they opt for informal methods, such as delivery time and business secrecy, to deem such methods more familiar, cheaper, less time-consuming, and more effective (Kitching and Blackburn, 1998; Leiponen and Byma, 2009). In a case study on the protection of innovations by SMEs, through analysis of patent data and 20 interviews with owners or managers, Mol and Masurel (2011) found that 65% of SMEs preferred other forms of protection to which patents and non-patented innovations are mainly protected by confidentiality clauses. The interviews also showed that the variables time in the market, type of innovation and R & D expenses influence the degree of formalization of protection.

A research about the available protection used by SMEs in their innovation activities, carried out through a multiple case study, pointed to evidence that complements the findings of Mol and Mol and Masurel (2011). According to the survey, SMEs tend to focus on protecting "innovative inputs" (which require trade secret protection and other complementary management practices) in contrast to protecting "innovative products" (which require patent protection) and therefore are believed to be more easily managed (Olander, Hurmelinna-Laukkanen and Mähönen, 2009).

From evidence gathered from research in manufacturing SMEs, Landry, Amara and Saihi (2009) point out that there is complementarity and independence between the various protection mechanisms (formal and informal), which are mutually reinforcing and should be considered as defining appropriation strategies. According to them, SMEs can formulate four generic strategies, based on complementary combinations, to protect their inventions and innovations: (1) pure formal strategy; (2) formal strategy supported by secrecy; (3) pure informal strategy; and (4) informal strategy supported by trademarks.

With respect to the protection strategies that can be applied throughout the innovative process, Seo et al. (2015) suggest four possibilities: formal (patents, industrial design), informal (secrecy, lead time), mixed (informal and informal) and investment in complementary assets. The authors analyzed the application of this combination of strategies in a sample of 640 manufacturing SMEs. The results show that the informal strategy (secrecy, lead time) is efficient at the stage of the invention. In addition, the mixed use of formal (patent) and informal strategies results in greater productivity at the marketing stage. Finally, the results suggest that productivity may vary depending on the investment in complementary assets.

Thomä and Zimmermann (2013), on the other hand, add the retention of qualified staff to the role of informal mechanisms of innovation protection. This appropriation strategy consists, in particular, of specific human resources management practices implemented by employers, with the objective to increase employee commitment. Such practices may include creating learning opportunities and appropriate compensation plans, valuing and recognizing employee contributions, and providing career opportunities. Considering that the SME knowledge base tends to be less explicit and less formal, resulting in know-how based on experience, with strong tacit elements typically embedded in human capital, retaining qualified staff should be a special concern of SMEs. Innovations developed on the basis of people's unique skills and quickly launched into the market generate greater profits for SMEs, since the knowledge created internally will be sufficiently secure through informal appropriation schemes (Agostini, Nosella and Soranzo, 2015; Seo *et al.*, 2016).

For Kitching and Blackburn (1998), there is a scale of application of methods of protection to intellectual property. In this way, SMEs can be divided into four groups, according to the degree of formalization of the methods used. In the first group, there are SMEs that do not take any conscious protective action; in the second, those that use informal mechanisms of protection (secrecy, advantages lead time, etc.); in the third, companies that adopt non-registrable legal regimes (clauses of confidentiality, licensing, etc.); and in the fourth group, SMEs making use of registrable intellectual property methods (patents, industrial design, etc.). According to the authors, owner-managers of SMEs preferred the formal mechanisms of protection in situations where the potential benefits of use were perceived as exceeding the operational costs of applying such mechanisms.

Regardless of the type of appropriation mechanism to be implemented (formal or informal), these should be in line with the company's overall strategy. In addition, it is important to consider that an overemphasis on protection (especially through patents or secrecy) rather than the exploitation of innovation may lead SMEs to face deterioration in their innovative and therefore economic and financial performance (Agostini, Nosella and Soranzo, 2015). In the present systematic literature review, four articles have been identified that address the importance of protection, but do not fail to emphasize that this protection must converge to the aspects related to exploitation.

