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Contextualization of the innovation capability: a sectorial and behavioral perspective.

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Introduction

1. General context

In today's society, the enterprises are facing important challenges in their labors. The opportunities represent not just a challenge itself in its creation, but also the companies' effort to make them outstand enough during a changeable environment (Pençe et al., 2019). Facing also the quick and variable dynamics of the necessities and desires of the customers. The external economical and multifactorial environment which each enterprise is settled represents as well as defy (Soltanzadeh et al., 2024). Contending as well with the delicate decision-making to choose the right technological adoption, suppliers, and diversity of strategies to be taken due to the complexities of the organizational context (Jackson et al, 2024). Adding a strong competitive market in which each moment a new and close competitor could appear, that represents a clear example of affronting the five Porter's forces in the daily bases of the companies (Dias et al., 2023). Moreover, the engaging of the internal diversity of factors that should be well attending (Gehani, 2011; Wiktorsson et al, 2011; Wolf et al., 2021; Moohammad et al., 2014).

A way to survive in that challenged and competitive context by creating and maintaining competitive advantages, the innovation, is considered. It represents a key and essential strategic component (Rodrigues et al., 2006; Tidd et al, 2013.; Wolf et al., 2021).

Nevertheless, the innovation management and its performance are not easy or automatic (Tidd et al, 2013.). In fact, a whole structured and robust system has been recommended by an ISO Norm to regulate it (ISO 56000, 2020). It reflects that the success of enterprise innovation is not a one factorial system. It is composed by different aspects considering internal and external elements of the company. One conceptual approach that integrates the complexity of this multifactorial phenomena is innovation capability.

Improving their innovation capability allows firms to develop and coordinate the innovation process and to use innovation inputs to produce innovation outputs (Adams et al., 2006). Therefore, innovation capability management has become a strategic priority for companies and institutions as illustrated by the recent publication of the international standard on innovation management systems (ISO 56000, 2020). Most of the authors that propose models or definitions for the innovation capability agree that this concept involves a multifactorial set of elements, and this concept is not an independent element of the reality and context of the organization (Feeny et al., 2003; Francis et al., 2005; Galvez et al., 2013; Oliveira et al., 2019; Rodrigues et al., 2006).

However, even if recent innovation studies have focused on the creation of models such as open innovation, lean innovation, incremental innovation, and others, to improve the way the organizations implement, managed and measure innovation

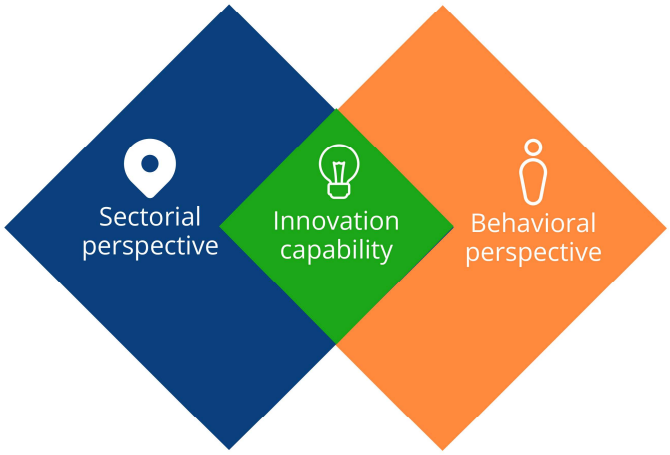
capability; few have focused on the impacting factors existing in the organizational contextualization.

Therefore, considering that gap in literature and studies focused on the contextualization of the innovation capability, results essential to understand and clarify the contextualization impact on the innovation capability.

The importance and relevance of consider the organization contextualization has its origin since the definition itself of the innovation. The ISO 56000 (2020) suggests the innovation as a system which also should: “consider the context in which an organization works and spans all types of innovations, including products, services, processes, models, methods and related approaches”. As a system the authors emphasize that the innovation is an inherently multifactorial entity (Galvez et al., 2013; Hauge et al., 2017; Hou et al., 2012; ISO 56000, 2020), thus is required a global and contextualized view to understand innovation.

In this document, these external factors are considered through a sectorial approach represented in figure 1.

Figure 1 Framework of Contextualization of the innovation capability: a sectorial and behavioral perspective



Note. Source : Own creation

Innovation capability is vulnerable to contextual factors, and its performances could be moderated by its environment (Ali et al., 2020; Voss et al., 2008), due to the impact of global business market in the environment of the organization. As a result, this innovation capability also depends upon a complex host of contingency factors and environmental aspects (Damanpour, 1996; Voss et al., 2008). That’s why a sectorial approach is convenient appropriated to analyze them systematically.

The innovation capability is also related to the individual aspects of the person behind the innovation (Behavioral perspective). However, few have focused on the persons behind the innovation process and on their individual competences, even if those competences can be an important factor to efficiently achieve what is proposed in the innovation models. The more the individual competences could be enhanced, the more the company's capability to develop and coordinate the innovation process could be improved (Adams et al., 2006; Boly et al., 2014; Gehani, 2011; Hiltunen et al., 2016).

Despite the multiple uses of behavioral theoretical constructs, there exist gaps in their own bases. Also, there exist increasing discrepancies between the competences and variables each construct used (Martinez et al., 2022). It leads to a difficult, non-uniformed, or non-common path to analyze and respond to what are the required individual competences within the innovation process, to enhance innovation performance results. The relevance and impact of this gap also implies that some of the industry's current practices such as recruiting, conforming teams, delegating roles, training, and motivating within the innovation processes could be badly focused and not efficient as it could be.

This doctoral thesis will explore the contextualization of the companies' innovation capability by adopting a sectorial and behavioral analysis in the path to closing those gaps and give a holistic context of the innovation capability. It means a systematic and holistic point of view that integrates the environmental and the individual aspects of the innovation capability. A Guide to analyze the contextualization of their innovation capability is proposed and a specific application on SMEs context is conducted.

2. Research questions and objectives

On the bases of the detailed context explained in the previous section, the main research focus is considered as follows.

2.1. Gaps in the literature

The discussion of the context leads us to identify the following gaps in the literature:

- There is not enough information about the impact of the contextualization of the innovation capability and how to improve it.
- There is no clarity of either common path of which individual competences are essential to be considered within the behavioral perspective, for the optimal innovation capability.
- There is a need to guide the companies (and particularly the SMEs) to design their own analysis of the impact of the contextualization on their innovation capability, in order to support them in getting strategic information to improve it.

2.2. Research questions and objectives

Considering the identified gaps of the literature, the research question for our research is:

How should companies improve their innovation capability through a behavioral and sectorial contextualization approach?

Respectively, the main following objective is the focus of this thesis:

To create an analysis guidance of the Behavioral and Sectorial contextualization approach for companies, to be used as a support for the decision-making in the improvement of their innovation capability.

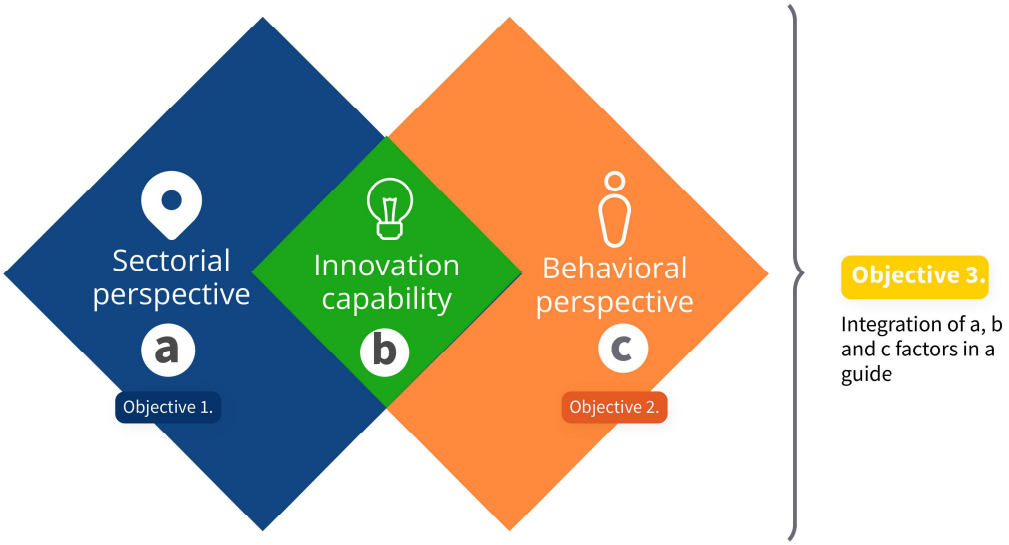
This main objective is subdivided into the following's specific objectives:

01- To establish the factors and measure of the sectorial perspective that impact the organizational innovation capability, by integrating a literature systematic review.
02- To propose a Model of Individual Competences for the behavioral perspective of the organizational innovation capability, by incorporating a literature systematic review and empirical approach.
03- To develop analysis guidance for companies by integrating the proposed behavioral and sectorial contextualization factors
04- To test it in a SMEs panel as a first field of experimentation as part of this thesis.

In order to clarify the overview of these specific objectives, each of them will be presented in the following subsections.

In figure 2, the three big dimensions to study in this thesis are represented: sectorial perspective (a), innovation capability (b) and behavioral perspective (c).

Figure 2 **Three-dimensional research approach**



Note. Source : Own creation

The first (a) is the sectorial perspective (objective one). Based on the objective one, it should be studied in order to identify the impacting elements from the sectorial perspective in the innovation capability and how to measure it.

The dimension (b) is the innovation capability. This dimension integrates the practices of the innovation capability as a core research foundation. Indeed, our thesis is part of a line of work on this topic done by the ERPI team. This will be presented in the state of the art.

The dimension (c) is the behavioral perspective (objective two). As mentioned in the second specific objective, it is necessary to identify the impacting factors of the behavioral perspective. Some theoretical constructs were identified, however those had contradictions and differences between them. It required from the research a deep analysis because it was not possible to identify an existing model that integrates all the elements. That deep analysis consisted in create a unified and new model of the essential competences for the individual innovation that impacts the innovation capability.
Once each dimension and the associated factors are studied, the question of their evaluation is considered. Then, it's time to integrate all this information into a guide

for the companies as it is established in the specific objective three. This guide will help them to identify the factors affecting their innovation capability and how to solve the problems they should be facing. Not just in terms of internal practices of the innovation capability itself, but also due to the impact of the contextualization factors.

This guide integrates a step-by-step process to analyze the three proposed dimensions, measure them and identify the aspects to be considered in order to improve the innovation capability.

Finally, a test is done on a SMES sample (objectives 4) in order to contribute to highlight the innovation capabilities of this specific type of companies.

To go into a deep understanding of this three-dimensional research approach, the following subsections are detailed.

2.2.1. First Specific objective: Factors and measures of the sectorial perspective

In the first specific objective, an identification of the sectorial perspective factors is required to understand that perspective. Due to the multifactorial phenomena the innovation capability represents, it is crucial to identify the environmental factors that impact it. But also, it's important to understand how those could be measured and compared between the differences of context the companies could have. Thus, this specific objective aims to answer the question:

Q1*: Which are the factors of the sectorial perspective that impact the innovation capability and how to measure them?*

This question focuses on find the factors of the innovation capability environment that affect and directly impact it. According to the Contingency Theory proposed by Mintzberg (1979) , there is not a model of a "perfect" company for the innovation, but a company well adapted and copes effectively with the contextual factors. By proposing this question, would be identified and measured the important sectorial factors the company should consider in order to deal with them effectively.

To answer that question, the following methodology was held:

1. For the identification of the sectorial factors a systematic literature review was made to understand which were the prominent factors that the authors proposed.
2. Then a comparative analysis between the different existing measures and index that integrate the found factors, so a measure could be identified as functional to analyze the sectorial perspective.

By establishing the factors and measures, this contribution is a huge advance for achieving the general objective, because the sectorial perspective could be now easier to analyze and evaluate. This contribution represents a clear and enough data about the impact of the contextualization of the innovation capability, closing the first gap founded.

2.2.2. Second specific objective: Model of Individual Competences for the behavioral perspective

Regarding the second objective. Due to the diversity of proposals within the behavioral perspectives and their contradictions for the proposal of the set of competences a person should have to better optimize their impact of the innovation capability, the second objective is centered to answering the following question:

Q2: *How to integrate in one model the set of essential individual competences for the optimization of the innovation capability?*

As mentioned before, the best the company could deal and incorporate the context factors, the best the innovation capability would perform. Thus, this question aims to find the way to have a common, integrated and unified reference of the individual essential competences impacting the innovation capability. This question results indispensable due the differences and contradictions found in the existing behavioral perspective proposals.

At this point, it is also emerged another question: is there just a one profile of competences for all the innovation process or according to each stage this profile would change? So, the following hypothesis was established and was focusing just in the profile of the person in charge of the innovation process:

H1: *The individual competences profile of the person in charge of the innovation process, may be different according to each stage of the innovation*

This hypothesis based on those contradictions and strong differences of within the theoretical constructs. It also could represent a challenge to be answered because the innovation process and its stage should be well defined first, and then for each stage the individual competences should be defined if this hypothesis were correct.

To answer that question and attending this hypothesis, a whole three phases methodology is developed to achieve the aim of identify a model and its measure, see more detail at Chapter II:

- Phase 1. Theoretical approach:
    - Systematic literature review to identify the variables proposed by the existing theoretical models.
    - Content analysis to identify a standard and shared variable's categories framework of the variables used by the theoretical

models. This research action is a replicable technique for compressing many words of text in fewer content and making inferences by identifying specific characteristics, trend, and patterns in text (Stemler, 2019).
    - Literature review to determinate the innovation process stages in order to clarify the emerged hypothesis.
    - Co-occurrence analysis to settle the set of competences in each variable's category for each innovation stage. This co-occurrence analysis technic is a bibliometric review method to draw a map of concepts, identify the association strength of the keywords and their frequency. It helps us to identify the variables for each category and stage, based on the literature. So, a theoretical set of competences was identified.
- Phase 2. Empirical approach:
    - Interview to identify the set of competences in the SMEs
    - A comparison of the theoretical set of competences with SMES competences was made to validate the proposal with the reality of the companies.
- Phase 3. Profiling Stage:
    - Literature review to identify the model of measure for the proposed set of competencies was held.
    - Co-occurrence analysis to match the model of measure with the model of set of competences.

A model of individual competences for each stage of the innovation process that functions as a reference for improving the organization's innovation capability is a contribution for the academics but principally for the SMEs as a reference of how it should be managed.

2.2.3. Third specific objective: Analysis guidance for companies

Considering that at this point the factors for sectorial and also the behavioral perspective had been identified, now the following question is established:

Q3*: How could a company analyze the Behavioral and Sectorial contextualization of their innovation capability to optimize it?*

Based on the importance the contextual factors have in the innovation capability, and with the previous questions already answered, it is important to integrate that information into a practical and measurable step-by-step process for the companies. This would help them to identify in which factors to focus and how to improve them in order to optimize their innovation capability performance. Therefore, this question should provide the basis to create a guide for companies to analyze the Behavioral and Sectorial contextualization.

2.2.4. Fourth specific objective: Application to a particular type of companies: the SMEs

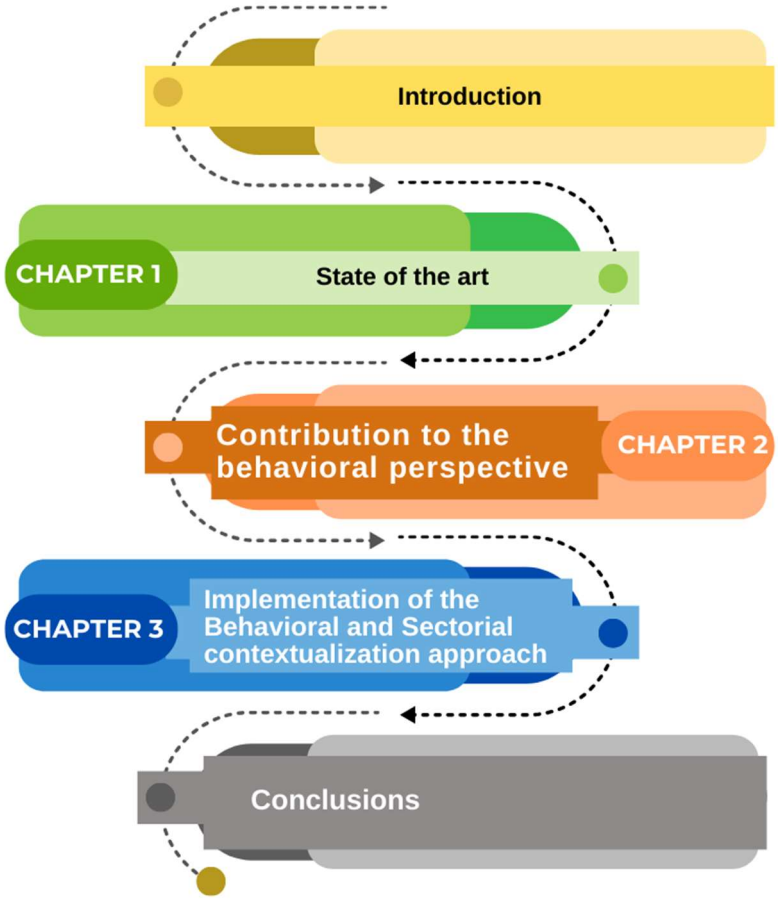
By integrating the results of the previous specific objectives, an experimentation is conducted on SMEs in order to highlight the specificities of our proposal when working under this particular field.

