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CAPACIDADE INOVADORA BASEADA EM PROPRIEDADE INTELECTUAL: UM FRAMEWORK DE GESTÃO CONCEITUAL

INNOVATIVE IP-BASED CAPABILITY: A CONCEPTUAL MANAGEMENT FRAMEWORK

CAPACIDAD INNOVADORA BASADA EN PROPIEDAD INTELECTUAL: UN MARCO DE GESTIÓN CONCEPTUAL

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Resumo

As pequenas e médias empresas (PMEs) são atores fundamentais no desenvolvimento econômico e social de diversos países, atuando como motores essenciais para o incremento de métricas socioeconômicas, especialmente em nações em desenvolvimento. Apesar de sua relevância, as PMEs enfrentam diversos obstáculos ao crescimento, sendo a inovação um elemento estratégico crucial para a sobrevivência e competitividade no mercado. Embora frequentemente associada a grandes corporações, as PMEs possuem características intrínsecas que podem facilitar a inovação; contudo, muitas vezes carecem de meios para quantificar sua capacidade inovadora ou identificar áreas prioritárias para investimento. Essa lacuna é ainda mais evidente em PMEs cujos processos de inovação resultam em ativos de propriedade intelectual (PI), como patentes e marcas. A gestão estratégica da inovação pode ser otimizada pela incorporação da metodologia de Foresight, que permite antecipar transformações sociais, ambientais e de mercado. Portanto, este artigo propõe um framework conceitual destinado a orientar PMEs intensivas em PI na avaliação de suas capacidades inovadoras. Ao integrar a prospecção futura à avaliação de capacidades, o framework visa auxiliar essas empresas no delineamento de estratégias de inovação mais robustas e eficazes.

Palavras-chave: PME. Gestão da inovação. Inovação estratégica. Propriedade intelectual. Foresight.

Abstract

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Small and medium-sized enterprises (SMEs) are pivotal actors in the economic and social development of various nations, serving as essential engines for improving socioeconomic metrics, particularly in developing countries. Despite their importance, SMEs encounter numerous obstacles to growth, with innovation standing out as a critical strategic element for market survival and competitiveness. While often associated with large corporations, SMEs possess inherent characteristics that can facilitate innovation, yet they frequently struggle to quantify their innovativeness or identify necessary investment areas. This research gap is more pronounced in SMEs whose innovation outputs result in intellectual property (IP) assets, such as patents and trademarks. Strategic innovation management can be significantly optimized by incorporating foresight methodologies, which allow organizations to anticipate societal, environmental, and market shifts. Therefore, this paper proposes a conceptual framework designed to guide IP-intensive SMEs in evaluating their innovative capabilities. By integrating future prospection with capability assessment, the framework aims to assist these enterprises in designing more reliable and effective innovation strategies.
Keywords: SME. Innovation management. Strategic innovation. Intellectual property. Foresight.

Resumen

Las pequeñas y medianas empresas (PYMES) son actores fundamentales en el desarrollo económico y social de diversos países, actuando como motores esenciales para el incremento de métricas socioeconómicas, especialmente en naciones en desarrollo. A pesar de su relevancia, las PYMES enfrentan diversos obstáculos para el crecimiento, siendo la innovación un elemento estratégico crucial para la supervivencia y competitividad en el mercado. Aunque frecuentemente se asocia con las grandes corporaciones, las PYMES poseen características intrínsecas que pueden facilitar la innovación; sin embargo, a menudo carecen de medios para cuantificar su capacidad innovadora o identificar áreas prioritarias de inversión. Esta brecha es aún más evidente en las PYMES cuyos procesos de innovación resultan en activos de propiedad intelectual (PI), como patentes y marcas. La gestión estratégica de la innovación puede optimizarse mediante la incorporación de la metodología de Foresight, que permite anticipar transformaciones sociales, ambientales y de mercado. Por lo tanto, este artículo propone un marco conceptual destinado a orientar a las PYMES intensivas en PI en la evaluación de sus capacidades innovadoras. Al integrar la prospección futura con la evaluación de capacidades, el marco busca ayudar a estas empresas en el diseño de estrategias de innovación más robustas y eficaces.
Palabras clave: PYME. Gestión de la innovación. Innovación estratégica. Propiedad intelectual. Foresight.

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1. Introduction

Small and medium-sized enterprises (SMEs) represent a cornerstone of economic and social development globally. In developing economies, these entities serve as primary engines for socioeconomic growth, job creation, and industrial stability. However, the path to sustained growth for SMEs is often obstructed by structural and financial barriers. In this context, innovation emerges not merely as an advantage but as a fundamental strategic requirement for market survival and competitive positioning.

While innovation is traditionally associated with large corporations and intensive R&D departments, SMEs possess intrinsic characteristics—such as organizational agility and rapid decision-making—that can facilitate innovative processes. Despite this potential, a critical question remains: do these enterprises possess the tools to quantify their innovativeness or identify specific areas for strategic investment?

The academic literature on innovation capability in SMEs is still evolving. This gap is particularly evident regarding "IP-intensive" SMEs—those whose innovative outputs result in Intellectual Property (IP) assets, such as patents, trademarks, or industrial designs. The strategic management of these assets, combined with Foresight methodologies, allows organizations to move beyond reactive stances and anticipate technological and market shifts.