In this sense, when dealing specifically with formal protection mechanisms, Flikkema, De Man and Castaldi (2014), through a study of a sample of 660 trademark applications in the Benelux countries, found that trademark counting is an important indicator of innovation for SMEs. The study has shown that protecting IP is a reason for registration for about half of trademark applicants. In addition, about 60% of the new brands referred to innovation activities. Trademarks, besides providing protection to the image of the company and its products, are complementary mechanisms with regard to exploitation, because the stronger and more protected, the more value they add to the company and the products to which they are associated.

The importance of formal mechanisms for SMEs is advocated by Ghatak (2003), who points out that the effective use of patent information can be very useful in determining the competitive position of a company in the market. Corroborating with Ghatak (2003), the Kay, Youtie and Shapira (2014) research focused on how indicators of research and patenting activities can be applied in obtaining information from

technology-based IP strategies. For Wang, Hu and Cai (2012), based on data from 1378 patents of 639 small and medium enterprises in Zhejiang province, China, patenting is extremely relevant for SMEs, especially those that cooperate with universities and research centers. However, so that these companies can use and benefit fully from this appropriation mechanism, it is fundamental that the government creates a solid market environment for the industrialization of patented technologies, through specific public policies.

Finally, addressing patenting in firm-level SMEs, Hsueh and Chen (2015) developed, based on a study of 238 innovative SMEs, an taxonomy of patent strategies, through cluster analysis. The classification covers five categories of strategies: *comprehensive* (management of the most active patents, to evaluate the commercial value and its competitive use); *exploitative* (improving the quality of patents, by managing portfolio maintenance cost); *defensive* (deposit of significant number of patents, providing a shield to protect the company from litigation), *reactive* (filing and accumulation of patent advantage, without management and extraction of value, due to the absence of a suitable process); and *marginal* (use of patents as a complementary strategy to other protection mechanisms). The companies that fall into the category of comprehensive strategies are aligned with the position pointed out by Agostini, Nosella and Soranzo, (2015) about the focus, both in the protection and exploitation of innovation.

3.3 Cooperation strategy and management of intellectual property

Intellectual property management is taking a prominent position in the current competitive environment, in which companies, especially SMEs, are increasingly considering the application of open innovation strategies in order to offer new products, services and processes to the market. In the context of open innovation, companies - even those most prepared and aligned with the market - should consider the identification and application of knowledge as an essential factor in the innovative process (Agostini and Nosella, 2017; Brem, Nylund and Hitchen, 2017). Resource-constrained SMEs can adopt various forms of alliances, such as collaboration in R & D, outsourcing, joint venture, etc., including through collaboration in networks with larger companies and research centers (Hu and Tsai). These alliances provide access to human, technological and financial resources, ensuring appropriability through access to markets, partners and strategic knowledge, reducing the costs and risks of innovation (Hu and Tsai, 2006; Rehman, 2016).

According to Van Rijnssoever, Kempkes and Chappin (2017), SMEs, when participating in an innovation project, can apply three different strategies regarding the degree of openness: making, buying or allying. Based on a survey of 427 SMEs, these authors identified four latent categories of companies about the propensity to choose one of the three strategies cited above: (1) SMEs oriented abroad; (2) Inward-oriented PMEs; (3) Collaborating SMEs; and (4) Flexible SMEs. In the case of externally oriented and flexible SMEs, the evidence identified in the revised articles points to a positive impact on intellectual property (Agostini and Nosella, 2017; Brem, Nylund and Hitchen, 2017). In addition, these firms are more likely to interact with market-based agents (providers) in relation to localized learning networks; in both cases, there is an increase in innovation capacity (Zubielqui, Jones and Statsenko, 2016).