This contribution allows the enterprise to know more about the different factors that could be impacting the innovation performance, how to analyze them and how to improve this innovation capability as a holistic and robust phenomenon.

3. Thesis structure

In order to answer our research questions, this thesis follows the structure presented.

Figure 3 Thesis structure



Note. Source : Own creation

The structure is composed of five main sections and three chapters. The first section is an introductory context of the topic and an overview of the general aspects. Some principal definitions and focuses are detailed, arriving in the research focus of this thesis, identification of gaps, definition of objectives and the research questions proposed. In addition, the structure of the thesis is presented.

The first chapter (second section) integrates the specific innovation concepts, definitions, and its levels. Focusing after on the organizational innovation capability, by using the literature review. Some existing models to evaluate innovation capabilities were identified implementing Scopus Data Base review and then, one of them was chosen to be used as a principal reference for this thesis. Here the objective one is answered. Furthermore, the contingency theory for the sectorial in proposed and likewise some theoretical constructs for the behavioral perspective.

In the chapter II (third section), a contribution for the behavioral perspective was made due to the missing unified model to integrate the individual competences. That's why a robust Model of Individual Competences was created. It answers and responds the second objective and its respective research question. In that order, an analysis guidance for companies is proposed.

Correspondingly, the chapter III (fourth section) detail an implementation of that proposal in real enterprises, SMES, by using a study cases methodology.

Finally, on the last section, conclusions, implication, limitation, and final comments are presented.

Chapter I. State of the art

1. Introduction

In this research work, we consider the contextualization of the innovation capability of the organization. The global objective is to create a guide for companies and especially in the framework of this thesis for the SMEs, so they can analyze the impact of the context (sectorial and behavioral perspectives) in to the innovation capability, in order to optimize it. As this research's core aim emerges, it is important to first define the related concepts and explain why contextualization matters, to offer a big-picture view of this aspect.

Due to it, innovation capabilities concepts are explained in section **2**. This section includes the definition and the different innovation levels. Then the Innovation Capability within the organization is identified in section **3.** Here, some models that explain this multifactorial concept are analyzed, and one is selected as a base for this research.

Likewise, the external and internal impacting factors of this Organizational Innovation Capability are amplified to better contextualize the phenomenon, in section **3.2** and **3.3** respectively. In those sections, a literature review has identified the most prevalent literary constructs. The sectorial and behavioral perspective are fundamental in those findings. Here, the theoretical based elements for our research are proposed and selected.

2. Innovation: a multifactorial construct

The concept of innovation capability is a complex and a trendy topic in the academic and organizational fields. To well define it, the innovation concept should be first defined.

2.1. Innovation definition

Innovation has been defined by authors, institutions, and organizations in different ways. (Drucker et al.,1986) suggest that innovation is "the act that endows resources with a new capacity to create wealth". These authors emphasize that innovation creates a resource and that there is no such thing as a resource, until man finds a use. While OEDC (2005) relates this concept with the implementation of a "new or significant improvement", and then underlines its implementation is made when the outcome is effectively utilized.

According to Baumol (2014), innovation is the "recognition of opportunities for profitable change". Similarly, Damanpour (1996) explains innovation "means of changing an organization, either as a response to changes in the external environment, or as a pre-emptive action to influence the environment". Moreover, Oslo Manual (2018) defines "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)".

In all the mentioned innovation definitions, the first part of the definition agrees with a factor of change, and this change is linked with a useful or beneficial purpose aim. This purpose could be wealth, use, profit, or value. It reflects an action concept with an intention, not just an act by itself. A definition that integrates the last defined structure and is the reference for this research work is the innovation definition proposed by ISO 56000 (2020), innovation is a "new or changed entity realizing or redistributing value".

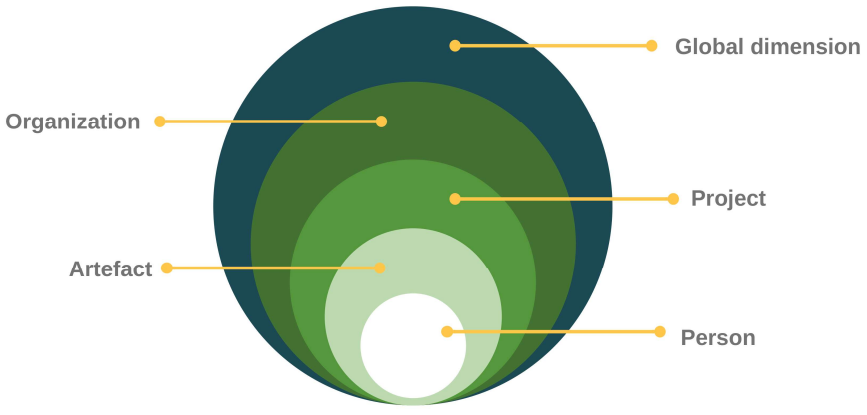
Using this innovation entity, the innovation could be present at any level impacting different individual, social or global aspects. To establish the level at which our research aims to analyze, the following section is presented.

2.2. Levels of innovation

Innovation has been seen as an interdisciplinary entity between different points of view, scales, and contexts. That is why it could be considered as a system. This system, as the ISO 56000 (2020) suggests: "considers the context in which an organization works and spans all types of innovations, including products, services, processes, models, methods and related approaches". This system also includes the levels in which the innovation is present.

There exist levels to better comprehend specific innovation aspect in each level. Boly et al. (2006), propose there exist five levels of the innovation. Those are detailed in **Figure 4**:

Figure 4 Innovation levels



Note. Source : (Boly et al.,2006)

The global dimension refers to the external level of the organization. Summarized by Galvez. D (2015), this context should be considered during all the development of the innovation process. The organization level is the dynamic of an institution or enterprise. The reserach is the managerial level for the achievement of an objective. The artefact refers to the result of the cognitive process of the precedent level. Furthermore, the person level reflects the individual or collectives cognitive and learning process (Boly et al., 2006).

The level of our research focuses on the organizational level, and the influence of the individual and global dimension in it. At this level, a concept that resume the innovation performance in organizational level is detailed in the following section.

3. Organizational Innovation Capability

While the focus of this research is at the organizational level, the organizational innovation is considered.

In the path of analyzing how to reach the best innovation performance, some studies focus their efforts to identify the key elements that an enterprise should accomplish to achieve innovation performance. Those key elements are defined as organizational innovation capabilities.

This concept is defined as the “set of knowledge, abilities, and skills owned by the firm” (Oliveira et al., 2019), allowing an organization’s “capacity to gain an advantage by implementing more and better ideas than rivals” (Francis et al., 2005).

Over time, the literature has been highlighting innovation’s importance at the organizational level. For example, since the beginning of 1900, Schumpeter (1934) proposed that economic development has in innovation, its fundamental phenomenon. Likewise, Drucker et al., (1986) presents innovation as “the best means to preserve and perpetuate that organization”. Recent authors still suggest the same level of importance. According to Francis et al. (2005), innovation is a “critical imperative for the survival and growth of a firm”. Similarly, Galvez et al. (2013) argue, is “the engine that drives revenue growth”. Due to the crucial role of innovation in the organization, analyzing how to reach the best innovation performance comes indispensable for the companies. In the following section, the detail of the most relevant models to evaluate and describe innovation capabilities are presented.

3.1. Models to evaluate Innovation Capabilities

Even though a lot of definitions of innovation emerge, the central idea still be the same. However, it does not happen with the indicators of innovation. There has been a change in the identification of the precursors of innovation over time.

Based on the importance and impact that the innovation has in the multiple levels, in the organizational level, a lot of research and proposals have been developed to find the indicators required to better performance in innovation.

3.1.1. Overview on several models

There exist some model proposals that integrate the most important innovation capabilities in the organization. Even if those models differ between them, they agree the innovation capability involves a multifactorial set of elements and this concept is not an independent element of the reality and context of the organization (Feeny et al., 2003; Francis et al., 2005; Galvez et al., 2013; Oliveira et al., 2019; Rodrigues et al., 2006).

Considering, the author's concordance that Organizational Innovation Capabilities require a multifactorial approach, some of the most relevant model proposals are detailed next. This helps to identify the most important framework or model to be considered in the research. Both theoretical and empirical approaches have been proposed.

For present the most important models, a Scopus Data Base review was handling to identify and compare them. The text used to identify them was:

1. *"TITLE ("innovation capab*" W/7 (measure OR instrument OR indicator OR index)) AND (LIMIT-TO (DOCTYPE , "ar"))".*

As a result, 10 articles were identified in Scopus. Those are detailed in the following table:

Table 1 Models of innovation metrics

	Authors	Indicators	Focus
1	(S. Yin et al., 2020)	Innovation input: mainly R&D funds, personnel, and equipment. Innovation output: products, technologies, new customer-oriented application (...). Economic output: innovative benefits gained Social effects: macroeconomic gains (losses), the benefits (drawbacks) of a green society, and changes in resource allocation and environmental quality.	Green Technology Organizations
2	(Galvez et al., 2013)	Creativity and Concept Generation New Product development Human Resources Management Technological Strategy Project Management Data and Knowledge Management	Organization
3	(Hauge et al., 2017)	Institutionalizing cross-industry innovation as a part of the firm's strategy Effective resource management combining different types of competences Learning from different industries Barriers of innovation Encouraging divergent 'across-borders' thinking Organic organizational structure barriers separating different functions and product groups Open and tolerant culture Management of related technologies Cross-industry experience	Organization
4	(Hernán et al., 2018)	Organizational Culture Knowledge Management Management Capacity Human Resources Management Organizational Health Factors	Health Organizations
5	(Gómez et al. 2021)	According to each firm	Organization
6	(Torabi et al., 2004)	Education topics	Education
7	(Al-Marzooqi et al., 2022)	Not determined	Health
8	(Wu et al., 2017)	Non-available	Not available
9	(Hou et al., 2012)	Innovation environment Knowledge creation Acquisition capability Technology innovation capability of enterprises Innovation synergy capability Innovation performance	Regional/Geographical Area's Innovation Capability

Source : Own creation

Five of the ten articles were analyzed, to identify its indicators of innovation capabilities into the organization. The other five were discarded, one because have a rejected attention, one was not available to consult (Wu et al., 2017) and other did not determinate clearly the elements in the paper (Al-Marzooqi et al., 2022). Also, education and regional focused paper were not considered (Hou et al., 2012; Torabi et al., 2004).

Consistently with an analysis of the five selected papers (numbers 1 to 5), a multifactorial perspective is required to develop the innovation capability into the enterprise. One of the models suggest that the indicators depend totally on the enterprise and did not present general indicators (number 5). However, some consistencies are present between the four rest of models, and those are explained following.

The most frequent indicator utilized is the management capacity; it is present in three of the four models. It refers to both human resources management and knowledge management. Another consistency is the technological indicator, present in three of the proposals. Into two of the models (Hauge et al., 2017; S. Yin et al., 2020) are considering external or environmental factors into their models, such as: Cross-industry institutionalization and social effects.

Due to our proposal of evaluating the innovation capability in multiple sectors, the proposal of Hernan et al., (2018) and Yin et al. (2020) are not adequate for our study because of their effort is focused on just one sector and is adapted to it.

As a result, just two models could be adjustable for our study requirements and nature (number 2 and 3). However, because of existent relation with the Potential Innovation Index (PII) model proposed by Galvez et al. (2013), as the same research school is shared. After that, for the access to the instrument application, previous experience with it and its consistency, this model results interesting and suitable for our research study. To detail the description and indicators it considers, the following section is developed.

3.1.2. PII Model

Since 2000, the laboratory ERPI: *l'Equipe de Recherche sur les Processus Innovatifs* (ERPI), from Lorraine University, France, has been developing and improving the management of the innovation by different research works. This laboratory is an Industrial Engineering Laboratory and by different research projects the ERPI has developed a strong structure of knowledge that support not just the proposal of the PII Model but the baste leader knowledge in innovation capability subject. Since 2000s the innovation metrology interest and research started with the objective of offer an evaluation of the innovation process and help with the companies' decision making (Enjolras et al., 2020).

The first thesis defended in 2005 (Armenta, 2005), proposed the first steps and others subsequent projects complement this initiative with algorithms, rules and integrated the PII (Boly et al., 2014; Galvez et al., 2013; Assiedlou G., 2018; Rejeb et al., 2008).

This is also the inspiration for further research projects, for example the use of this PII within research projects to propose a method to help the digital transformation strategies in SMEs and to know their maturity level (Dethine, 2023). Other projects have been focused on contributions to the measurement and improve of the performance in the Industry 4.0 (Cardenas, 2023). As well as the development of the innovation capability in the open innovation process (Moya, 2021) which contributes to develop a proposal of an index to classify the innovation open capabilities in the suppliers.

Our research is part of this ERPI's line of work, and is proposed under this laboratory support. It tried to now be focused not just in the practices and improvement of the innovation capability but in its context. The contextualization factors and it impacts from a sectorial and behavioral perspective would give a new and a holistic point of view for the industry and academy, and could help to now integrate this contextualization to the PII.

That why the section of this model. It is justified, as explained in the previous section, because of the suitability for this study, due for the result of the comparative analysis. But also it is justified because it has part of this aliened work in the ERPI, and with the objective of strength and complement the PII approach.

The Potential Innovation Index (PII) is a framework of best practices in the organization to achieve innovation (Galvez et al., 2013). It concerns the practices and activities and evaluates them with the Index indicators. Specifically, it evaluates six practices and twenty activities.

As a result, the current PII model structure is presented in the **Figure 5**

Figure 5 **PII structure**

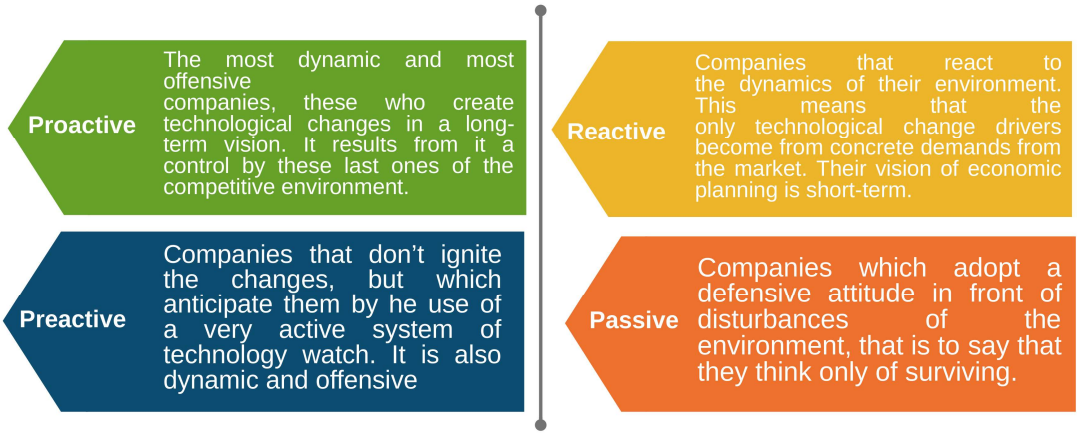


Note. Source: (Galvez et al., 2013) ; Own creation for the Design

This model allows the classification of the company into four categories or girds of innovation maturity performance: Proactive, Preactive, Reactive and Passive, and gives an automatic recommendation generation to the enterprise.

The PII categories are described in **Figure 6** as follows:

Figure 6 PII categories



Note. Source: (Boly et al., 2014)

Those categories are based on the classification proposed by (Godet et al., 2007), and determines the global indicator of overall innovation capability of the firm (Enjorlas et al., 2019).

This model is going to be used in our research as a base to measure the innovation capability of the organization.