This study proposes a conceptual framework that integrates innovation capability, intellectual property strategy, and strategic forecasting to support decision-making in intellectual property-intensive SMEs. Instead of presenting an empirically validated model, the work seeks to organize and connect these dimensions conceptually, offering a theoretical basis for future empirical validations.

2. Theoretical Framework

2.1. Innovation Capability

The world dynamics are running fast, and businesses face the challenge of adapting, innovating, and creating change. In the business world, the inability to innovate is the largest reason for the failure of new ventures. (Khadan, 2018; Szczygielski et al.,

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2017; Yang et al., 2015; Paliokaitė and Pačėsa, 2015).

In order to understand what defines the capacity of a firm to innovate, it's firstly recommended to understand what innovation is.

> An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process). (OECD/Eurostat, 2018)

The meaning of innovation can be both an activity itself and its outcome. At Oslo Manual, it is defined as "a new or developed product or process (or the combination) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)". At this definition, the generic term unit describes the actor responsible for innovations (OECD/Eurostat, 2018). Innovation can also be described as a process because ideas are transformed into products, services, or new or enhanced processes, collaborating with business advances, using new knowledge sources (Baregheh et al., 2009; Gogodze, 2013).

Other concepts related to innovation, like innovation activities and business innovation, can cause misunderstandings in strategy making. According to Oslo Manual (2018), innovation activities can be described as new or improved goods or services that differ significantly from the firm's previous ones and that has been introduced into the market. Differently, business innovation is described as a new or refined business process for one or more business functions that contrasts significantly from previous and has been brought into use by the firm.

The definition given by the Oslo Manual was used as a guide to build innovation assessments by some worldwide governments and international institutions to build their research about innovation and then make well-structured comments and suggestions.

On the other hand, innovation capability (IC) can be conceptualized as the ability to

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create new technology, design new features of products and processes, and/or develop patentable inventions (Szalavetz, 2019) or also, as strategies and actions or even the best practices that a firm has to use a group of skills, assets, and knowledge efficiently, to develop corporate orientation, achieve its goals, and increase results (Wang and Das, 2017; Ribau et al., 2017; Hult and Knight, 2004). Innovation capability can also be described as the influence dimensions that affect a company's ability to manage innovation (Rajapathirana and Hui, 2018; Yang et al., 2015)

It can also present other variations like technological and business innovation capability (TIC and BIC). Technological IC is the ability to transform knowledge and creative ideas into new products, processes, and systems with the technology support, benefiting the enterprise and stakeholders (Yu et al., 2017; Aziati et al., 2014). It's generally connected to R&D expenditure, intensity, and manpower (Cruz-Cázares et al., 2013). According to Yam et al. (2004), to be successful with its technological innovations, a firm should also be concerned about other critical capabilities like manufacturing, marketing, organization, strategy planning, learning, and resource allocation.

Business IC refers to new organizational structures, administrative systems, management practices, processes, and techniques (Damanpour and Aravind, 2012). It can also be described as the critical success factors related to innovation processes (Perdomo-Ortiz et al., 2006). For Saunila (2016), these factors can measure the seven dimensions of business IC, which are participatory leadership culture, ideation and organizing structures, work climate and well-being, know-how development, regeneration, external knowledge, and individual activity.

> "First, there is no automatic transition from production to innovation capability: the learning efforts the accumulation of innovation capabilities requires are different from those associated with the accumulation of production capability. Second, innovation capability cannot be restricted to its science-based R&D component. Design, engineering, testing and the associated management of change are also equally important components of innovation capability" (Szalavetz, 2019)

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Recent research into small business innovation suggests that innovation capability is increasingly seen as a strategic organizational result rather than a standalone process, directly connecting conscious efforts to enhanced performance (Saunila, 2020). This view is grounded in the Dynamic Capabilities framework, suggesting that SME competitiveness in turbulent markets relies on the ability to sense, seize, and reconfigure resources (Deyassa, 2023). Thus, innovation capability is no longer treated as a static repository of knowledge, but as a dynamic competence essential for adapting to an ever-changing environment.

Lau et al. (2010) had proposed an audit framework for evaluating a firm's innovation performance and competitiveness based on Yam et al. (2004) that considered 7 main dimensions that were considered in this work:

- Learning capability - Capacity to identify, assimilate, and exploit new knowledge essential for a firm's competitive success
- Manufacturing capability - Ability to transform R&D results into products, which meet market needs, in accordance with design requests and can also be manufactured in batches
- Resource allocation capability - Ability to mobilize and expand its technological, human, and financial resources in the innovative process
- R&D capability - Refers to a firm's ability to integrate R&D strategy, project implementation, product portfolio management, and R&D expenditure
- Marketing capability - Capacity to publicize and sell the products based on understanding consumer's current and future needs, customer's access approaches, and competitors' knowledge.
- Organizing Capability - Capacity to constitute a well-established organizational structure, cultivate organizational culture, coordinate the work of all activities towards shared objectives, and influence the speed of innovative processes through the infrastructure it creates for developmental projects.
- Strategic planning capability -. Capacity to identify internal strengths and weaknesses and external opportunities and threats, adopt different types of strategies that can adapt to environmental changes for excelling in the highly

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competitive environment.