In analyzing primary and secondary data of 150 Italian SMEs, Agostini and Nosella (2017) found that the skills and knowledge of the employees (internal knowledge for innovation) have a positive impact

on patent propensity; and open innovation (partnerships and alliances) has a positive influence on the size of the patent portfolio. The study by Brem, Nylund and Hitchen (2017), carried out in the Spanish Community Innovation Survey database for 2,873 companies, pointed out that SMEs benefit from open innovation in different ways with formal and informal mechanisms of protection depending on which protection mechanism is used and how it is applied. However, according to the authors, the benefits for SMEs are much lower when compared to large companies.

In the view of Freel and Robson (2017), open innovation creates for SMEs a trade-off between the cost of losing control of the technology and the benefits of aggregating knowledge from other actors to improve innovation, since openness results in exposure, which can create tension with appropriation. In this sense, as a way to strengthen the trust of partners and promote the exchange of knowledge in the cooperation process, inventions resulting from collaboration in R & D can be presented in the form of co-patents (Lv, Zeng and Lan, 2018). Based on an analysis of 74 biopharmaceutical research and development alliances, Delerue (2018) has shown that joint patenting can be done to keep partners "hostages" as a way to ensure continuity of partnership, since this way of patenting creates overlapping boundaries that can persist beyond the alliance relationship, provided there is a managerial framework to monitor the process of joint patenting.

Finally, according to Belingheri and Leone (2017), among the main intellectual property management mechanisms for innovation collaborative, licensing is one of the most used in the scope of SMEs, being responsible for establishing an effective connection with the market in the innovation process. The authors assert that licensing is a strategic tool for companies, especially startups, as it provides them with additional channels to acquire know-how in the market. For Rassenfosse (2012), in SMEs one of the main determinants of patenting is obtaining revenue through licensing. Köhler (2011), in turn, complements addressing cross-licensing in his all. According to him, technological interdependence is a key factor in motivating companies to engage in cross-licensing transactions. In this type of licensing, there is a prominent use of patents as a means of blocking competitors and boosting their own technological image

4 Conclusion

This article has summarized empirical studies on the intellectual property management in small and medium-sized enterprises (SMEs). The review of 53 articles suggests some progress towards understanding, from the systematization of concepts, good practices, strategies and management models, how intellectual property is being implemented in SMEs. In addition, the study contributes to the literature outlining the research patterns in this area, since it allowed the authors to capture the entire spectrum of intellectual effort on the subject, through a rigorous approach in the analysis of the works.

Systematic review is an evolutionary process and aims to answer some important questions for research in a given area. Based on the content of this review, it was verified that there is a pattern of management actions in the scope of SMEs with regard to the protection, appropriation and intellectual property management. There was also a diversity of contexts, but the research focuses on three aspects: (1) the intellectual property management and its implications in the organizational strategy; (2) the relationship

between the formal and informal mechanisms of protection of the result of the innovative effort; and (3) the intellectual property management through cooperation strategies.

With regard to the methodologies and strategies proposals extracted from the reviewed documents, the contribution of the researches to market intelligence, monetization of intellectual assets, performance evaluation in IP management, knowledge management, decision making on appropriation strategies and operational efficiency. Most of the strategies and methodologies proposed had a focus on the creation and delivery of value by SMEs, since they converged towards the alignment between the actions related to intellectual property and organizational strategy.

Given the breadth and quality of the articles analyzed, this SLR is an important contribution from the academic point of view, since it will allow an analysis of which strategies to protect intellectual assets are best suited to SMEs, especially with regard to formal and informal mechanisms of appropriation and their relations with organizational strategy, in (partnership in R & D, outsourcing, joint venture, etc.), and can be improved by the scientific community and applied in the corporate environment.

In general, considering the characteristics of SMEs, future research should focus more specifically on certain mechanisms protection (trademarks, trade secrets, lead time, retention of qualified personnel, etc.), since a considerable number of articles dealt only with patents as a protection mechanism, while others only compared the formal and informal mechanisms.