3.2. External (sectorial) impacting factors in Organizational Innovation Capability: Contingency theories

The previous sections highlight the multifactorial aspects that integrate the innovation capability within the enterprise. However, organizational innovation is also vulnerable to contextual factors, and its performances could be moderated by its environment (Ali et al., 2020; Voss et al., 2008), due to the impact of the global business market in the environment of the organization. As a result, this innovation capability also depends upon a complex host of contingency factors (Damanpour, 1996; Voss et al., 2008). This external factor is our corresponds to the sectorial approach we are going to consider for our research.

Some theories have been developed to better conceptualize the different factors. In these sections, external factors are explained.

As organizational innovation did not depend on just organizational factors, external and contextual factors should be considered. Some theories have been developed and those used by the innovation researchers, to identify the impact of the

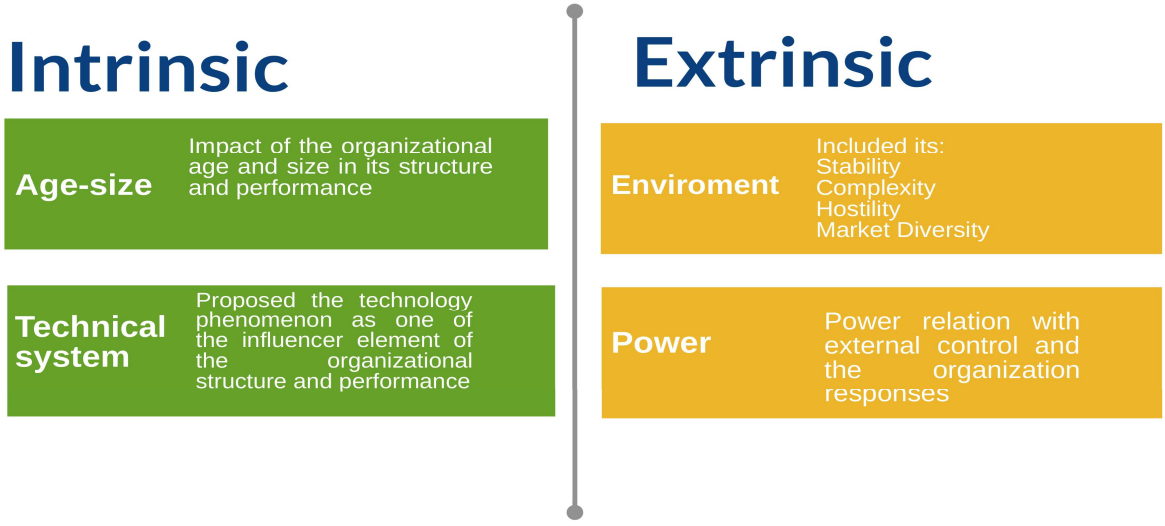
contextual factors in the innovation performance. The theories that explain that impact is called Contingency Theories.

One of the most recognized proposals of a contingency theories used in innovation studies is proposed by Mintzberg (1979). This author explains that the performance of the organization depends on its internal organizational structure features but also of the environment within the organization is established. It means, there is not a "perfect structure" of the organization but an organization that fits and adapts with its environment (Enjolras et al., 2020).

The factors for this contingency theory include intrinsic factors to the organization itself (age and size, and technical system elements), and also extrinsic factors (environmental and power relations). Mintzberg (1979) argues every organization exists in a milieu (set of domains), to which the organization must respond when designing its structure. Those correspond to the extrinsic factors, classified in the general environment conditions and the system of power it has to face.

The resumes of this definition of the four factors in the Contingency Theory are detailed in **Figure 7**.

Figure 7 **Contingency theory' factors**



Note. Source : (Mintzberg, 1979)

This theory is frequently studied for the innovation researchers, as a method to contextualize the innovation (Blindenbach, 2015; Caldart et al., 2014; Enjolras et al., 2020; Pérez et al., 2010; Renkema et al., 2022; Wolf et al., 2021). The literature agrees that adopting a contingency theory perspective generates sets of conditions and resources for the innovation outputs.

As our study focuses on the innovation capability from a sectorial and behavioral perspective. The sectorial perspective would be focused on one of the intrinsic and one of the extrinsic factors from the contingency theory, been considered the age-size factors and environmental factor (environmental factor from Costa Rican and French companies), respectively.

3.2.1. Age-size factor

The Age and Size factors has been two variables considered in our study to highlight the relation between those and the innovation performance. Our objective is not to give an answer about the positive or negative relation but reinforce there is a connection (Assefa et al., 2022; Dukeov et al., 2018; Qiu et al., 2018; Schubert et al., 2015; Moohammad et al., 2014).

In the case of age, there exist a lot of research work. Since 1976, when Joseph A. Schumpeter explains his theory about how the larger and older firms were more innovative than the small ones, this “Schumpeterian hypothesis” has been studied by other authors (Medase, 2020). The age is aspect is expected to affect firm growth because of the learning process through which firms learn about efficiency (Erdogan, 2023). However, some others contradict this theory arguing the newer the company is the more able to innovate, because of their flexibility to adopt new ideas (Cooley et al., 2003). Coad et al., 2018) suggest that this relation is not a direct one and it could be impacted also for elements as routines, accrued reputation, etc. Regarding size factor, our study is focused on the SMES. The smaller firms have distinct managerial configuration, freedom, and capacity of control. Also, the small size comes with bigger impediments, but that can be faced by the strengths. (Coviello et al., 1999; Man et al.,2023.)

The size factor has also been frequently studied to verify it relation with the innovation. Not a clear position has been yet developed, and the literature seems to be not conclusive (Medase, 2020). However, some interested results have been highlighted; for example, (Martínez et al., 2002) found that this factor plays a role in the ability of firms to innovate. Correspondingly, (Patacconi et al., 2010) found that performance with patent tends to be stronger for small companies.

Those variables are used as a characterization factor of the firms used in the analysis. In our case, these factors would be used as descriptors of the firms, not a variable to evaluate it impact in the organizational innovation.

3.2.2. Environmental dimension

3.2.2.1. External elements

The environmental factors include the external elements outside the organization, customers and competitors, its geographical setting, economic, political and externals proposals. Consider all those factors could result in an impossible project since the environment of each organization changes. However, based on the Mintzberg' theory, it argues that four big dimensions of the environment could contextualize this element. Those elements are stability, complexity, market diversity and hostility.

The four dimensions have a range to determinate its nature. The following **Table 2** introduces them.

Table 2 Environmental dimensions

Environmental dimensions	Range
Stability	Stable environnement Dynamic environnement
Complexity	Simple environment Complex environment
Market diversity	Integrated environment Diversified environment
Hostility	Munificent environment Hostile environment

Note. Source : (Mintzberg, 1979)

According to the author, in the dimension of Stability, elements of unstable government, unpredictable shifts in economy, unexpected changes of supply and demand of the customers and similar could generate impact on the organization.

Concerning complexity, it is highlighted that a complex environment is which requires organizations to have sophisticated knowledge about products, customs, or other aspects, to have a great deal. In market diversity, the diversity and heterogeneity of outputs, customers, geography, and so on, are incorporated. The hostility is defined in availability of key resources and the level of competition in the external environment influenced by the competition, organization's relationships with unions, government, institutions, and others (Mikalef et al., 2020; Mintzberg, 1979).

All those elements happen in the context of the firm. In this research is considered the environmental factor as an element that mixes those elements.

3.2.2.2. Environmental factors for innovation

The authors emphasize that the innovation is an inherently multifactorial entity (Galvez et al., 2013; Hauge et al., 2017; Hou et al., 2012; ISO 56000, 2020), thus is required a global and contextualized view to understand innovation. It means, innovation represents a Contextualized Phenomenon, and multilevel and multifactorial studies should be handled to understand it. Over time, the authors have been proposing some indicators into the multi-sectorial aspects to find the best way to propose a metric of innovation.

Vonortas (2014), made a comparison of the different indicators used over time. These indicators have been classified into the four-generation according to the period they have been developed. The author explains how those indicators have been measured in different ways. The first-generation metrics were focused on inputs, for example, R&D investment, education expenditure, capital expenditure, research personnel, etc. The second generation was focused on accounting intermediate outputs (counts, scientific publications, counts of new products, and so on). The third generation was measured based on the innovation indicators and indexes based on surveys and integration of publicly available data, from the nation's capacity to innovate.

In the case of the fourth generation (from the year 2000 +emerging focus), this author highlights that the classic model of measuring innovation results in stands of innovation outputs based on a set of inputs, still missing a largely untouched meaningful input indicator. Those missing meaningful input indicators are explained as follows in **Table 3**.

Those indicators are not just from the market but the author consider also the country elements that should be integrated.

Table 3 Missing meaningful input indicators

Indicators	Metrics proposed
• Knowledge • Intangibles • Networks • Demand • Clusters • Management techniques • Risk/Return • System Dynamics	**Knowledge indicators**. Account for the knowledge that underlies creation and the ways it is developed and diffused. May include composite knowledge investment indicators and composite performance indicators.
	Networks. Composite network indicators account for both contractual agreements like strategic partnerships, and intellectual property licensing and for informal collaboration and knowledge exchange such as working relationships of individuals across organizations (e.g., clusters). Such networks are not just regional, but also national and global.
	Conditions for innovation. Systemic innovation metrics that capture the context in which organizations form and match expectations and capabilities to innovate. Economic demand, public policy environment, infrastructure conditions, social attitudes, and cultural factors are critical for successful innovation. Is called for primarily are indicators that 'intelligently' (a) describe the main characteristics of the innovation system and its dynamics and (b) look forward in anticipation of likely broad developments (e.g., balanced scorecards, mapping of general-purpose technologies, monitoring demand shifts and global innovation patterns, technology option accounting, etc.)

Note. Source: (Vonortas et al., 2014)

In the effort to avoid missing a meaningful input indicator and considering the multifactorial entity that represents the innovation, contingency theories are still a good way to think about the external factors that affect the organizational innovation ability.

Considering the contingency environmental indicators, and the missing meaningful inputs indicators for the innovation, there are multiple developed ways to evaluate the environmental factors affecting the innovation. For example, Global Innovation Index (GII), European Innovation Scoreboard (EIS)(Union, 2023) and Global Competitiveness Index's innovation sub-index (World Economic Forum, 2004).

The European Innovation Scoreboard is focused on three dimensions Enablers, Firm activities, outputs. Regarding the proposal of Mintzberg, (1979) and the consideration of Vonortas et al.,(2014), there are not a consideration of the basic environmental indicators. In the case of the Global competitiveness index, the

information comes from a survey and not from other sources, so it has been considered as a weakness in the objectivity of the results(Kose, 2016).

The Global Index Innovation (GII)(Dutta et al., 2023) in one of the most used and robust metrics to evaluate the innovation between countries and starting point to decision-making (Brás, 2023; Pençe et al., 2019; Reis et al., 2018.; Smith et al., 2023). It integrates seven pillars, two are outputs, and 4 are inputs. The inputs are detailed in **Table 4**.

Since 2007, this index has been used as a reference and base of important decisions. It uses 5 pillars from the Innovation Inputs, and two as innovation outputs, integrating as inputs the elements of the economy that enable and facilitate innovative activities.

Thus, this model considers not just the market factors but also the country elements impacting innovation.

If we compare the GII indicators with the Environmental indicators proposed by Mintzberg (1979), the GII factors have relation with the Contingency theory. For example, the dimension proposed for Mintzberg, called Stability, is considered for the GII in the pillar of Institution. Complexity is related to the business sophistication (knowledge) and Human Capital. Market diversity with the Market sophistication pillar. With Marketing pillar and Business sophistication, it's also related to the Hostility dimension.

Also, the GII includes the called "meaningful indicators" proposed by Vonortas et al., (2014), explained in **Table 3.**

With this analysis, GII results being a measure that integrates most of the environmental indicators that literature proposes to integrate the environmental approach. Due to the suitability of this index, in this research the GII is going to be used as a reference for the sectorial approach.

Table 4 GII pillars

Input Pillars	Indicators	
Institutions	Institutional environment • Operational stability for business • Government effectiveness Regulatory environment • Regulatory quality	• Rule of law • Cost of redundancy dismissal Business environment • Policies for doing business Entrepreneurship policies and culture
Human capital and research	Education • Expenditure on education, % GDP • Government funding/pupil, secondary, % GDP/cap • School life expectancy, years • PISA scales in reading, maths and science • Pupil–teacher ratio, secondary	Tertiary education • Graduates in science and engineering, • Tertiary inbound mobility Research and development (R&D) • Researchers • Gross expenditure on R&D • Global corporate R&D investors QS university ranking
Infrastructure	Information and communication technologies (ICTs) • ICT access* • ICT use* • Government's online service* • E-participation* •	General infrastructure • Electricity output • Logistics performance • Gross capital formation Ecological sustainability • GDP/unit of energy use • Environmental performance ISO 14001 environment
Market sophistication	Credit • Finance for startups and scaleups • Domestic credit to private sector • Loans from microfinance institutions Investment • Market capitalization Venture capital (VC)	• VC recipients • VC received. Trade, diversification and market scale • Applied tariff rate • Domestic industry diversification • Domestic market scale
Business sophistication	Knowledge workers • Knowledge-intensive employment • Firms offering formal training • Gross expenditure on R&D (GERD) performed by business • . GERD financed by business • Females employed Knowledge absorption • Intellectual property payments • High-tech imports • ICT services imports • FDI net inflows • Research talent	Innovation linkages • University–industry R&D collaboration • State of cluster development • GERD financed by abroad • Joint venture/strategic alliance deals • Patent families

Note. Source: (Dutta et al., 2023)

3.3. Internal (behavioral) impacting factors in Organizational Innovation Capability: a Behavioral perspective

As was seen in the previous sections the innovation capability in the organization is a multifactorial concept. All the models studied in this research directly include aspects at the organizational level. However, in the previous levels, there exist an individual aspect that represents the starting point of the innovation.

Some models are consistent in includes skill force, or management resources as an important element of the innovation capability. It evidences the impact that the employees and their skills, innovative behavior and own employee competences have on the innovation capability of the firm. Those are called individual competences.

In this section, individual competences for the innovation are going to be analyzed. The behavioral perspective is required to be studied to understand the individual characteristics.

Despite the multiple uses of those theoretical constructs, there exist gaps in their own theoretical bases and increasing differences and discrepancies between those constructs and the competences and variables. It leads to a difficult, non-uniformed, or non-common path to analyze and respond to how the person in the innovation process should be profiled for the best innovation performance results.

Into the innovation capability, indicators refer to aspects related to the behavior of the person holding this process. For example, in the last section**,** all the models include the individual, human resources, skills, and their respective management. All of those have in common to be carried by the human capital of the enterprise.

Those aspects referring to the individuality within the human capital is defined as individual competences. This concept is known as the ability of the person to integrate and apply contextually-appropriate the knowledge, skills, and psychosocial factors (beliefs, attitudes, motivations, etc.) to provide successful outcomes (Bartram, 2005; Vitello et al., 2021).

In this study, we are based on those individual's competences that help to have successful outcomes in innovation.

The individual competences represent the origin of the enterprise's innovation due to the innovation foundation, being it a group of ideas. It is people who develop, carry, react, and modify them (Nham et al., 2020; Margana et al., 2019.). That is why the identification of the ideal competences to innovate is currently indispensable to know, intensify and motivate if a high innovation level wants to be achieved.

In the last decades, some theoretical constructs have been developed with the intent of identifying the profile or set of competences of the person behind the innovation

process. Based on literature review, experts' opinion and professionals in this subject, some of the most relevant theoretical constructs are:

- Innovative Behavior (IB) (Lepoutre et al., 2013; Scott et al., 1994; Stauffer, 2015; Welbourne et al., 1998; F. Yuan et al., 2010) is defined as "all individual actions directed at the generation, introduction and or application of beneficial novelty at any organizational level" (ISO 56000, 2020).

- Entrepreneurial Behavior (EB) (Liñán et al., 2021; Mandysová, 2018; Pietersen et al., 2021; Riyanti et al., 2022), is defined as a "behavior in response to a judgmental decision under uncertainty about a possible opportunity for profit" (Gómez et al., 2019)

- Psychological Models (Gao et al., 2020; Luthans et al., 2011; Y. Yuan et al., 2020) (Psy) Psychological model to integrate individual or Psychological variables. Are all the models and theoretical proposal from a psychological perspective, related to innovation.

- Managers' innovation profiles (de Visser et al., 2015; Engle et al., 2017; Martínez et al., 2012). We consider as a manager's innovation profile those characteristics, individuality, and specifics behaviors required for innovation managers to and enlisted for different authors and founding in SCOPUS database.

Different authors have extremely studied those theoretical constructs. This also causes discrepancies and differences between the models.

Those are going to be deeply studied by a systematic literature review in the following chapter, to identify and summarize the principal premises of those constructs.