According to Rosenbush et al. (2011), performance of innovation processes at a firm, depends directly on factors such as the type of innovation, firm's age, and internal culture. So, how can a firm use the parameters shown in Table 01 to measure the capability to innovate?

Some researchers have developed studies on evaluation methods of innovation capability. One way is to use weighting to evaluate the considered aspects at innovation capability; for example, Zhang and Yue (2017) had combined matter element extension theory with the principle of the maximum correlation degree, Changhui et al. (2015) had chosen TOPSIS method to determine the evaluation system index, and considering small and medium-sized enterprises (SME), Yibo and Jingqin had used AHP to give weights to characteristics in analysis. On the other hand, for some authors, quantitative evaluation is not enough or is incomplete to evaluate such an intangible theme. For Yang et al. (2015), the determinants of innovation capability involve intangible aspects for which it is difficult to acquire precise data, so they considered uncertain linguistic information to construct the evaluation indicators system, integrating objective and subjective evaluation.

2.2. SME'S Innovation Capability and Intellectual Property

Global economy has been changing fast and constantly, bringing significant changes to market dynamics. Big firms show slow growth, and on the other hand, small and medium sized enterprises (SMEs) start to play as an important engine of economic growth and employment (Lee et al., 2012; Rassenfosse, 2012; Ejdys, 2014; Neef and Daheim , 2005) . SMEs entrepreneurial behavior helps them to provide flexibility and quick responses to these new market requirements, and somehow collaborate with larger organizations using their structure and resources to control resources for exploitation (Brink, 2017). Thus, improving innovativeness in SMEs is crucial for a nation's innovation and economic growth (Lee et al., 2012; Nada and Ali, 2015; Natário and Oliveira, 2018). SMEs can also contribute to innovation and industry competitiveness through collaboration with larger enterprises (Brink, 2017).

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Some external variables can be related to innovativeness improvement of SMEs such as: 1. Governmental policies that motivate and support innovation at small companies (Herliana, 2014; Hult, 2004; Paula and Silva, 2019, Jabeen et al., 2019); 2. internationalization (Bagheri et al., 2019; Vuorio et al., 2020; Battaglia and Neirotti, 2020); 3. Network integration provides access to resources and the possibility of dividing risks and costs (Gronum et al., 2012; Herliana, 2014; Brink, 2017; Pierre and Fernandez, 2018; Jabeen et al., 2019). It remains the capacity to detect network possibilities and ability to keep these collaborative relationships exploiting all the related resources and outputs at the best way; 4. Institutional support, private or governmental, that provides knowledge and resources providing SMEs competitiveness, increasing their innovative process (Pierre and Fernandez, 2018; Jabeen et al., 2019); 5. Innovation strategy that fits the firm's business model supports the innovative environment to achieve better results (Pierre and Fernandez, 2018). Hult et al. (2004) defines SMEs innovativeness as 'ever-changing environment-responsive strategies and actions to achieve corporate goals.' Developing knowledge management, that provides transparent knowledge information and benefits the creation process based on the added value of knowledge can increase competitiveness, worker motivation (Sulistiyani and Harwiki, 2016) and, consequently, innovation capability.

In this paper, innovation capability will be focused on the innovation able to produce assets of intellectual property (IP), such as patents, which is directly related to R&D process. For Raymond and St Pierre (2010), at some point R&D is still confused with innovation, thus it is needed to better conceptualize and draw the methodology to clarify the relation between R&D activities and innovation. Previously clarified in the first topic. These authors also point out that R&D cannot be used as an innovation indicator. SMEs face some obstacles to improving their innovation process, and it's due to a lack of internal and external investments in R&D processes and internal issues like management strategy, firms' structure, technology/innovation policy, and staff's level of education (Hult, 2004; Rassenfosse, 2012; Jabeen et al., 2020).

Patents are a direct result of R&D processes, but do SMEs take advantage strategically or financially of their IP assets? Independently of the firm's innovative

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strategy level, it has agency costs to keep the patent protected. Nikzad (2014) summarize the benefits that an organization can obtain by protecting their intellectual property rights as the possibility of protecting it from competitors and infringement, turn back the investments on R&D processes, shows growth and prospect potential to investors, shows their technology dos not infringe other technology, which can bring venture capital investors, woks as a valuable tool to help financial innovation and to obtain new resources, their technology can possibly be licensed or commercialized, differentiation by the market and also reputation, bigger access to new markets.

For Okamuro et al. (2019), even SMEs that have a high innovative capability, face difficulties in getting benefits from their innovations, because it's challenging to develop a patent portfolio, and no complementary assets (including intellectual property rights management) are available to protect their competitive advantage. Nikzad (2014) quotes that small companies trade more than 25% of their patents and leave less than 20% of their patents unused. Medium-sized companies actively use 65% of their patents, trade about 10%, and leave 25% unused. Meanwhile, large companies trade less than 10% of their patents and leave 40% of them unused. This behavior of different sized companies on how they use their patents can imply that a well-designed and conducted innovation management process, based on the organization's innovativeness.