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Apêndice 1 - Search strings applied in the systematic literature review

Databases	Search string
<p>Scopus (Search date: February 15th, 2018)</p>	<p>TITLE-ABS-KEY (smes AND "Intellectual property") OR TITLE-ABS-KEY (smes AND patent*) OR TITLE-ABS-KEY (smes AND appropriability) OR TITLE-ABS-KEY (smes AND patenting) OR TITLE-ABS-KEY (smes AND trademark*) OR TITLE-ABS-KEY (smes AND appropriation) OR TITLE-ABS-KEY ("Small and medium-sized enterprises" AND "Intellectual property") OR TITLE-ABS-KEY ("Small and medium-sized enterprises" AND patent*) OR TITLE-ABS-KEY ("Small and medium-sized enterprises" AND appropriability) OR TITLE-ABS-KEY ("Small and medium-sized enterprises" AND patenting) OR TITLE-ABS-KEY ("Small and medium-sized enterprises" AND trademark*) OR TITLE-ABS-KEY ("Small and medium-sized enterprises" AND appropriation) OR TITLE-ABS-KEY ("Small and medium enterprises" AND "Intellectual property") OR TITLE-ABS-KEY ("Small and medium enterprises" AND patent*) OR TITLE-ABS-KEY ("Small and medium enterprises" AND appropriability) OR TITLE-ABS-KEY ("Small and medium enterprises" AND patenting) OR TITLE-ABS-KEY ("Small and medium enterprises" AND trademark*) OR TITLE-ABS-KEY ("Small and medium enterprises" AND appropriation).</p>
<p>Science Direct (Search date: February 20th, 2018)</p>	<p>TOPIC:(smes AND "Intellectual property") OR TOPIC:(smes AND patent*) OR TOPIC:(smes AND appropriability) OR TOPIC:(smes AND patenting) OR TOPIC:(smes AND trademark*) OR TOPIC:(smes AND appropriation) OR TOPIC:("Small and medium-sized enterprises" AND "Intellectual property") OR TOPIC:("Small and medium-sized enterprises" AND patent*) OR TOPIC:("Small and medium-sized enterprises" AND appropriability) OR TOPIC:("Small and medium-sized enterprises" AND patenting) OR TOPIC:("Small and medium-sized enterprises" AND trademark*) OR TOPIC:("Small and medium-sized enterprises" AND appropriation) OR TOPIC:("Small and medium enterprises" AND "Intellectual property") OR TOPIC:("Small and medium enterprises" AND patent*) OR TOPIC:("Small and medium enterprises" AND appropriability) OR TOPIC:("Small and medium enterprises" AND patenting) OR TOPIC:("Small and medium enterprises" AND trademark*) OR TOPIC:("Small and medium enterprises" AND appropriation).</p>
<p>Web Of Science (Search date: February 25th, 2018)</p>	<p>TOPIC:(smes AND "Intellectual property") OR TOPIC:(smes AND patent*) OR TOPIC:(smes AND appropriability) OR TOPIC:(smes AND patenting) OR TOPIC:(smes AND trademark*) OR TOPIC:(smes AND appropriation) OR TOPIC:("Small and medium-sized enterprises" AND "Intellectual property") OR TOPIC:("Small and medium-sized enterprises" AND patent*) OR TOPIC:("Small and medium-sized enterprises" AND appropriability) OR TOPIC:("Small and medium-sized enterprises" AND patenting) OR TOPIC:("Small and medium-sized enterprises" AND trademark*) OR TOPIC:("Small and medium-sized enterprises" AND appropriation) OR TOPIC:("Small and medium enterprises" AND "Intellectual property") OR TOPIC:("Small and medium enterprises" AND patent*) OR TOPIC:("Small and medium enterprises" AND appropriability) OR TOPIC:("Small and medium enterprises" AND patenting) OR TOPIC:("Small and medium enterprises" AND trademark*) OR TOPIC:("Small and medium enterprises" AND appropriation).</p>