4. Conclusion

As our core concept of the research is innovation capability, innovation must be defined. Using some of the most common definitions and approach of innovation concept, its definition and levels are explained in **2**. It allows us to focus our reserch on the innovation as an action that improves the context that uses it new or changed solution at the organizational level.

The Organizational Innovation Capability was explained. The elements required to explain its constitution suggest a multifactorial approach. With an analysis and comparative with other models, the PII Model was selected to better define it, in section **3.** This model is a strong and validated model developed by ERPI Laboratory, and this work is part of its line of work**.**

Also, this chapter considers the external impacting factors in the Organizational Innovation Capability. By using the Contingency Theory, some of the most important elements are identified. For our resarch, in section **3.2** are selected the age-size factor and geographical factor. The support for this decision was fully developed. This allows us to have a sectorial perspective.

There were also considered the internal impacting factors. A description of the most important theoretical constructs is presented. By doing this, the behavioral perspective is robustly presented.

For the sectorial perspective it was determined the The Global Index Innovation (GII), as the model and measure for that perspective.

In order to achieve the global objective, two of the three big factors proposed in this thesis have been supported according with the existent literature. However, for the third factor (behavioral perspective) a deep analysis and work should be developed to identify and measure the impacting factors of this perspective into the innovation capability. This deep analysis is developed in the following chapter.

The principal outcome of this chapter for the state of the art of the innovation capability into the organization, is the strong, supported, and updated base of the developed analysis here developed.

Chapter II. Contribution to the behavioral perspective: Model of Individual Competences for the organizational innovation capability; behavioral and sectorial contextualization approach

1. Introduction

As previously mentioned, the general aim of this research is to provide a behavioral and sectorial contextualization approach to improve the innovation capability of a company. To do so, a three-dimensional approach has been proposed.

In the previous chapter, the dimensions of sectorial perspective and innovation capability were detailed and a model for each one has been selected. Now each one has a clear list of indicators and way to measure them.

However, in the case of the third dimension, the behavioral perspective, we noticed some contradictions within the studied theoretical constructs, so a deep analysis is required.

In this chapter, both the development of a model for individual competences is presented as a contribution for a better understanding of r the behavioral perspective, as well as an instrument capable to measure it. The integration of this model completes the missing dimension of our three-dimensional approach.

2. Model of Individual competences for the organizational innovation capability

2.1. Introduction

Due to the multiple theoretical frameworks related to the behavioral impacting factors in the innovation, and the differences of the points of view of each structure, it is currently missing a profile of individual competences for the innovation process that functions as a reference for improving the organization's innovation capability.

For this reason, it results relevant for this research study to analyses and synthesize the theoretical constructs propositions to easily identify the individual competences that effectively impact the innovation. But also, as a real contribution to further theory development and increases the generalizability requires a confrontation with the empirical and daily of the enterprises (Cunningham et al., 2016), an empirical approach it's also developed.

2.2. Methodology Design

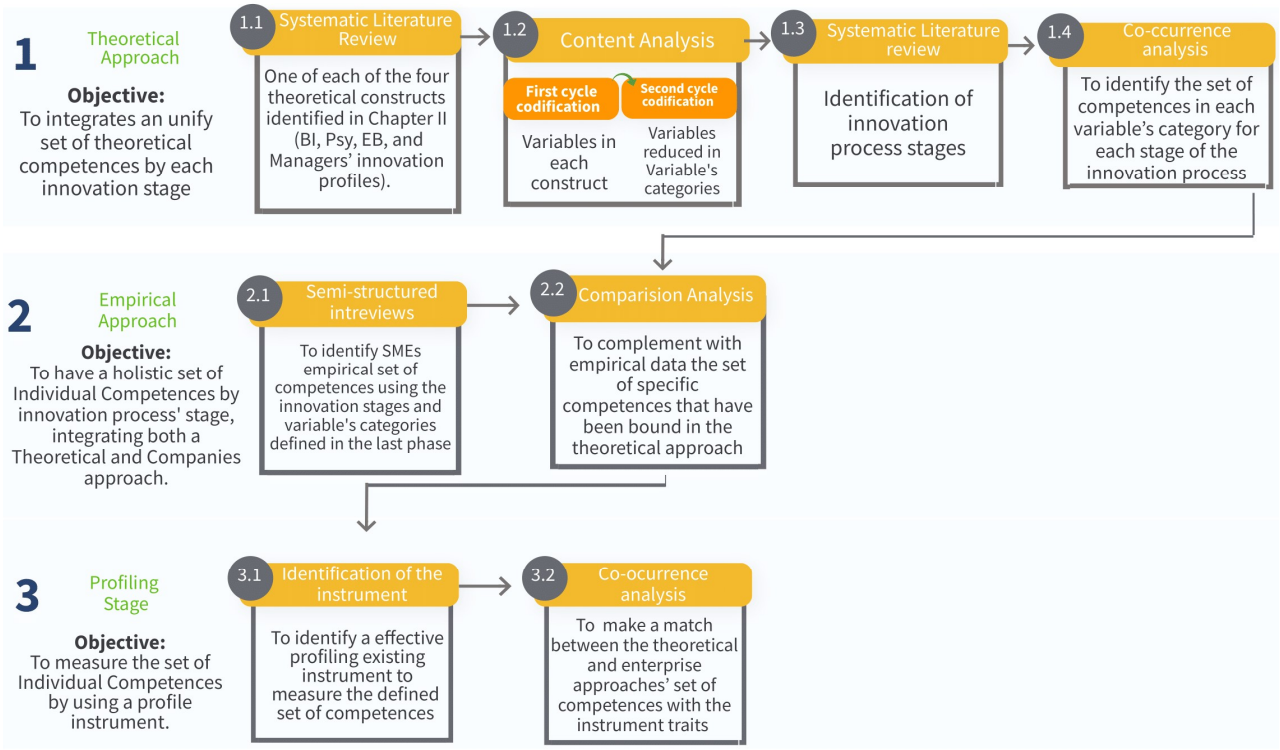
To contribute to this behavioral perspective, three methodological phases were developed. The aim of this methodology was to include not just the results and existing data in the literature but also include the reality of the companies and in our case of SMEs in their daily basis with the empirical approach.

The first one a theoretical approach (phase 1), then an empirical approach (phase 2), and the third one a Model Instrument profiling stage (phase 3), each one with specifics methodological steps.

Likewise, regarding the general objective, this specific objective should bring the identification of unified model for the behavioral perspective and it respective instrument to measure. Consequently, the three big dimensions of the research approach presented in the introduction could result in a guide for the companies with a focus on SMEs as a field of experimentation.

The following figure resume the methodological phases. And in the succeeding subsections the methodology used is going to be detailed:

Figure 8 Methodological phases



Note. Source : Own creation

2.2.1. Phase 1. Theoretical Approach

Due the existence of multiple proposals from different theoretical constructs, that deny us the possibility to choose one construct for the behavioral perspective in this study, it was required to analyze all those theoretical constructs to try to unified the proposals in one model.

2.2.1.1. First systematic Literature Review

The first step of the theoretical approach' phase was a systematic literature review, one for each of the four theoretical constructs identified in the chapter II (BI, Psy, EB and Managers' innovation profiles). It allows us to identify the variables each construct proposes for the innovation individual competences.

In other words, for each theoretical construct this step would help us to find the individual competences each construct proposes. Thus, by searching their principal models, measure, evaluation or assessments, the variables could be identified.

Each of the four theoretical constructs follows the following process:

- A Scopus literature review was carried on, with specific research descriptors.
- Then, the resulting articles were filtered by excluding non-open access articles, literature reviews, and other focus different from our study nature.
- Afterward, a qualitative analysis was made, looking for those "models" that the authors used to evaluate or measure how the innovative person behaves within the resulting articles.

2.2.1.2. Content analysis

All those articles resulting from the literature review had a lot of information. Our aim now was to look for patterns and trends to identify the specific competences used in each model to evaluate the individual innovation so we can clearly identify the competences (variables) used in each model of each theoretical construct.

That's why this content analysis technic was useful and appropriate for our aim. Moreover, it follows a systematic and replicable technique (Stemler, 2019).

This replicable technique for compressing many words of text in fewer content and making inferences by identifying specific characteristics, trend, and patterns in text. The words are coding or classified in categories in the coding cycle, it means each category is determined by integrate a group of word with similar meaning or connotations (Stemler, 2019).

In this study, two coding phases were necessary:

- First coding cycle: The first coding cycle was required in order to identify and group the variables proceeding from the theoretical constructs.
- Second coding cycle: Then a second coding cycle was held with the aim of classified them into categories and found a common and standard framework of categories.

In resume the variables proposed by most of the authors of the selected constructs were codified in a first cycle codification phase and then those variables were reduced by classified them into categories in the second cycle coding phase. As a result, a framework of variable's category for the individual competences for innovation is proposed.

2.2.1.3. Second systematic literature review

After the content analyses of the literature data, it was important to determine if individual competences were the same in all the innovation process. To clarify the innovation process stages, a literature review was handled.

The stages for innovation process are associated with a unique set of tasks and so with a specific skills and roles. It means a specific set of competences may be needed in each stage, as Yeboah (2023) argues. An only set of competences could not be enough to supply all the necessities in the different stages.

Because of this, and as it was mentioned in the general introduction, the following hypothesis was proposed:

The individual competences profile of the person in charge of the innovation process, may be different according to each stage of the innovation

That's why, for this study, it seems relevant to define first the stages of the innovation process and its expected outcomes, due to the individuality and differences in each stage. It would allow us later to better fit a person's set of competences for the innovation with the nature of each stage. Moreover, it could avoid the bias of generalizing one person's set of competences for the whole process, omitting the differences between the stages.

In this case, the following process was held:

- A Scopus review was carried on, to identify the theoretical proposals of innovation process stages.
- And an R-Studio co-citation analysis was performed in order to identify the original papers where the innovation process stages were established.
- With the clusters resulting from co-citation analysis, an individual lecture could be made to identify the structure proposed by the authors for the stages in the innovation process.

As a result, six stages of innovation process were determinate for this study.

2.2.1.4. Co-occurrence analysis

Subsequently, to identify the set of competences in each variable's category for each stage of the innovation process, a co-occurrence analysis based on literature data review, was handled.

The co-occurrence analysis technic is a bibliometric review method to draw a map of concepts, identify the association strength of the keywords and their frequency (Narong, 2023). It would help us to identify the variables for each category and stage, based on the literature.

Some programs have been developed in order to automatize this kind of technics. For this study the VOSviewer software was selected (Sedighi, 2016). This software a map based on a co-occurrence map and is easy to identify the clusters or categories. Moreover, all the information could be downloaded to a deep analysis.

This step includes:

- Scopus review: for each stage, a Scopus review was generated using the keywords used by the authors of the innovation stages and the words of the variable categories propose in the framework.
- Co-occurrence analysis. With the input for the resulting papers in each Scopus review, a co-occurrence map was generated in the VOSviewer. This information was downloaded into an excel, and once there the clusters more related with our study were selected. All the resulting words were classified into the variables' categories of the framework.

This step result in a list of competences classified in the framework of variable's categories for each stage.

2.2.2. Phase 2. Empirical Approach

The empirical approach' phase is a great complement for our study to support the literature results.

This phase includes the following methodological steps:

2.2.2.1. Semi-structured interview

The first step of this approach was applying semi structured interview to SMEs to identify their empirical set of competences. A semi-structured interview instrument was developed. Using a concrete guide provides a way to create comparable data and secure the analysis coherence. But also, using this kind of instrument guarantees the interviewer flexibility to track queries and to adapt to unpredicted directions (Williams et al., 2013).

This method has been studied and carried out considering recommendations to make it as useful as a face-to-face interview (de Villiers et al., 2021).

2.2.2.2. Comparison analysis

Then with empirical and theoretical set of competences a comparison analyses were handled. The goal is to complement with empirical data the set of specific competences that have been bound in the theoretical approach.

This analysis was made for the data treatment, to compare and unify the Theoretical Model with the new information from the companies.

2.2.3. Phase 3. Profile definition

Due to the interesting and valuables outcomes of the previous stages, it results convenient and useful to identify an instrument that could describe the set of competences into a profile, so it could be measured and easy referenced as a profile in each stage of the innovation process. That's why, the final part has as objective to propose an integrative model to present a profile of the core individual competences in each stage of the innovation process.

2.2.3.1. Identification of the instrument

A literature identification of a profiling instrument was made.

The process in this identification includes:

- Scopus review to identify the instrument: by using specific descriptor the resulting papers were identified. From those, just the 15 most cited were analyzed in order to obtain the most used measured instrument in innovation.
- Review of the 15 papers. An analysis was made for each paper so the most used model could be identified. The Big Five instrument is selected
- List of variables or indicators in the dimensions of the instrument. To identify the dimensions of the selected instrument, for each dimension of the instrument a list of indicators was resumed based on the papers.

2.2.3.2. Co-occurrence analysis

By using a co-occurrence analysis to make a match between the theoretical and enterprise approaches' set of competences with the instrument traits was developed. In this case this analysis was made manually because we already have de detailed data and variables, so the next step was to make the matching between the variables and the indicators of the instrument.

As a result, a profile model of individual competences for the innovation process that functions as a reference for improving the organization's innovation capability was established.

2.3. Theorical approach: Individuals innovative variables classification proposal

As discussed in the last part of the Chapter I, four theoretical constructs have been commonly used in the literature, trying to understand the competences of the person behind the innovation. Those are: IB, EB, PSY, and Manager's Innovation Profile. Though, not a single path of competences was determined, even some discrepancies and differences between the models were found.

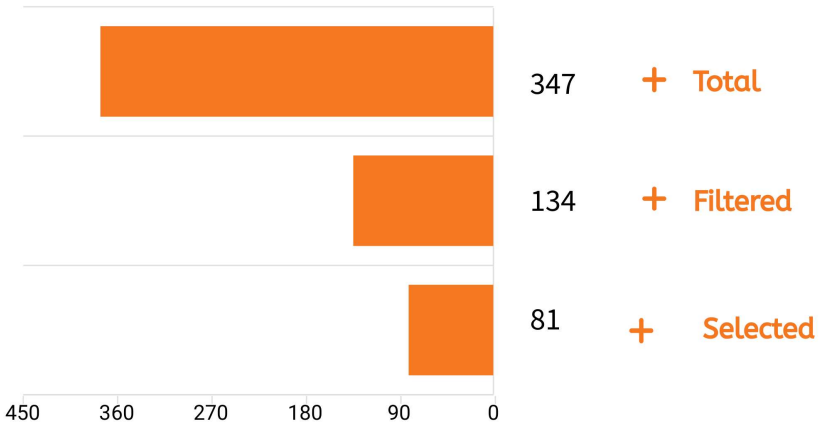
For this reason, it is important to synthesize the theories considered today from the authors and unify concepts and identify the principal categories of variables that should be used for analyzing an individual level of innovation. To doing this, a systematic literature review was held.

2.3.1. Innovative behavior

2.3.1.1. Systematic Literature Review

The first step consisted in finding how this behavior was measured or evaluated, so we could find those principal characteristics of the person that innovate that this construct proposes. It was analyzed through a literature review to identify the principal structure, variables, and models enabling their assessment. A Scopus literature review was carried on using different filters, as **Figure 9** describes:

Figure 9 Scopus filters for Innovative Behavior



Note. Source : Own creation

From the total of 347 SCOPUS articles based on the research: ("TITLE-ABS-KEY ("individual innovativeness" OR "individual innovativeness" OR "individual innovativeness" OR "individual innovation" OR "innovative behavior")) W/15 (TITLE-ABS-KEY ("measure" OR "evaluation" OR "evaluation" OR "assess*" OR "model"))", we filtered articles excluding non-open access articles because we need open access to read and analyze each article, so the non-open ones are difficult to obtain. We also exclude literature reviews because not all of them show the theories used in applied research to evaluate the behavior, and customer innovation because our focus is how the person innovates into a company. The result of this filtering used was 134 effective papers.

Another filtering was used, by excluding those in other languages than the English ones, literature reviews, and topics not related with innovation into the companies or with the person itself. 81 finalist publications were the result.

After we read all the 81-finalist publication. A qualitative analysis was made, looking for those “models” that the authors used to evaluate or measure how the innovative person behaves.

Into the 81-finalist publication, twenty-one models were found that studied IB. To really identify which were the specific variables used to measure the IB, so we could find those principal characteristics of an innovative person, we enlisted all the models and the respective variables. However, it was only possible to identify the variables of each model in a total of 14, since in some remaining ones the model used is mentioned. Nevertheless, when searching the literature, it was not possible to access the specific variables used.

The 14 IB models found with their respective variables are summarized in **Annex** 1. IB (Bysted, 2013; de Jong et al., 2010; Gómez et al., 2019; Janssen, 2000; Kleysen et al., 2001; Lepoutre et al., 2013; Lipych et al., 2018; Monica Hu et al., 2009; Scott et al., 1994; Stauffer, 2015; Welbourne et al., 1998).