Similarly, Rassenfosse (2012) says that 'SMEs mainly patent to protect from imitation, nearly half of them also patent for monetary reasons. Large companies mainly patent to prevent imitation by competitors and to protect their freedom to operate. In terms of how the patent portfolio is used, SMEs were found to use their patents more than large firms do, both in Europe and in the USA. Patents are expensive, and SMEs are probably more selective when deciding if patent protection must be applied for. In addition, large companies often file patent applications to secure freedom to operate, which results in a larger proportion of patents that are not used.'

Valdez-Juarez et al. (2018) had concluded that the major factor that makes SMEs struggle to compete with big firms is the lack of intellectual property management

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practices and the lack of incentive for innovation. The authors quote that the use of information and communication technology in a firm's knowledge processes should be considered at the strategic planning stage, aiming to increase their innovation and profitability. Also, they confirm that using their resources and capabilities on technology and IP management helps the firm to get more competitive. For innovative SMEs, utilizing external knowledge and protecting their own innovations via an intellectual property right (IPR) system is also an important strategy (Okamuro et al., 2019).

Contemporary literature emphasizes that the value of Intellectual Property (IP) for SMEs stems not from the sheer size of an asset portfolio, but from strategic management capabilities (Grzegorczyk & Głowiński, 2020). When leveraged as structural capital and mediated by dynamic capabilities, IP becomes a primary driver of innovative performance (Ali et al., 2023).

Within this framework, SMEs face the challenge of aligning their innovation models—whether open or closed—with appropriate protection mechanisms. This involves navigating a spectrum of formal protections, such as patents and trademarks, and informal strategies, including trade secrets and lead-time advantages (Ayerbe et al., 2024).

Research suggests that SMEs operating under open innovation regimes utilize formal protection as a necessary safeguard to facilitate licensing and technological partnerships, mitigating imitation risks during catch-up processes (Obradović et al., 2021). Ultimately, IP strategy must be configurational; different innovation stages and varying degrees of technological uncertainty require tailored combinations of legal and strategic tools to ensure value appropriation (Ayerbe et al., 2024).

Focused on all characteristics, obstacles, and the entire environment among SMEs innovativeness, some private and governmental institutions, from different countries, had developed their own SME innovation capability report, aiming to have a complete and real perspective of how SMEs innovate. These reports help to design new governmental policies to stimulate innovation and also build guides that can be held by SMEs themselves or by consultancy programs, to run appropriate innovation management strategies. All of these reports set their bases on the Oslo Manual, and

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the Statistical Office of the European Communities (Eurostat) also focuses on product and process innovation but also evaluates marketing and organizational parameters. In Brazil, the most complete and reliable report is PINTEC, held every three years, the latest one being the 2017 report. PINTEC isn't provided only for SME, but there, specific results can be inferred for many of the dimensions and characteristics described above.

Therefore, there is no methodology considered complete to evaluate innovation capability, given that the choice of the adequate method will depend on the enterprise aspects, sector, and its main goal. Also, there is a lack of work in innovation capability methods drawn specifically for SME. This fact constructs the first hypothesis of this work

2.3 Futures and Innovation Strategy

A prospective resolution about future change provides a more reliable design of innovation process management. Assuming that there could exist multiple futures, which developments are uncertain and unpredictable, these changes can be identified and studied, then the future can be influenced (Rohrbeck et al., 2015). Foresight can refer to the ability to take a forward view and use the insights gained in organizationally useful ways (Slaughter, 2002) or also the particular human capacity that individuals have for thinking about the future (Maree Conway, Rohrbeck et al., 2015; Ruff, 2015), driving the change, to accordingly support the decision-making process and manage strategy and R&D. The goal is to design a strategy that is flexible enough to allow firms to be agile in their response to future changes (Conway, 2006).

With the evolution of society's complexity, due to the increasing importance of technological and organizational innovation, the development of service economies, rapid globalization, environmental and demographical structures, cultural practices, and social services, foresight has been a widely acclaimed activity associated with policymaking by government, industry, and other institutions to shape the society's future (Saritas, 2013, Dufva et al., 2015).

Conducted research indicates that carrying out foresight projects in enterprises may

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affect their innovativeness, both in terms of incremental and radical innovation (Ejdys, 2014). From an organizational perspective, foresight refers to corporate and strategic foresight.

Corporate foresight is a way for a firm to reach higher positions in the future market using a set of practices (Rohrbeck and Kum, 2019), and can be studied from three main perspectives:

a. Strategic Management - Strategic decisions are taken and implemented based on previous scanning of the organization's environment (Rohrbeck and Gemünden, 2009) and developing mechanisms to help companies to detect these weak signals, interpret them, and trigger a response (Battistella and Toni, 2011), pointing possible directions.

b. Futures Research - The identification of systematical methods to prospect the future, detecting changing trends and discontinuous changing.

c. Innovation Management - Refers to the integration of knowledge about market demand, emerging technologies, and technical feasibility (Rohrbeck and Schwarz, 2013), that is, studying different kinds of innovation as radical and disruptive ones (Rohrbeck and Gemünden, 2009).

Rohrbeck et al. (2015) defined corporate foresight by emphasizing the perception and interpretation of value creation, pointing out that ‘Corporate foresight involves multiple stakeholders and creates value through providing access to critical resources ahead of competition, preparing the organization for change, and permitting the organization to steer proactively towards a desired future.’

Integrating strategic foresight into innovation management represents a vital expansion of how radical innovation is studied. For SMEs, this means moving beyond simple forecasting to actively exploring multiple, uncertain scenarios (Tiberius et al., 2020).

This forward-looking capability acts as a catalyst for organizational maturity, enabling tactical adjustments in tools, processes, and internal culture. Such preparation is essential for firms to effectively absorb disruptive innovations (Hadjinicolaou et al., 2022).

By developing foresight dimensions—such as environmental scanning, strategic

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selection, and networking—SMEs can overcome 'managerial myopia.' This approach fosters organizational agility and ensures that decisions are grounded in anticipatory intelligence, sustaining competitive advantage over the medium and long term (Elmi & Kinyua, 2022)."

In this dynamic environment that organizations are held to, it is needed to follow some steps in order to survive and compete successfully, Burt and Nair (2020) define it as strategic foresight. It has been considered the ability to anticipate events before they happen, aiding organizations to cope with the future, helping them to avoid potential problems or crises, planning by evaluating the implications of future events before they occur proactively (Adegbile et al., 2016). The authors also emphasize that ‘strategic foresight draws on traditions of work in long-range planning and strategic planning, horizontal policymaking and democratic planning, and participatory futures studies but is also highly influenced by systemic approaches to innovation studies, science and technology policy, and the analysis of critical technologies.

The design of an institutional foresight activity is seen as a creative process that will be engaged in designing a future system to fulfill goals and expectations (Saritas, 2013). And when it comes to talking about different and multiple future possibilities, one of the main methods that help decision-makers draft strategies for their businesses, better knowing what is really predictable and what is uncertain, is the scenario development (Blyth, 2005; Duijine and Bishop, 2018).

Scenarios are used to encourage people to reflect and give their perceptions about possibilities that may occur as a result of their decisions (Blyth, 2005; Adegible et al., 2016). Depending on the target, scenarios can contain quantitative analyses and projections. They may appear in three different types: 1. Contextual, describing external factors that cannot be controlled by the organization; 2. Normative, describing the desired future, and 3. Goal-oriented, that helps an organization in finding its role in a changed world (Duijine and Bishop, 2018).

The foresight process is totally adaptable to the organization's needs, which should choose methodologies that will fit better with its work dynamics and also adapt to

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the foresight practitioner that will conduct the whole process (Voros, 2003). To run this process, organizations can choose different techniques or methodologies for each step. As an example, Kononiuka and Glińska (2015) point to the use of the Porter's five forces analysis, business coaching, and a future-box technique. Nada and Ali (2015), suggest the use of design thinking methodology.

Sacio-Szymańska et al. (2017) comment on how it has become difficult for entrepreneurs to make strategic and innovative decisions. Otherwise, entrepreneurial skills and capabilities can be taught, but a future-oriented mindset should also be included in this field of studies, to give entrepreneurs, the competence to deal with uncertainty when managing their businesses. There's a little research about Foresight carried out by small companies that is relatively (Vecchiato et al., 2019; Milshina and Vishnevskiy, 2017; Kononiuk, 2017).

As far as SMEs play an important role in countries' economies, they should have a chance to design their future strategy, based on a systemic review, not only based on specific projects (Milshina and Vishnevskiy, 2017). In this way, they would be able to optimize the classification of their resources and then, make decisions based on well determined priorities (Vecchiato et al., 2019).

3. Methodology

The main objective of this research is to answer each hypothesis given here, by proposing a framework that enables SMEs to improve their innovation management by developing their innovation capabilities and, also, build strategies based on an uncertain future.

This research is divided into three parts. The first aimed to develop a survey that will evaluate the level of a firm's innovation capability. The second aimed to add value to the surveys by using foresight as a manner of orientation to the organization. Within the foresight approach to enable effective guidance to a firm's innovation management process, it's expected to develop its abilities to innovate. The third part is to develop the conceptual framework that will be used by the organizations.

The validated survey and methodology developed by Yam et al. (2004) and then

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customized by Lau et al. (2010) were the basis of this study, corroborating with the main objectives and to facilitate firms' own evaluation. In both, the survey was based on the seven dimensions, already described before.

The original measurement instrument was adapted to reflect the specific context of SMEs with a strong presence in intellectual property. Although the core dimensions proposed by Yam et al. (2004) and Lau et al. (2010) were maintained, some indicators were adjusted to include aspects related to intellectual property management, technology protection, and the acquisition of external technologies.

These adaptations were made to better capture the role of intellectual assets in formulating innovation strategies in companies that use their intellectual capital. Indicators related to technology protection, licensing, and technology monitoring were incorporated, aligning the diagnostic instrument with the strategic management of intellectual property.

As its survey is part of the proposed framework, it will work as a guideness. No industrial sector was emphasized, to attend different kinds of SMEs. The selected sample population, here called respondents, could be formed by a firm's council, senior product development managers, vice presidents, directors (Lau et al., 2010).