2.3.1.2. Content Analysis

For a better mange of the information, it was decided to develop a content analysis with this data. A first cycle codification phase was developed, identifying the variables.

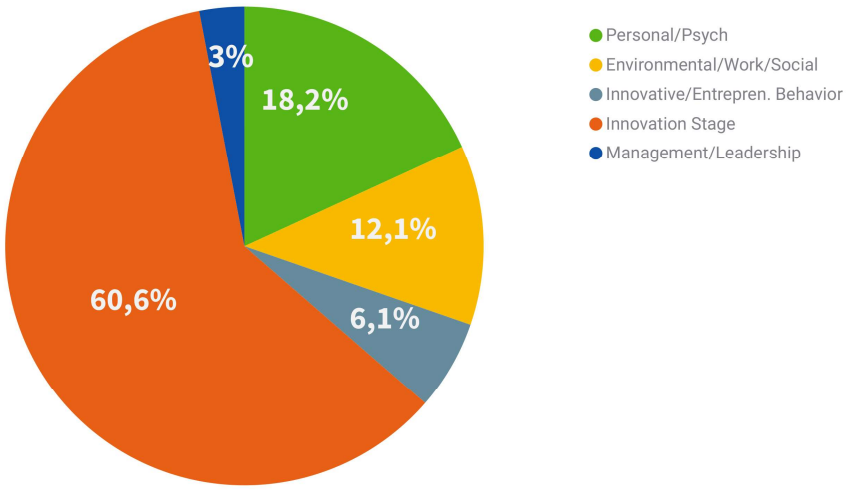
Afterwards, with the variables defined, a second cycle codification phase those variables were reduced to variable’s categories. This process classifies the variables according to their definition or nature, in some categories. All the variables followed a pattern or characteristics that allow us to classify them into four categories. For example, some words related with personal attributes or psychological characteristics, or personal features were integrated in one category. Then, those related with entrepreneurship or with that word were identified in another category. Those related not with personal attribute, but with a process or an

innovation stage or action were classified in another category. After, those related with environmental, or social or work support were in another category. In other words, all the found variables followed some similitude and coincidences, been easy to classify them into categories:

- Environmental/Work/social variables: related to the support of the company or social aspects. Example: innovative work environment, horizontal support, institutional trust.
- Personal/Psychological factors: related to natural or personality characteristics. Example: flexibility, detail-oriented, risk-taking.
- Innovative or Entrepreneurial Behavior: specifically, variables or behaviors related to, or for, innovation or entrepreneurship. Example: entrepreneurial activity, entrepreneurial innovativeness, innovative behavior.
- Management/Leadership: related to the kind of leadership or those variables developed in a charge of leadership. Examples: leadership efficacy, communication, and management skills.
- Innovation stage actions. More than behavior, they are the expected actions. For example, implementation, action, exploitation, etc

In **Figure 10** the distribution of variables is found:

Figure 10 **Innovative Behavior variables classification result**



Note. Source : Own creation

Analyzing this figure, 60.6% of the variables that studied innovative behavior were not related to individual variables or psychological variables. Therefore, a model that is supposed to be an identification of individual behavior just uses 18.2% of individual variables and variables to do it.

To try to understand this surprising context, we also analyzed the other variables that the 81 publications studied when they analyzed IB. For example, if they studied IB and its effect on leadership, leadership was classified as an “other variable”.

The distribution of those other variables’ classification is summarized next. The publications and some of the authors that studied IB related it to another individual variable (46%). Thus, they conceived IB as a variable different or separated from the person, as if IB was not part of the individual and psychological variables. The reason could be because they are focused on IB as a specific reaction or as a form of activity necessary for each stage, not as a list of individual variables. For example, three publications studied the IB and the variable of creativity in a separate.

In one explanation or synthesis of IB, we can say that this is a variable or model that considers a behavior per stage or expects a response in a stage of the innovation, and it is not a model just for psychological variables or individuality exclusively related. For example, the capacity of exploration, exploitation of ideas, opportunity promoter, championing ideas, new ideas’ researcher, etc.

As we found those “contradictions” into the IB models, with the recommendations of innovation specialist, we decided to make a new literature review. This time, using entrepreneurial behavior models and psychological (PSY) models related to innovation, to verify or compare if the similar results were found or if a new variable were missing in IB.

2.3.1.3. Adopted Innovative behavior classification

Regarding the previous results, the following proposal for the classification of the innovative behavior variables is adopted:

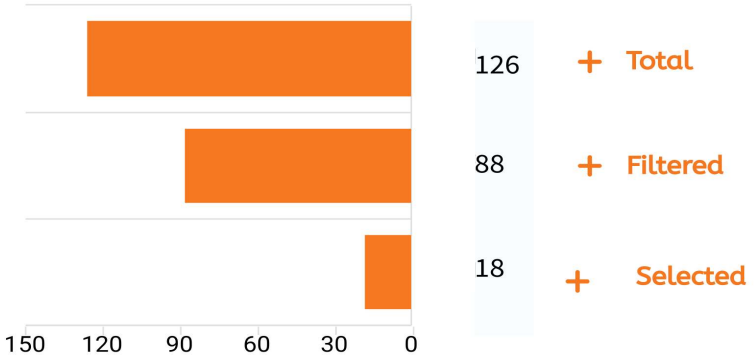
- **Innovation stages actions**: related directly with the behaviors or actions required in the stages of the innovation process.
- **Environmental/Work/Social variables**: related with the support of the company or social aspects.
- **Individual variables:** related to psychological variables or individuality characteristics.
- **Innovative or Entrepreneurial Behavior:** specifically, variables or behaviors related to, or for, innovation or entrepreneurship.
- **Psychological factors:** related to natural or personality characteristics.

2.3.2. Entrepreneurial behavior

2.3.2.1. Systematic Literature Review

It was analyzed through a literature review to identify the principal structure and proposal of the model of variables and their assessment. Scopus' literature reviews were carried on using different filters, as **Figure 11** describes.

Figure 11 Scopus filters for Entrepreneurial Behavior



TITLE-ABS-KEY ((TITLE-ABS-KEY ("Entrepreneur* behavior" OR "entrepreneurial competences" OR "entrepreneurial characteristics" OR "entrepreneurial skills")) W/15 (TITLE-ABS-KEY ("measure" OR "evaluation" OR "assess*" OR "model"))) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007) OR LIMIT-TO (PUBYEAR , 2006) OR LIMIT-TO (PUBYEAR , 2005) OR LIMIT-TO (PUBYEAR , 2004) OR LIMIT-TO (PUBYEAR , 2003) OR LIMIT-TO (PUBYEAR , 2002) OR LIMIT-TO (PUBYEAR , 2000))

Literature review filter and excluded (subject, area, literature review, not open access, customer innovativeness, old than 2000, not English or Spanish)

Note. Source : Own creation

We filtered articles excluding non-open access articles because we need open access to read and analyze each article, so the non-open ones are difficult to obtain. We also exclude literature reviews because not all of them show the theories used in applied research to evaluate the behavior, and customer innovation because our focus is how the person innovates into a company.

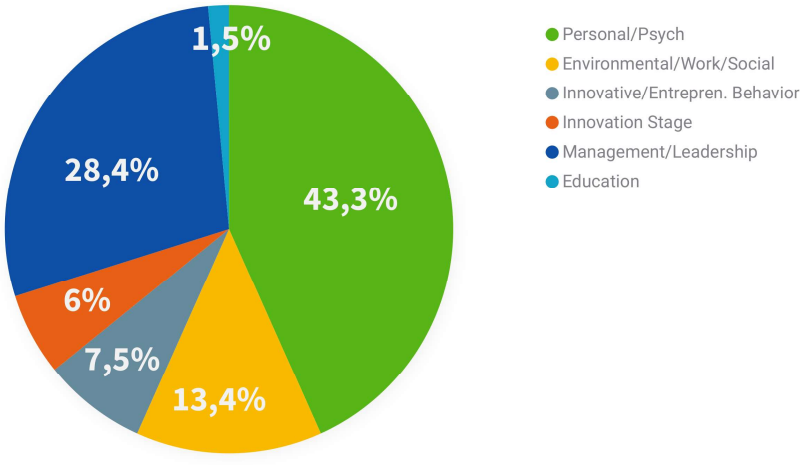
2.3.2.2. Content Analysis

From the 18 publications, a first cycle codification phase to identify the variables used by the authors. Then in a second cycle codification phase those variables were reducing, classifying them into categories according to their nature:

- Environmental/Work/social variables: related to the support of the company or social aspects. Example: innovative work environment, horizontal support, institutional trust.
- Psychological factors: related to natural or personality characteristics. Example: flexibility, detail-oriented, risk-taking.
- Innovative or Entrepreneurial Behavior: specifically, variables or behaviors related to, or for, innovation or entrepreneurship. Example: entrepreneurial activity, entrepreneurial innovativeness, innovative behavior.
- Management/Leadership: related to the kind of leadership or those variables developed in a charge of leadership. Examples: leadership efficacy, communication, and management skills.
- Education: related to the educational process. For example, engineering education, empirical studies, and high school studies.
- Innovation stage actions. More than behavior, they are the expected actions. For example, implementation, action, exploitation, etc.

In **Figure 12** the distribution of variables is found:

Figure 12 Entrepreneurial Behavior variables classification result



Note. Source : Own creation

Entrepreneurial behavior integrates individual or psychological variables but also environmental, innovative behavior, and education, so it is an integral analysis, more than innovative behavior. Includes individual/psychological elements and also de management/leadership skills of the person. The innovative stage variables are not as fundamental as in the IB, but they are also considered.

2.3.2.3. Adopted Entrepreneurial behavior classification

Regarding the previous results, the following proposal for the classification of the variables is detailed:

- **Innovation stages actions**: related directly with the behaviors or actions required in the stages of the innovation process.
- **Environmental/Work/Social variables**: related with the support of the company or social aspects.
- **Individual variables:** related to psychological variables or individuality characteristics.
- **Innovative or Entrepreneurial Behavior:** specifically, variables or behaviors related to, or for, innovation or entrepreneurship.
- **Psychological factors:** related to natural or personality characteristics.
- **Education**: related to the educational process.

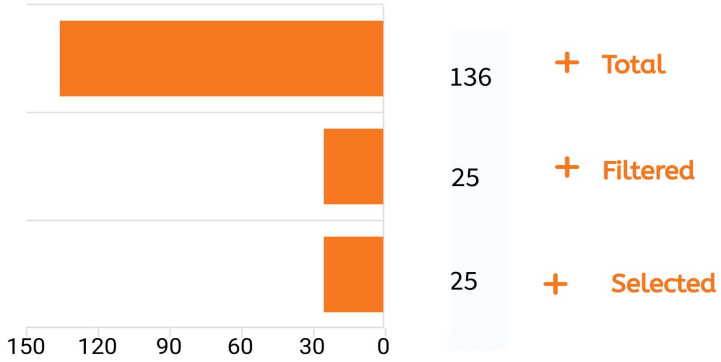
2.3.3. Psychological innovation models

2.3.3.1. Systematic Literature Review

For this reserach, we consider psychological innovation models, those in which the database SCOPUS finding related to the psychological measures used for innovation, evaluation of innovation using psychological characteristics or psychological profile for the innovation.

It was analyzed through a literature review to identify the principles, variables of psychology, and neuro structure for innovation. A Scopus literature review was carried on using different filters, as **Figure 13** describes:

Figure 13 Scopus filters for Psychological Model Variables



(TITLE-ABS-KEY ("personal innovativeness" OR "personal innovation" OR "individual innovativeness" OR "individual innovation" OR "innovative behavior" OR "innovation" OR "innovat* competences" OR "innovat* characteristics" OR "innovat* skills")) W/3 (TITLE-ABS-KEY ("psy*" OR "psy* characteristics" OR "Neuro* characteristics" OR "psy* measure" OR "psy* evaluation" OR "psy* assess*" OR "psy* model" OR "psy* profile" OR "psy* variabl*" OR "neuro* measure" OR "neuro* evaluation" OR "neuro* assess*" OR "neuro* model" OR "neuro* profile" OR "neuro* variabl*")) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007) OR LIMIT-TO (PUBYEAR , 2006) OR LIMIT-TO (PUBYEAR , 2005) OR LIMIT-TO (PUBYEAR , 2004) OR LIMIT-TO (PUBYEAR , 2003) OR LIMIT-TO (PUBYEAR , 2002) OR LIMIT-TO (PUBYEAR , 2001) OR LIMIT-TO (PUBYEAR , 2000)) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "Spanish"))

Literature review filter and excluded (subject, area, literature review, not open access, customer innovativeness, old than 2000, not English or Spanish)

Note. Source : Own creation

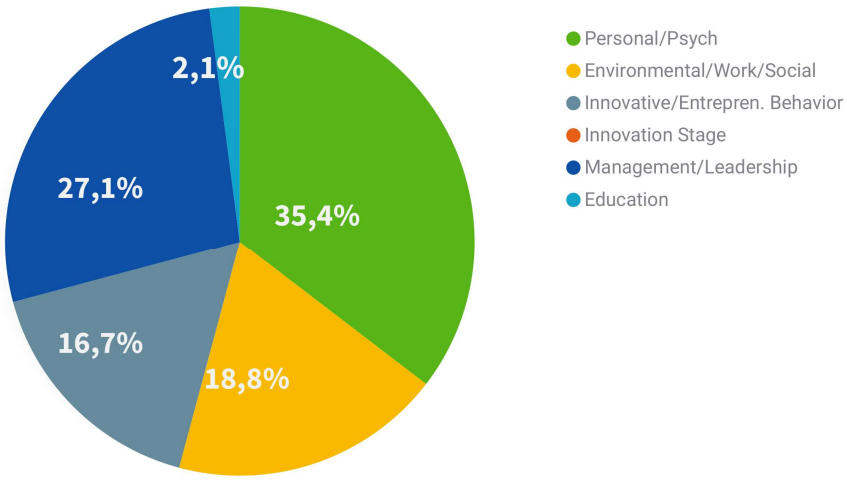
The filters were the same as the previous literature reviews.

2.3.3.2. Content analysis

From the 25 publications, a first cycle codification phase was developed, and the variables used to study psychological innovation models were identified and analyzed. In a second cycle codification phase, those variables were classified in the same five categories as EB due to the same nature of the variables.

The distribution of the variables is as follows (**Figure 14**):

Figure 14 Psychological variables classification result



Note. Source : Own creation

Psychological model integrates individual or psychological variables but also environmental, innovative behavior, and education, so it is an integral analysis. It follows almost the same distribution of EB. As expected, the base of this variable is the individual/psy variables, however, it also includes management/leadership skills and environmental/work/social elements.

2.3.3.3. Adopted Psychological variables classification

Regarding the previous results, the following proposal for the classification of the variables is detailed:

- **Environmental/Work/Social variables**: related with the support of the company or social aspects.
- **Individual variables:** related to psychological variables or individuality characteristics.
- **Innovative or Entrepreneurial Behavior:** specifically, variables or behaviors related to, or for, innovation or entrepreneurship.
- **Psychological factors:** related to natural or personality characteristics.
- **Education**: related to the educational process.

2.3.4. Managers innovation profile

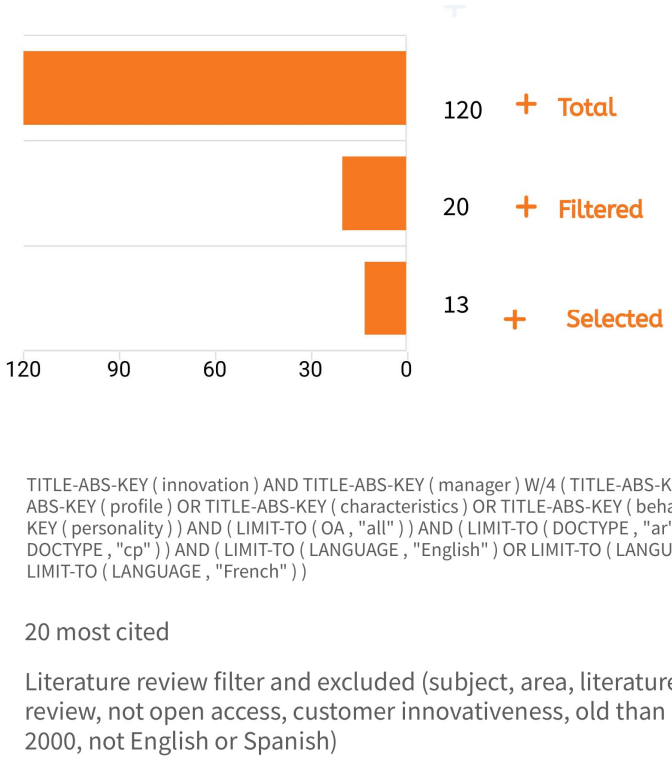
2.3.4.1. Systematic literature review

For this study, we consider as a manager's innovation profile those characteristics, individuality, and specifics behaviors required for innovation managers to and enlisted for different authors and founding in SCOPUS database.

As our focus is on SMEs, and the structures could not include a managerial position or well-defined position, our study was focused on knowing the innovation profile of the managers (if exist) or the person that leads the innovation process. This person is not necessarily a manager, due to the nature of the SMEs; but is the person supervising, or the team leader that is, in the end, responsible for the process. Once a general person profile (IB, EB, PSY models) was studied, it seemed interesting to apply the same sequence of literature reviews for the manager's profile.

A Scopus literature review was carried on using different filters, as **Figure 15** describes:

Figure 15 Scopus filters for Managers' profile



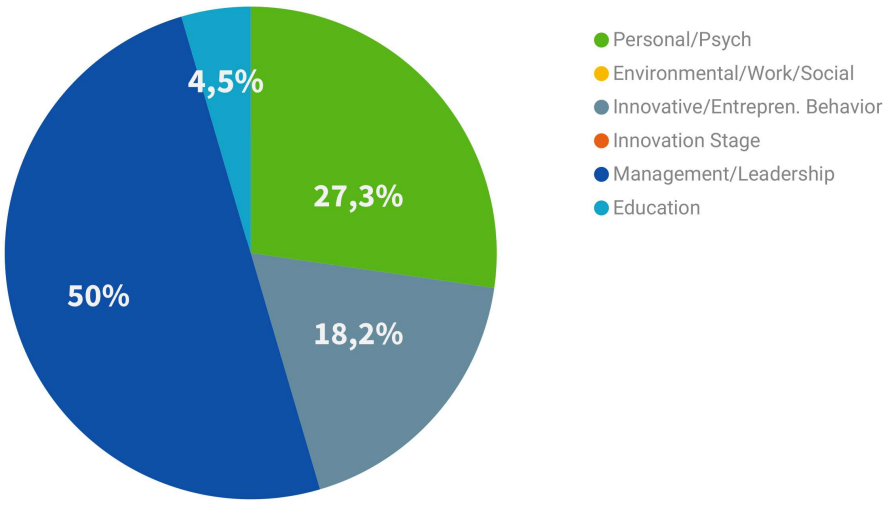
Note. Source : Own creation

The used filters were the same as in previous reviews.

2.3.4.2. Content analysis

From the 13 publications, the variables used to study the Manager Innovation profile were identified in a first cycle codification phase, and then classified in four of the categories resulting from the second cycle codification phase. The distribution of the variables is as follows:

Figure 16 **Managers' innovation profile variables classification result**



Note. Source : Own creation

As expected, most of the variables correspond to a management/leadership category. However, one of the most interesting data is that the education category is bigger than the other variables studied before. Innovation stage was not found into the variables, either environmental/work/social category. One of the possible explanations is that the social context is developed also for the managers, so probably in a general way, the general person is into the context, but the manager develops their context under a certain point. However, it's important to underline and retake in future studies this phenomenon.

This variable can be considered more technical or professional because it focuses 50% on management/leadership skills. A 27.3% is for the individual variables and 18.2% for EB.

2.3.4.3. Adopted Managers variables classification

Regarding the previous results, the following proposal for the classification of the variables is detailed:

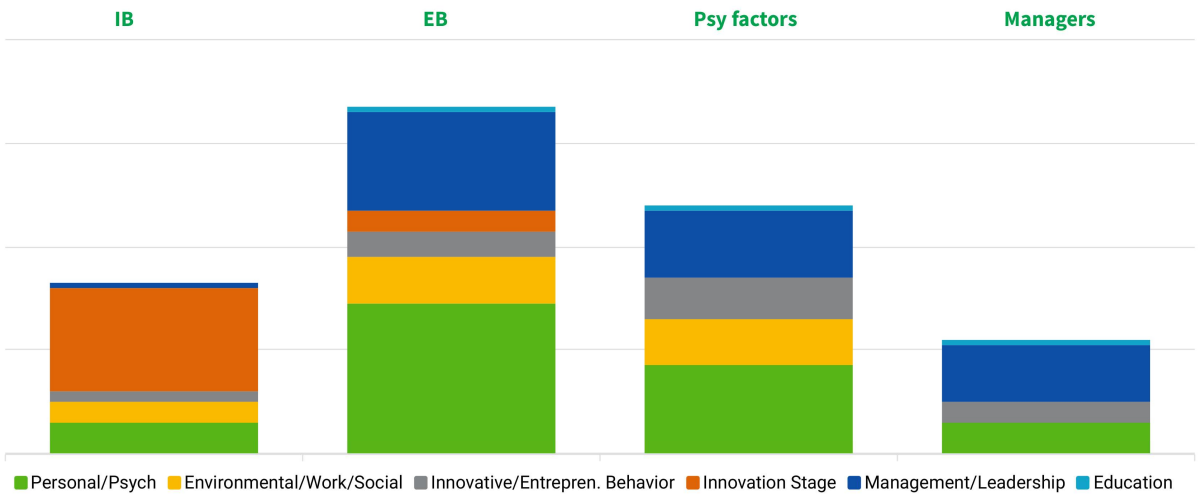
- **Individual variables:** related to psychological variables or individuality characteristics.
- **Innovative or Entrepreneurial Behavior:** specifically, variables or behaviors related to, or for, innovation or entrepreneurship.
- **Psychological factors:** related to natural or personality characteristics.
- **Education**: related to the educational process.

2.3.5. Variable's categories comparison

The four theoretical models: IB, EB, PSY, and Manager's Innovation Profile, shared most of the categories for the classification of their variables. At this point, a comparison between them to establish a common pattern of categories of variables is required, to better understand the differences and analyze possibilities to establish a model to study the innovation profile of the person.

The **Figure 17** represents the comparative.

Figure 17 Variables classification comparisons



Note. Source : Own creation

The individual/Psychological category variables are in the four variables because this is the base of this study.

IB is the model studied that integrates more variables related to stages and specifically expected behavior required for different moments of the innovation. The individual and contextual categories are important for this variable as well.

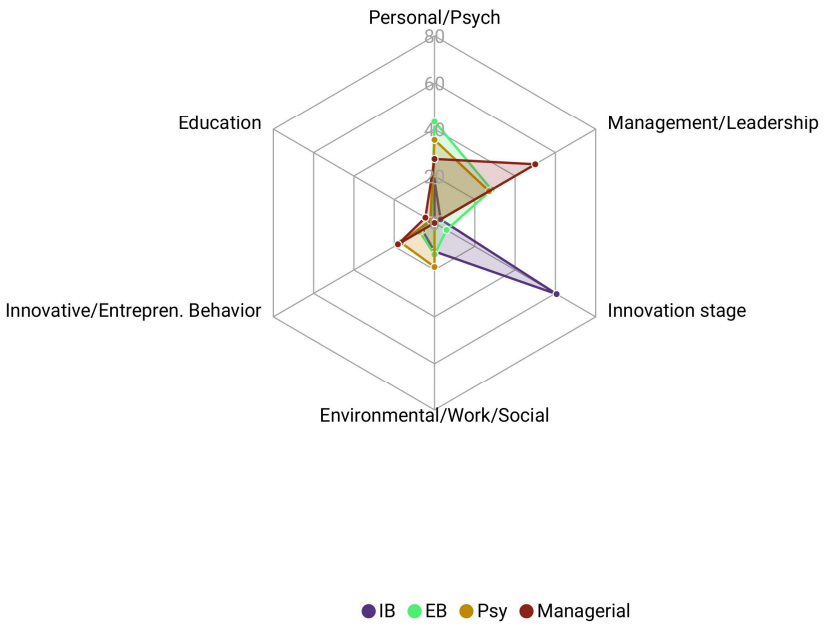
EB is one of the most integral of the models because it utilizes the five categories in a most equilibrated way. Integrate contextual and management/leadership (technical or professional skills) categories. And the innovation stages, education, and innovative behavior are also present.

Psy Variables are based mainly on individual models, but also is interesting that integrate the other categories as well. Even if the expected result was only the individual category, it also integrates other categories, principally management/leadership. It is not focused on specific behaviors for stages of the innovation.

A manager's profile is half for "technical" variables or capabilities as a leader. The education category has the highest value in managers' profiles compared with the other variables studied. The contextual variables here are not found, even if for the other variables of innovation (IB, EB, PSY) it is there.

Another way to see these variables is the following:

Figure 18 Variables classification comparisons



Note. Source : Own creation

In this figure, the different matrixes of each construct are easily recognized. Some strong points are the management/leadership, and individual psych factors. However, there exists an internal level shared by most of the constructs but not all. Those include the environmental and psych.

This is consistent with the previous figure and helps to visually identify the constructs and their nature.

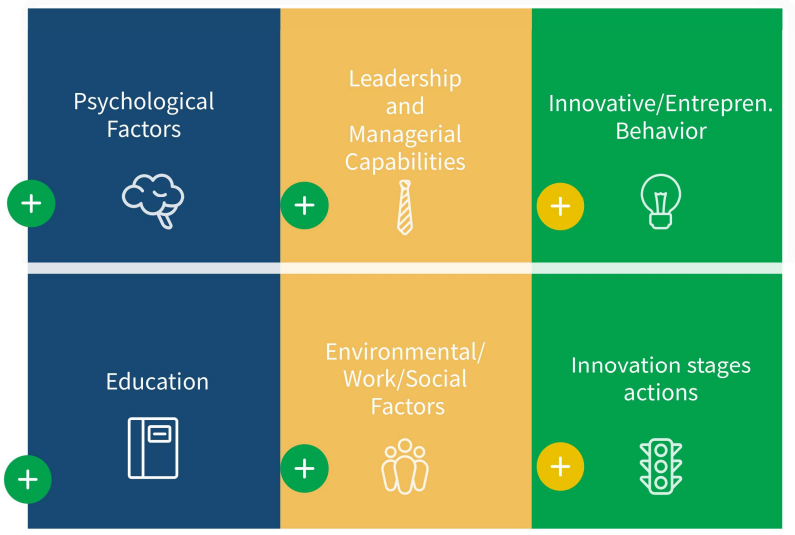
2.3.6. Framework of variables categorization for individual competences in innovation

Based on the literature review made in section 3.3 and the comparison between the results, it can be deduced that an innovative person could not be considered as one element and separated from other variables. Not only the individual or psychological models are enough to explain the innovative individual competences.

Since the Psychological models analyzed imply other categories such as leadership, environmental elements, and others, it's a clear signal that the profile of the innovative person it's a result of the sum of different variables.

The principal variables' categories are (**Figure 19**):

Figure 19 Framework of variables categorization for individual competences in innovation



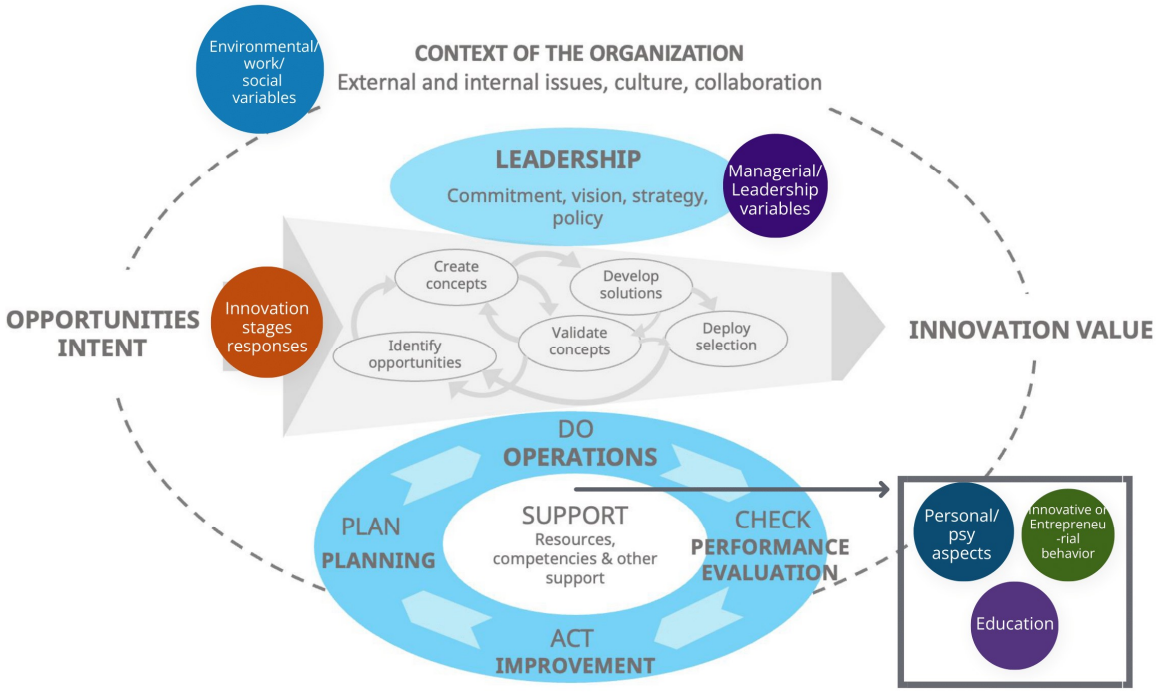
Note. Source : Own creation

Those categories are the categories to be considered when an identification or measure want to be developed.

Those categories of variables of the model is consistent with the ISO 56000:2019 (Innovation Management – Fundamentals and Vocabulary). This norm integrates holistic and integral aspects of the innovation and its management system (ISO 56000, 2020). It proposes the areas of the organization for innovation. Those are in the following figure in color gray. Those areas resulting consistent with the categorization of variables we proposed, resulting from a literature and empirical approach.

It supports our proposal as it has relation with the ISO 56000:2019. The following figure shows this consistency:

Figure 20 **Association with ISO 56000:2019**



Note. Source : Adaptation from (ISO 56000, 2020)

Our adaptation of the ISO Model of innovation management system leads to the highlighting of the individual competences on innovation for each process:

- Support: Resources, competencies, and other support.
  - Consistent with individual/psychological aspects, education, and innovative/entrepreneurial behavior.

- Leadership: Commitment, vision, strategy, policy
  - Consistent with management/leadership skills.

- Operations: Identify opportunities, create concepts, etc.
  - Consistent with innovation stage responses.

- Context of the organization: External and internal issues, culture, collaboration
  - Consistent with environmental/work and social support and conditions.

All the variables found in the literature review are consistently related to ISO 56000:2019.

It is a demonstration that the bases of the categories proposed for studying the individual innovation competences are coherent and sustained by an international norm.

2.3.7. Stages for the innovation process

For this study, resulted relevant to define the stages of the innovation process and its expected outcomes, due to the individuality and differences in each stage, and also to answer the hypothesis proposed: The individual competences profile of the person in charge of the innovation process, may be different according to each stage of the innovation. It would allow us later to better fit a person's set of competences for the innovation with the nature of each stage. Moreover, it could avoid the bias of generalizing one person's set of competences for the whole process, omitting the differences between the stages

There exist some theoretical and empirical approaches that suggest different stages in the innovation process. Some of them include from four innovation stages to six (Cooper, 1990; ISO 56000, 2020; Rogers, 2003; Tidd et al, 2013.).

In all the cases, the author's proposal highlights defined outcomes and aims in each stage, different from the other stages. It means each stage has its own expected outcomes and its own objective. For example, (ISO 56000, 2020) refers to the first step to identify opportunities, and the second step is with now this information create the concept. Those are also different from its last suggested stage, which requires implementing the innovation outcome in the enterprise.

To define the innovation stage, Scopus research was held due to the multiples and variety of innovation stages used by other authors and norms (ISO 56000, 2020).