A seven-point Likert scale was chosen to be used in this diagnostic model proposition for its simplicity and for being the most widely used psychometric scale in survey research. The respondents indicate their level of agreement within a determinate statement (Qing Li, 2013). The medium level, 3, referred to neither disagree nor agree (Joshi et al., 2015; Li, 2013). The answers should indicate how much in agreement the proposed statements are with the respondents (Lau et al., 2010). Each dimension will be measured using multi-item statements and the Scale reliability should be checked by using the Cronbach alpha value. (YAM et al., 2004)

To reach the second part of this methodology, the generic foresight framework proposed by Voros (2003) aims to help the decision-making process by dividing it into four levels: inputs, foresight, outputs, and strategy. 1. Inputs refer to a strategic scanning, a 'thought' of a near future, where some known support methods like Delphi, brainstorming, 'competitive intelligence' techniques can be used. 2. Foresight is subdivided into three parts: Analysis - where the team will analyze what

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seems to be happening in its internal and external environment; Interpretation - where the main question is 'What is really happening?' and they look for deeper structure and insights; Prospection - here it will be created or examined. 3. Outputs - there will be both tangible and intangible results. 4. Strategy will be designed by the analysis of the outputs and the actions for implementation that will come from the decision-making process. The author points out that the analysis of the whole framework should be driven constantly.

The third part will be taken by unifying the 'diagnostic' questionnaire and the foresight framework in guidance of best practices so that they facilitate the actions for innovation management development in SMEs.

4. Discussion

Needless to affirm that innovation plays an important and essential part in a firm's survival, especially when it comes to small and medium-sized enterprises. Some factors help SMEs to be more agile, like size and staff number, and respond to and adapt themselves faster than big firms, when facing market changes. Political and economic situations affect all sizes of firms, in a better or worse way. How an organization will respond to that depends on how their management maturity and strategy were built. In 2020, for example, the world faced what is considered the worst pandemic in the late 21st century, which has changed the way firms design their strategic management. Jung et al. (2018) discuss how SMEs behave in relation to their innovativeness and R&D investments during recession periods. Authors show that this is an issue for organizations because there's no guarantee of their survival. On the other hand, if the firm already has such an innovative level, it's more important because it can determine the impact of R&D investment. They also affirm that if an SME does not have a proper capability, some R&D investments can bring prejudice to small firms.

The aim of this paper is to propose a guide that could help SMEs to evaluate their actual capability of producing innovation, especially those including IP assets, and, with this, develop their market and get profits and other benefits from it. In order to improve their decision-making ability to design their innovation management

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strategy, a framework will be proposed that will unify the innovation capability evaluation to an understanding and prospection of different possibilities of the future, here called futures. This could help small firms to be more agile when facing market or socioeconomic changes and trace their strategy to know what is needed to improve themselves in internal and external environments.

Designed as the first part, some questions of the survey proposed by Yam et al. (2004) and customized by Lau et al. (2010) were also customized here to better fit this paper's aims. Some items were rewritten, and others were added, to analyze firms's understandings about their capability to generate intellectual property assets, especially, patents that can be an output of the R&D process. The customized survey is presented in Appendix 1. A proper profile of respondents, in this case, could be presidents/CEOs, R&D, manufacturing, marketing staff, like managers (Yam et al., 2004; Wang et al., 2008). Multiplicity of respondents can guarantee a more reliable result because it will bring different points of view and diversity of knowledge.

This survey will give a diagnosis of at which level the firm is on its innovation capability. With the proposed framework (Figure 01), the survey will be part of a step called Actual Scenario Evaluation. This step will be divided into two items: internal and external evaluation.

Internal evaluation comprises the main management characteristics of a firm. The aim of this step is to offer the decision makers as much information as is needed to design an adequate and efficient innovative strategy. The survey is part of this evaluation together with other management tools like SWOT matrix and SMART goals. The firm is also free to choose other tools and methodologies for this item, so that they have stronger data and metrics.

External evaluation is more comprehensive because it aims to analyze external factors, those not controlled by the firm, like social, technological, economic, environmental, political, and values-based factors that can affect its results, directly or indirectly. These factors should be analyzed based on the current period that the framework will be applied to. They are part of a brainstorming tool called STEEPV (an acronym) (ETF, 2014) that will be used at the following step of the proposed

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framework.

The following step is futures prospection, or foresight. The generic foresight framework proposed by Voros (2005) was used in this article as an orientation of each step that should be taken. In his work, the author divided the framework into inputs, which can be described as a 'construction of near-future context'; foresight work, where the data should be analyzed and interpreted to facilitate the creation/design of different possibilities of the future; outputs, which are the expansion of perceptions and consolidation of the propositions made before; and finally strategy, where decision-makers will direct strategic actions for its implementation (Voros, 2005).

The conceptual framework proposed in this paper, whose main objective is to design innovation strategy based on IP assets, will be considered as an input, data given at the Actual Scenario Evaluation together with Foresight. For Saritas (2013), foresight aims for improving or changing one or more parts of the STEEPV systems.

With these two steps together as the input of the process, there will be a whole content about what is possible and feasible when considering the capability of the firm to innovate, generating intellectual property assets. According to Saritas (2013), these contents can, both, change the perceptions or questions about factors analyzed by STEEPV. The STEEPV system will also be applied at the Foresight step, to make comparisons with the Actual Scenario Step and to stimulate creativity when planning future scenarios.