The Scopus research description is detailed in **Figure 21.**

Figure 21 **Scopus research for innovation stages identification**



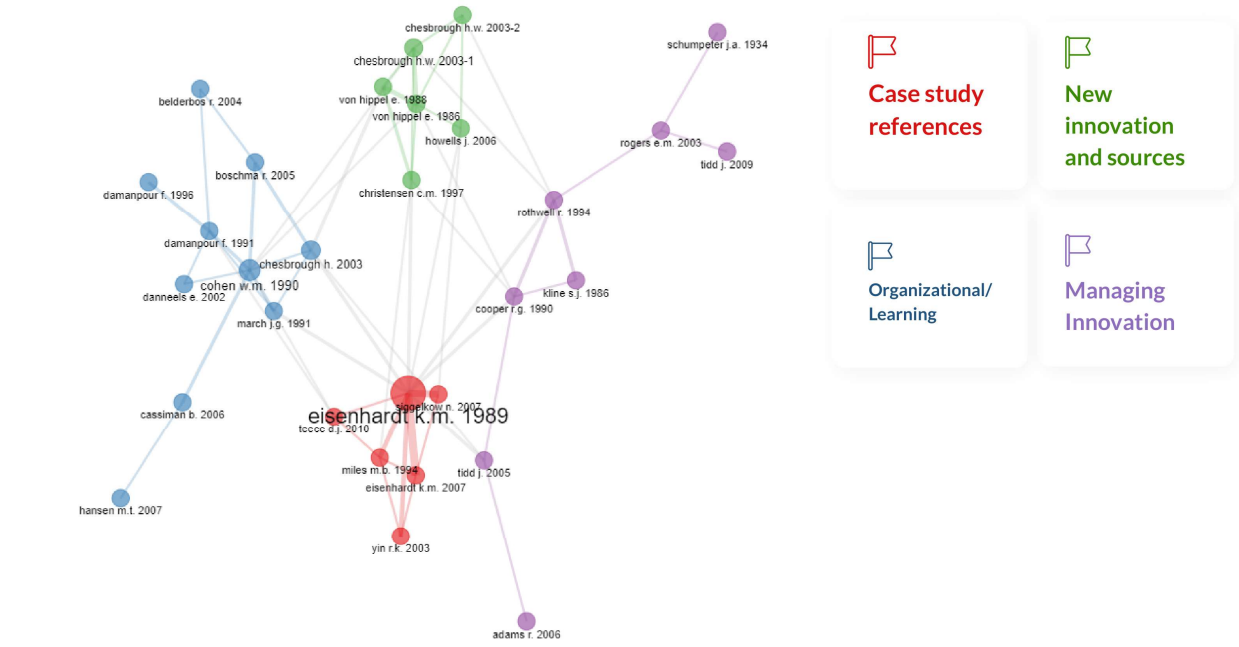
TITLE-ABS-KEY ("innovation stages" OR "innovation process") AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Innovation Process") OR LIMIT-TO (EXACTKEYWORD , "Innovation Processes"))

Note. Source : Own creation

Considering the 309 papers and identifying the most common proposal of innovative stages used by the authors, an R-Studio co-citation analysis was performed.

As a result, the following analysis map was obtained:

Figure 22 R-Studio co-citation analysis



Note. Source : Own creation

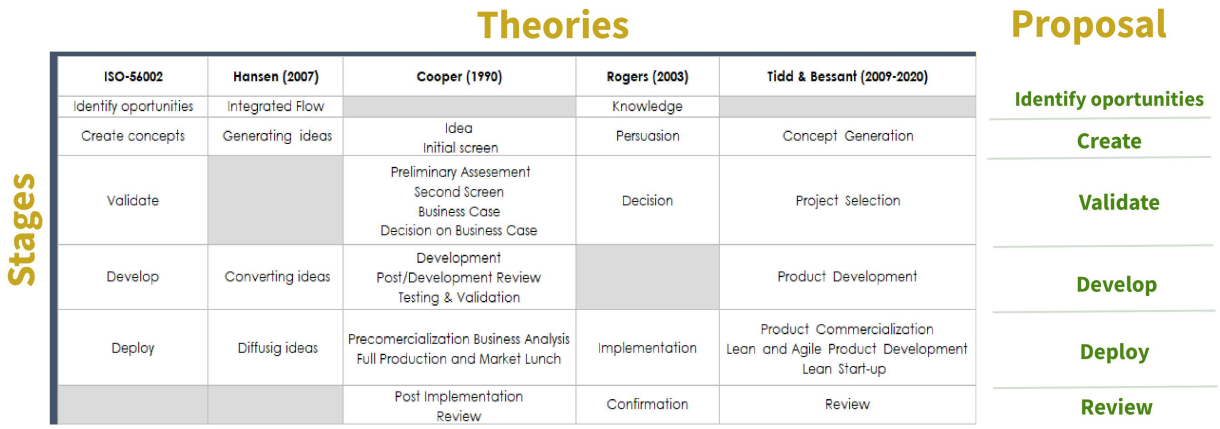
Four clusters were identified. After identification of the nature of each cluster by reading keywords and an abstract review, two of them were selected: the blue and purple ones; being those related to organizational learning subjects and managing innovation respectively.

With those clusters, an individual lecture was made to identify the structure proposed by the authors for the stages in the innovation process.

The papers (Cooper, 1990; Hansen et al., 2007; Rogers, 2003; Tidd et al, 2013.) were considered to analyze and resume the stage models suggested. Also, was included the purpose of the stages for the innovation process used in the ISO- 56002 (ISO 56000, 2020).

The following figure represents a resume of the stage proposed by each author and the proposal for the unification of innovation processes in 6 stages:

Figure 23 Scopus research for innovation stages identification



Note. Source : Own creation

Starting from this resume, it was analyzed each author's suggestion and compared with the other's proposals, in Figure 23, for each row the name of the stage is established using the main idea in each theory, but also giving to ISO-56002:2019 a leader of the row. The main part of the authors concerns the process or the main idea in each stage, even if they are called different.

Considering this study, a proposal of six innovation process stages is presented:

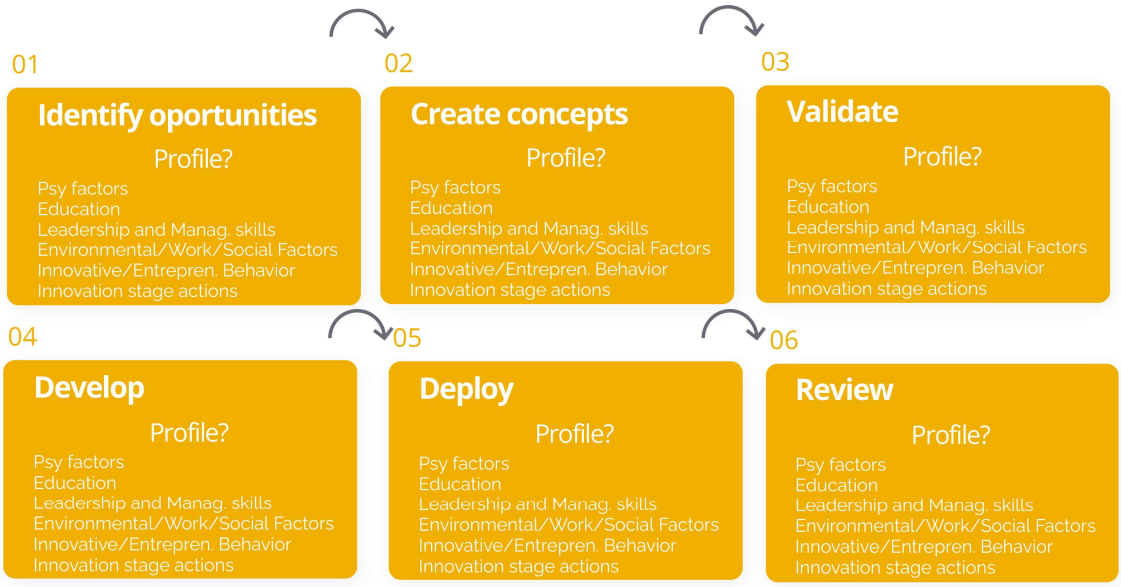
- Stage 1. Identify opportunities: knowledge of a necessity or problem to be solved and where the innovation initiative started(Hansen et al., 2007; ISO 56000, 2020; Rogers, 2003).
- Stage 2. Create concepts: idea generation, initial screen, and concept generation. The potential solutions are handled in this stage (Cooper, 1990; Hansen et al., 2007; ISO 56000, 2020; Rogers, 2003; Tidd et al, 2013.).
- Stage 3. Validate: the project or solution selection is carried on, as well as the following process to decrease the uncertainty of technical, financial, marketing, and organizational aspects. The viability and validation of the risk are reviewed in this stage (Cooper, 1990; ISO 56000, 2020; Rogers, 2003; Tidd et al, 2013.).
- Stage 4. Develop the materialization of the concept and convert ideas in a real solution in held in this process. The participation of stakeholders is preferred to help the creation process and validate its acceptability (Cooper, 1990; Hansen et al., 2007; ISO 56000, 2020; Tidd et al, 2013.).

- Stage 5. Deploy: diffusing and communicating the idea is realized. It is also called as implementation, and here the commercialization of the solution is executed, could integrate some stakeholders and organizational departments to integrate the solution (Cooper, 1990; Hansen et al., 2007; ISO 56000, 2020; Rogers, 2003; Tidd et al, 2013.).
- Stage 6. Review: the right function of the solution reviewed, and the identification of new opportunities to be solved in future innovation processes (Cooper, 1990; Rogers, 2003; Tidd et al, 2013.).

2.3.8. Theoretical Set of individual competences for each stage of the innovation process

In order to identify the right theoretical competences for each innovation stage (See Figure 24), it was considered the proposal of six innovation process stages identified in Section Stages for the innovation process. For each stage, the framework of categorization variables for the individual competences in the innovation was studied.

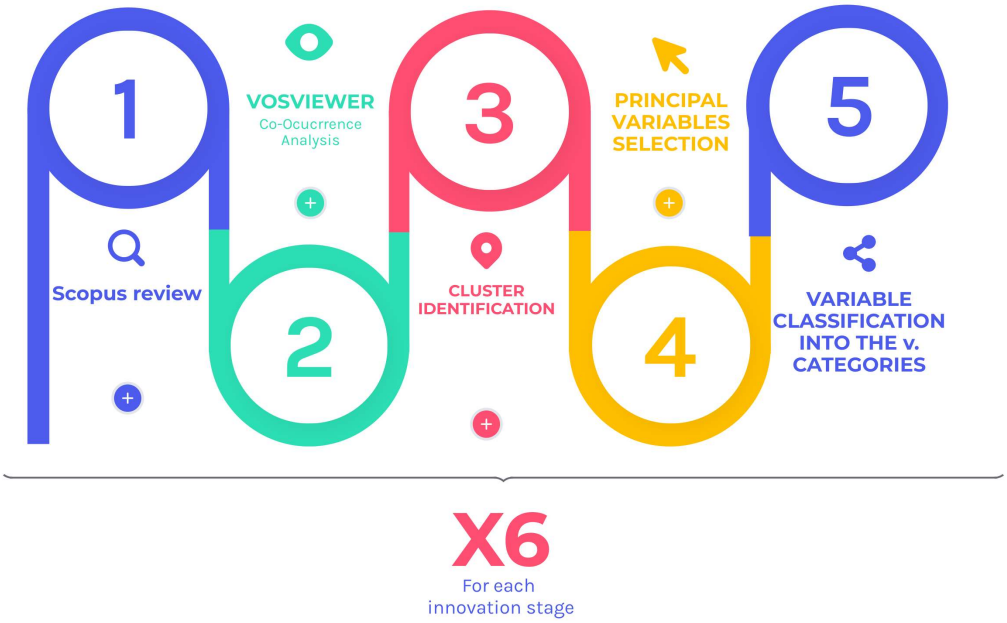
Figure 24 Competences in each variables' categories framework



Note. Source : Own creation

The process to fulfill the set of competences in each stage was developed first from a theoretical approach, as **Figure 25** shows:

Figure 25 **Process to identify the competences in each stage**



Note. Source : Own creation

For each stage, we generate Scopus research using the keywords used by the authors of the innovation stages and the words of the variable categories propose

Table 5 Research descriptor

Stage	Descriptor
For Identify Opportunities stage	(KEY (innovat*)) AND ("identify opportunit*" OR "integrated flow" OR "knowledge" W/3 "stage" OR "process") AND (profile OR individuality OR person OR psycholog* OR education OR skills OR leadership OR social OR environment* OR behavior OR skills) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (LANGUAGE , "English"))
For Create Concepts stage:	(KEY (innovat*)) AND ("create concept*" OR "concept generation" OR "generating ideas" OR "Idea" OR "initial screen" OR "persuasion" W/3 "stage" OR "process") AND (profile OR individuality OR person OR psycholog* OR education OR skills OR leadership OR social OR environment* OR behavior OR skills) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (LANGUAGE , "English"))
For Validate stage:	(KEY (innovat*)) AND ("validate" OR "business case" OR "preliminary assessment" OR "second screen" OR "decision" OR "project selection" W/3 "stage" OR "process") AND (profile OR individuality OR person OR psycholog* OR education OR skills OR leadership OR social OR environment* OR behavior OR skills) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (LANGUAGE , "English"))
For Develop stage	: (KEY (innovat*)) AND ("develop*" OR "converting idea" OR "develop* review" OR "testing" OR "validation" OR "product development" W/3 "stage" OR "process") AND (profile OR individuality OR person OR psycholog* OR education OR skills OR leadership OR social OR environment* OR behavior OR skills) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (LANGUAGE , "English"))
For Deploy stage:	(KEY (innovat*)) AND ("deploy*" OR "diffusing idea" OR "precommercialization" OR "production" OR "implementation" OR "commercialization" W/3 "stage" OR "process") AND (profile OR individuality OR person OR psycholog* OR education OR skills OR leadership OR social OR environment* OR behavior OR skills) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (LANGUAGE , "English"))
For Review stage:	KEY (innovat*)) AND ("post implementation*" OR "review" OR "confirmation") AND (profile OR individuality OR person OR psycholog* OR education OR skills OR leadership OR social OR environment* OR behavior OR skills) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (LANGUAGE , "English"))

Note. Source: Own creation

in our framework for the innovation profile. Each stage research descriptor used were:

With the articles resulting from the Scopus review, we download the 2000 CSV documents in each stage. 2000 because Scopus just allows downloading this number. With this document we uploaded into de VOSVIEWER to identify the most common words used, the objective was to identify in those words the variables most used in each stage. Here the co-occurrence is generated automatically by the platform using the 2000 Scopus papers.

The process handled was the following:

- **Co-occurrence map.** For each stage, we generate the co-occurrence map. Each map shows clusters of the most frequent words, making a kind of group of topics. (See Annex 1).
- **Co-occurrence words**. With each co-occurrence map, we download the words into Excel (one download for each stage) with the classification in clusters. All cluster were analyzed and then selected.
- **Cluster selections.** Once into the Excel for each stage, we selected the clusters most related with the possibility to find variables classifiable into the individual innovation framework. For example, we exclude some clusters related to the kind of investigation because those have words like case studies, literature review, etc. Words that are not a variable classifiable into the individual characteristics of an innovative person profile. Another example is the cluster related to the country or places where the investigations were developed. Because those do not add any interest or variable to our analysis, we select some clusters related to individual characteristics and those with the possibility to found variables for the framework classification.
- **Selection of words in each cluster chosen**. Into the excel, in each cluster chosen before, we identify those words for individual characteristics or behaviors or other classifiable a variable of the framework. Not all the words of the cluster were individual characteristics or behaviors, so the analysis was intense at this point.
- **Classification into the Variables' Categories Framework for the Set of Individual Innovation Capabilities**. Each time a word was identified as a variable was at the time classified into the variable category of the framework (psy factor, leadership/managerial factors, etc.).
- **Theoretical Model of Individual Competences**. A theoretical proposal of the variable categories with the respective competences was enlisted at each stage.

An extract of the theoretical Model (Stage 1 and Stage 2) is presented in the following tables. (See the Complete Model in Annex 3. Theoretical individual competences for innovation)

Table 6 Stage 1. Model individual innovation competences: from theoretical approach.

Innovation Stage: 1. Identify opportunities

Category	Individual Competences
Educational profile or studies:	Project management
	Engineering education
Environmental/Work/Social factors that could impact:	Organizational culture
Innovation stage actions required:	Exploitation
	Exploration
	Planning
Innovative/Entrepreneur. Behavior expected:	Innovation capability or innovativeness Collaborative innovation
Leadership and Manag. Skills required:	Communication
	Problem solving
	Risk assessment Leadership Dynamic capabilities
Psychological factors expected:	Absorptive capacity, Abstraction capacity
	Creativity, Cooperative

Note. Source : Own creation

Table 7 Stage 2. Model individual innovation competences: from theoretical approach

Innovation Stage: 2. Create Concepts

Category	Individual Competences
Educational profile or studies:	Project manager studies, empirical
Environmental/Work/Social factors that could impact:	Collaboration, team's collaboration
Innovation stage actions required:	Planning,
	Exploitation, solution creation
Innovative/Entrepreneur. Behavior expected:	Innovativeness
Leadership and Manag. Skills required:	Leadership
	Dynamic capabilities,
Psychological factors expected:	Creativity, Trust

Note. Source : Own creation

2.4. Empirical Approach: an exploratory multiple case approach

2.4.1. Theoretical Background.

The second part of the methodology includes the exploratory multiple case for the confrontation with the companies to verify and compare the theoretical individual competences proposed in this study.