For the effective operationalization of the proposed framework, it is essential to address its microfoundations, which encompass individuals, interaction processes, and organizational structures (Magistretti et al., 2021). The execution of sensing, seizing, and reconfiguring capabilities relies on specific micro-activities: 'sensing' is enhanced by empathy and an openness to new data; 'seizing' requires routines for experimentation and prototyping; and 'reconfiguring' demands agile structures and decentralized decision-making (Magistretti et al., 2021).

Strategic foresight can be understood as an organizational capability that strengthens the sensing dimension of dynamic capabilities, allowing companies to

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identify emerging technological and market signals. Through these processes, organizations expand their ability to anticipate changes in the environment, favoring both the identification and exploitation of strategic opportunities and the reconfiguration of their innovation resources.

By decomposing innovation and foresight capabilities into their micro-foundational bases, SME managers can identify specific gaps within their internal competencies. This granular understanding allows for a more precise implementation of IP-intensive and future-oriented strategies.

Above many tools, in literature, to produce the foresight methodology, scenario planning will be the tool used in this proposed framework. For Schoemaker (1995), scenario planning is a disciplined method for imagining possible futures that companies have applied to a great range of issues. One of its advantages is that it provides a way of addressing uncertainty that avoids the need to estimate subjective probabilities (Goodwin and Wright, 2001). The objective here is to have the organization's staff able to make assumptions about how the future will be in their business environment. According to Schoemaker (1995), scenario planning aims to settle with underprediction and overprediction of change, two frequent mistakes.

Still, according to this author, there are ten steps to better build the scenarios: 1. Defining scope, 2. Identifying the major stakeholders, 3. Identifying basic trends, 4. Identifying key uncertainties, 5. Construct initial scenario themes, 6. Check for consistency and plausibility, 7. Develop learning scenarios, 8. Identify research needs, 9. Develop quantitative models, 10. Evolve toward Decision Scenarios

After collecting important and strategic data by the first two steps of this proposed framework, it’s time to submit for assay and define what to do with the given information. The output of the proposed framework is the careful analysis of the data originating from the first two steps and strategy design. Some useful Tools/methods for the analysis step are trend analysis, cross-impact matrices, and other such analytical techniques (Voros, 2005). Each organization can choose the most practical and effective method to better analyze data.

Innovation strategy design is the most important output of this framework.

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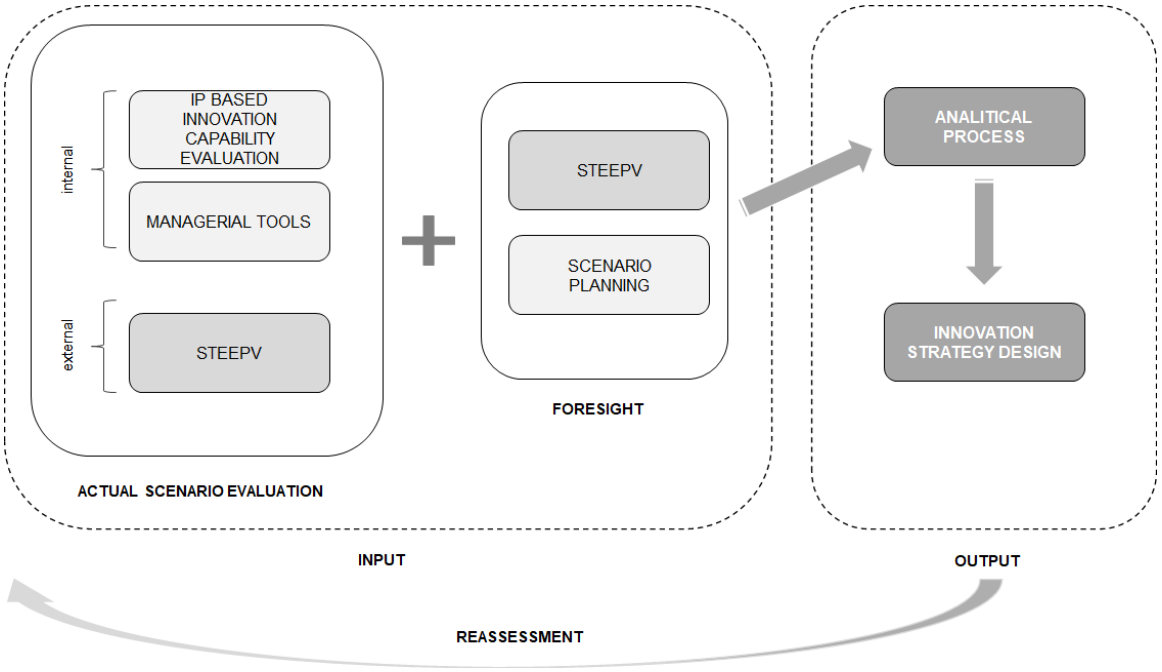
Meanwhile, the previous steps will give the firm effective information about which level of innovative capability it is at, strong data about its business environment and future prospects, and strategy design will effectively guide actions to improve and develop the organization. Voros (2005) also points out that the strategy process results need to be constantly fed back into inputs. It will guarantee a continuous process of reassessments and “course corrections.”

Figure 1. Proposed Conceptual Framework for IP-Based Innovation Strategy Management



Source: Prepared by the authors

The comparative analysis presented in Table X highlights an evolution in the literature on innovation capability, which has moved from models focused on internal measurement to more integrated and strategic approaches. In this context, the proposed framework positions itself as an extension that seeks to fill relevant gaps in previous models.

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Table 1:

Framework	Focus	Dimensions	Contribution
Yam et al. (2004)	Innovation capability assessment	Internal technological capabilities (R&D, resource allocation, learning, organization, etc.)	Foundational innovation audit model linking capabilities to multiple performance outcomes
Lau et al. (2010)	Capability–performance relationship	Measurable innovation capability indicators across firm functions	Empirical evidence on how different capabilities affect innovation performance
Proposed framework	Innovation strategy integration	Internal + IP + foresight + external environment	Advances prior models by integrating IP management and strategic foresight into innovation capability analysis

The work of Yam et al. (2004) established the basis by conceptualizing innovation as a set of interconnected organizational capabilities and by proposing an audit model that relates these capabilities to performance. Despite highlighting the importance of balance between dimensions, the model remains centered on internal factors.

Then, Lau et al. (2010) advance by empirically validation of the relationship between capabilities and performance, demonstrating the central role of R&D and resource allocation. Even so, the approach maintains an operational focus, with little integration of broader strategic dimensions.

In contrast, the framework of this study broadens this perspective by integrating internal capabilities, intellectual property management, and strategic foresight. This approach shifts the analysis to a strategic level, considering not only the generation but also the protection and anticipation of the value of innovation. In this way, the model does not replace previous ones, but expands upon them by proposing a more comprehensive vision oriented towards long-term competitiveness, especially relevant for SMEs.

5. CONCLUSIONS

In a world that is going through intense transformations like experienced in 2020,

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It is essential that SMEs have a more deeply concerned about their production reliability and outputs. There are few studies about SMEs' innovation, and when it comes to innovation based on intellectual property, they are nonexistent. Thus, improving the ability to assess the whole innovation process, comprehending the internal capability of producing intellectual property assets, along with a prospective view, should bring more agility in taking strategic and effective decisions. For future work, it is suggested to apply this proposed conceptual framework at SMEs from different markets and analyze the obtained results and make customizations when necessary. This study presents a conceptual framework that has not yet been empirically validated. Future research should test the proposed model through empirical applications in SMEs and evaluate its diagnostic effectiveness in different technological contexts.

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Appendix - Survey Of Innovation Capability Evaluation

Learning capability

Your company systematically monitors technology development trends

Your company assesses technologies relevant to firm's business strategy

Your company encourages work teams to identify opportunities for improvement

Your company assimilates accessed knowledge

Your company understands firm's core capabilities and match it with market needs

Your company passes lessons learned across boundaries and time

Your company promotes learning culture and invests on learning

R&D capability

Multi-functional departments are involved in concept with market needs

Your company has highly efficient communication among R&D personnel

Your company apply advanced designing methods, such as concurrent engineering

Your company has high quality and quick feedback from manufacturing to design and engineering

Your company has good mechanisms for transferring technology from basic research to new product development

Your company has great extent of market's and customer's feedback into innovation process

Your company has high level of investment in new products

Your company has high level of investment in new process

Your company has high percentage of R&D personal in firm's total employment

Resource allocation capability

Your company can attach importance to human resource

Your company plan human resource in phase

Your company can select appropriate personnel in each functional department in

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innovation process

Your company can provide steady capital supplement in innovation activity

Your company fully use acquisition, license or other action of external technologies

Your company has a percentage of investiment for protection and maintenance of

IP assets generated by internal process

Your company understand competitor's core technologies

Your company adapt its technology level to changes in external environment

Manufacturing capability

Your manufacturing department has great contribution during the conceptual design stage in innovation process

Your manufacturing department transforms R&D output into production

Your company has effectively applied advance manufacturing methods

Your company has capable manufacturing personnel

Your company has great extent which is continuously improve manufacturing system

Your company has high level of importance of overall quality control

Your company has high degree of manufacturing cost advantage

Marketing capability

Your company has good relationship management with major customers

Your company has good knowledge of different market segments

Your company has highly effective marketing intelligence systems

Your company has high sales-force efficiency

Your company provides good performance of after-sale services

Your company closely tracks customer satisfaction level

Your company protect properly and maintains its brands and earn profits of it.

Organizing capability

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Your company can flexibly adjust the organization structure Each sub-units in your company gain entity

Your company can handle multiple innovation projects in parallel

Your company has good coordination and cooperation of R&D, marketing, and manufacturing department

Your company has good communication between major suppliers and major customers

Your company has high-level integration and control of the major functional departments with company

Your company has effective mechanisms to track progress of innovation process

Strategy planning capability

Your company has great extent of contingency thinking and planning

Your company is able to identify internal strengths and weaknesses

Your company is able to identify external opportunities and threats

Your company has clear goals

Your company has clear plan – a road map of new product and process with measurable milestones

Your company is highly adapted and responsive to external environment

Your company is able to protect and maintain the internal developed technologies

Your company has on its core the ability of acquisition and license external technologies