As detailed in the introduction of this chapter, an empirical approach was handled to complement and validate the theoretical individual competences proposed in the section 2.3.

Since a Theoretical Model of Individual Competences is based on the literature, this methodological step aims to have the individual's core competences from both theoretical and empirical approach, for each innovation stage.

To verify and complement the Theoretical Model of Individual Competences proposed in this study, an exploratory multiple-case approach was developed according to the methodology proposed by (Yin, 2014). By collecting data from independent sources: the theoretical and empirical approach, this approach is preferred because can lead to further theory development and will increase the standardization of qualitative studies (Cunningham et al., 2016).

Three steps in this exploratory multiple case were developed, as follows in the next subsections.

Finally, considering that the Theoretical Model of Individual Competences has been developed based on a unified and systematic literature review, it is considered as a methodological starting point.

This model contains a set of individual core competences for each innovation stage. Those are the competences required to efficiently respond and succeed in each stage.

2.4.2. Semi-structured interview

2.4.2.1. Target Sample

For the interviews, a target sample includes ten owners and managers of SMEs operating in Costa Rica. The data were collected between October and December 2023. The selection process for the businesses to be surveyed depended on two criteria. First, businesses should belong to one of four sectors: Energy, telecommunication, and manufacturing, or services SMEs. These sectors have the most quantity of innovative processes held in Costa Rica. Based on a comparative analysis held for this study of the Science and Technology Index of the years 2013 to 2016 and 2018 (*Indicadores de Ciencia y Tecnología – Ministerio de Ciencia, Innovación, Tecnología y Telecomunicaciones*,2022.). In Costa Rica, the business

sectors include the agricultural sector, manufacturing, energy and telecommunication, and services.

Comparing the results of those years, in 2013 at least 93.2% of the sectors of manufacturing, energy, and telecommunications handled an innovative process; in 2014, 60% of the agricultural sector held an innovative process; in 2015-2016, 88.7% of the service sector held an innovative process; and in 2018, and 36.2% of the agricultural sector realized an innovative process.

Averaging and comparing those results, in those years the sector with the highest percentage of kind of innovation processes handled was manufacturing, energy, and telecommunications, followed by the service sector. This is the reason only the three first sector was selected.

The second criterion was to have the experience of at least three innovation processes realized in the last three years. Once these businesses were selected, an exhaustive semi-structured interview was conducted.

The next table resumes the ten SMEs selected:

Table 8 SMEs selected

SMEs	Industry
7 companies	Services Sector: 6 from IT 1 from consulting services
3 companies	Manufacturing

Note. Source : Own creation

2.4.2.2. Interview instrument

A semi-structured interview instrument was developed. Using a concrete guide provides a way to create comparable data and secure the analysis coherence.

In total, ten semi-structured interviews were conducted in private sessions, in a video communication channel with the camera of both the interviewer and interviewer.

The interview followed a guideline built based on the scheme of the theoretical individual competences. The guideline considers the six categories from the Variables' Categories Framework for the individual competences defined in the

previous stage of this study in each stage of the six innovation stages proposed based on the literature review. For more detail the used guideline of the interview, see Annex 4.

The individual competences requirements were focused on the person in charge of each stage procedure. This person is not necessarily a manager, due to the nature of the SMEs; but is the person supervising, or the team leader that is, in the end, responsible for this stage's success. In some cases, this person is not defined in the organizational structure but, is in practice the person leading the stage process. It's important to clarify it is not one competence for the whole innovation process, but each stage's in-charge person. This was defined with the aim of assuring the most specific set of competences possible and avoiding the bias of generalizing the profile by evading the differences between the stages found in the literature review. This is due to its different aims and requirements found in the theoretical results mentioned before.

The aim of the questions was to identify the most essential individual innovation competences existing or ideal for the person in charge in each stage of the innovation process. At the end of each stage section, once the interviewee's intervention is finished, if some category from the framework was not considered, a sub-question was realized mentioning the missing category. This was done to identify the most critical variable or competencies if it exists for the interviewee.

2.4.3. Empirical and theoretical approaches comparison

2.4.3.1. Comparison analysis protocol

With the company's information, a comparison analysis protocol would allow us to unify the competences from the theory and the company's approach, for each stage.

The protocol to implement this comparison analysis includes the following process:

- **Individual innovation competences identification**
  The researcher identified keywords, examples, or concepts related to individual innovation competences in each innovation stage, resulting from the interviews.

- **Deductive analysis**
  Then, a deductive procedure to rename or identify the competences described by the interviewee, but not mentioned with a specific name of a variable or competences. Here were also unify those repeated or synonymous variables into the same variable.

- **Keywords classification**
  The third step of analysis consists in allocates or classify those keywords into the variables' categories framework used in this study, at each stage.

This analysis allows us to have a set of individual competences from theoretical and the company's approach, for each stage. That's why the variable's similitude, synonyms, or repeated items between both models, theoretical and company approach, were unifying integrating all the similitude into one model. The not similar variables were not included.

2.4.3.2. Comparison analysis results

As a result, the following model of individual innovation competences: theoretical and empirical approach:

Table 9 Stage 1. Model individual innovation competences: from theoretical and empirical approach.

Innovation Stage: 1. Identify opportunities

Category	Individual Competences
Educational profile or studies:	Project management
	Engineering education
Environmental/Work/Social factors that could impact:	Organizational culture
Innovation stage actions required:	Exploitation, new functionalities
	Identifying problem, exploration
	Planning, Prioritization, risk assessment
Innovative/Entrepreneur. Behavior expected:	Innovation capability or innovativeness
Leadership and Manag. Skills required:	Communication
	Problem-solving, Solution researcher, decision maker Risk assessment
	Dynamic capabilities: Capacity building or adoption, Materialize ideas Proactive
Psychological factors expected:	Absorptive capacity, Abstraction capacity
	Creativity, Structured, Persistent

Note. Source : Own creation

The competences integrated from the variable's coincidences between the theoretical and empirical approach displays the ideal set of competences for SME innovation supervisor for the innovation processes' stage 1: Identifying opportunities. The innovation actions required for this stage are compatible with the nature of the stage, being the first step of identifying knowledge and visualizing problems and possible solutions (Hansen et al., 2007; ISO 56000, 2020; Rogers, 2003).

The innovative behaviors, skills, and psychological factors expected from an innovative manager in this stage are well-matched with the actions required. The constant communications, the materializing and absorptive capacity to understand an issue, and enough innovation capability and creativity to search solutions options. The organizational culture has an impact on innovation performance

(Souto, 2015; Tan et al., 2008); at least in this stage, the organizational culture reaffirms its participation.

For the stage 2. Create Concepts, the **Table 10** characterize the variables for it stage. The educational profile should include technical knowledge or profile, it can integrate project manager studies or some other empirical studies that facilitate technical knowledge. This stage is centered in finding solutions, that's why the innovation stages are related with exploitation referring the solution creation and action plan, it is consisted with the evaluation initial for the future development proposed by ISO 56000 (2020). Similarly, the innovative behavior, skills and psychological factors are correlated with those tasks, suggesting the creativity, innovativeness, and solution thinking the base of the concept's creation.

Table 10 **Stage 2. Model individual innovation competences: from theoretical and empirical approach.**

Innovation Stage: 2. Create Concepts

Category	Individual Competences
Educational profile or studies:	Technical knowledge, Technical profile, project manager studies, empirical
Environmental/Work/Social factors that could impact:	Teamwork, Collaboration, team's collaboration
Innovation stage actions required:	Planning, Action plan
	Exploitation, solution creation
Innovative/Entrepreneur. Behavior expected:	Innovativeness
Leadership and Manag. Skills required:	Leadership
	Dynamic capabilities, Solution thinking
Psychological factors expected:	Creativity, Trust

Note. Source : Own creation

Into the stage 3. Validation, the Table 11 represents the ideal set of competences.

Table 11 **Stage 3. Model individual innovation competences: from theoretical and empirical approach.**

Innovation Stage: 3 Validate

Category	Individual Competences
Educational profile or studies:	Technical knowledge, Technical profile, Education computing, Educational innovation, Engineering education, Project management, Interdisciplinary
Environmental/Work/Social factors that could impact:	Organizational factors: corporate entrepreneurship, organizational learning, organizational change, organizational strategy Social factors: social innovation, social influence, social change, market behavior and acceptance
Innovation stage actions required:	Innovation management, confirmation of the innovation process, research and development management
	Specific Management: Financier and Analysis study (strategic, change, industrial, energy, human resource, risk, and technology management)
Innovative/Entrepreneur. Behavior expected:	Cocreation, collaborative innovation
Leadership and Manag. Skills required:	Strategic thinking, problem solving Proactive, Prediction, expectation
Psychological factors expected:	Analytic, risk perception, perceived risk, risk-taking

Note. Source : Own creation

Considering Validation stage as moment of analysis to decrease the uncertainty linked with the acceptation, resources needed, reliability (4), by developing business cases, assessments, and selection of the project (13,15) The interdisciplinary and different technical and engineering knowledge are associated with the aim of the stage. Correspondingly, other organizational factors as the presented could present a key element for this process because according to the organizational capability and availability to learning, strategy and change, the resources required for the

stage should be confirmed or not. Additionally, the management actions required are completely related with validation process as the finance and analysis study, for example.

The psychological factors and skills required are essential capabilities for the success of this stage, being not that creative or innovative, but more detail focusing, analytic and risk validation. For the innovation behavior, cocreation or collaboration are expected, as cocreation implies the collaboration between organization and participants that generates benefits for all an creates value (24) offering benefits as: more relevant ideas, better insights, cost efficiencies, speed to marketing or reduced risk (Hatch et al., 2010; Kazadi et al., 2016; Ramaswamy, 2010; cited by Ind et al., 2017). All of those elements considered in the validation process to select the ideal project.

Table 12 represents the set of competences for the Stage 4. Development.

In stage 4, converting ideas in an operational solution and value creation is demanded (Hansen et al., 2007; ISO 56000, 2020). The results found harmonizes with the description of the stage. Starting with the environmental or organizational factors, the development stage requires collaboration, teamwork, and also the stakeholder participation. It coincides with the collaborative innovation and cocreation definition that considers innovation partnerships and interorganizational efforts for collaborative innovation, and collective intelligence for co-creation. Therefore, the psychological factors and skills required agrees with those elements, requiring creativity, building capacity, leadership, resilience, communication, and analysis capacity.

Table 12 Stage 4. Model individual innovation competences: from theoretical and empirical approach.

Innovation Stage: 4 Develop

Category	Individual Competences
Educational profile or studies:	Technical knowledge, Technical profile, Education computing, Educational innovation, Engineering education, Project management, Specialization or training, Business formation, Engineering education, Information, programmer engineering
Environmental/Work/Social factors that could impact:	Teamwork, Collaboration Stakeholder participation, client's participation, social networking (online), stakeholder engagement and participation, social networking, networking
Innovation stage actions required:	Exploration General management, Strategic planification Research and development management, develop
Innovative/Entrepreneur. Behavior expected:	Cocreation, collaborative innovation
Leadership and Manag. Skills required:	Communication Analysis capacity, Strategic Planning Thinking Leadership
	Building capacity, effectivity
Psychological factors expected:	Creativity Resilience

Note. Source : Own creation

For stage 5. Deploy, as some authors proposed, is the stage in which the pre/commercialization or diffusing of the idea starts (Cooper, 1990; Hansen et al., 2007; Rogers, 2003; Tidd et al, 2013.). ISO 56000 (2020), highlights the integration with marketing, communication, sells, and the engagement with users and all the interested parts, and the adoption and information back from them. Subsequently, the set of competences presented in table 14 is according to this process. The educational profile in marketing or engineering, the participation of the stakeholders

and engagement, the communication skills are also required. Finally, the responsibility, resilience, or adaption and adoption for final settings are expected as psychological factors.

Table 13 **Stage 5. Model individual innovation competences: from theoretical and empirical approach.**

Innovation Stage: 5 Deploy

Category	Individual Competences
Educational profile or studies:	Marketing studies Education in general Industrial engineering, Informatic engineering
Environmental/Work/Social factors that could impact:	Stakeholder participation client's participation, Stakeholder engagement
Innovation stage actions required:	Implementation
Innovative/Entrepreneur. Behavior expected:	-
Leadership and Manag. Skills required:	Communication
Psychological factors expected:	Responsibility Resilience, Adaptation, adoption

Note. Source : Own creation

For stage 6 some authors (Cooper, 1990; Rogers, 2003; Tidd et al, 2013.), the final review and post implementation process and following should be handled. However, as some SMEs mentioned is also the opportunity to see what others needs or problems does the enterprises has to start again the innovation process. Moreover, this stage is the end of the innovation process, to making final settings or adjustment to satisfy the client; but also represent as well beginning of new one, by the searching new issues to start the innovation.

Table 14 Stage 6. Model individual innovation competences: from theoretical and empirical approach.

Innovation Stage: 6 Review

Category	Individual Competences
Educational profile or studies:	Project Manager Education 4.0, Customer center services studies
Environmental/Work/Social factors that could impact:	Stakeholder engagement, Client relationship
Innovation stage actions required:	Exploration, ideation
Innovative/Entrepreneur. Behavior expected:	Innovation capability or innovativeness
Leadership and Manag. Skills required:	Communication Feedback acceptance capacity, adoption
	Leadership, transformational leadership, Care of others necessities
Psychological factors expected:	Creativity Safety, Trust, Confident or trustful person Resilience, Adaptation, adoption

Note. Source : Own creation

That's why some theoretical and empirical approach are consistent at some elements used for the two focuses described, and it shapes this profile. For the following of the implementation and final adjustment, the educational profile proposal includes a customer center focus, it emphasizes the relevance of the stakeholder awareness that a person managing this stage should have. The skill of feedback acceptance capacity can represent the entrance to improve and adapt some specification, requested from the stakeholder, of the product or services deployed. It is also related with resilience, adaptation, and adaptation capacity detailed by the psychological factors. The importance of safety and confident person according to the SMEs approach relies on the importance of care of other necessities, adjust the necessary time to satisfy the client and is the base of this relationship and communication.

For the new problem searching that could eventually again start the innovation process, the innovation stage action required in the exploration or ideation, it emerges once more due to the new opportunity to identify problems. Afresh, the innovative behavior is expected and also the creativity.

Those results, are in fact a confirmation for the hypothesis presented in the previous section: The individual competences profile of the person in charge of the innovation process, may be different according to each stage of the innovation.

The differences between the profiles for each stage have been detailed and those differences confirm the hypothesis is true. The profile of the person changes according to the stage of the innovation process.

2.5. Profile definition phase

Once each innovation stage has a set of competences from both empirical and theoretical approach, those could be converted in a profile reference. This individual competence's profile allows to have all the specifics competences under one name (profile) and it could be also measured.

In the way to look for this profile, an instrument should be required. In this section the research of this instrument is detailed.

2.5.1. Individuality Traits definition

Individual knowledge, perceptions, experiences, and behaviors shaped individuality traits. (Hwee Nga et al., 2010). Those are known as predictable and persistent feature in the adoption of individual behavior that could help to explain actions and decision makings in some scenarios (Devaraj et al., 2008; Kor et al., 2007; Llewellyn et al., 2003).

Some different characteristics have been classified into five dimensions, known as the Big Five(Costa et al., 1980; Digman, 1990). The Five dimensions are called: Agreeableness, Openness, Extroversion, Conscientiousness, and Neuroticism.

Some features in each dimension are described as follows: Agreeableness is a feature of social, altruistic, cooperative, and trusting behavior (Major et al., 2006). Conscientiousness refers to a preference for goal-oriented activity, meticulousness, responsibility, and organization (Hwee Nga et al., 2010; Judge et al., 2015). Extroversion represents social interaction and activity, also enjoy social attention, outgoing attitude, and assertiveness (Hwee Nga et al., 2010; Judge et al., 2015)(Devaraj et al., 2008; Major et al., 2006); Openness involves the tolerance for new ideas and new ways of doing things (Hwee Nga et al., 2010; Judge et al., 2015; Major et al., 2006; Marcati et al., 2008a); and Neuroticism, which denotes the inability to respond to external stimuli through charge emotions and impulses under control, impulsiveness, and low self-steam(Hwee Nga et al., 2010a; Judge et al., 2015; Marcati et al., 2008b).

Those traits help to profile a person according to the most presented traits in them.

2.5.2. Design of a profile instrument

This step is a proposal of a profile instrument that represents individual profiles based on the proposed competences profiles. In this case, due to the profiles showing individuality and person's descriptions, a literature review was held to verify the most used instrument for measuring individual characteristics or individuality in relation to innovation.

For this aim, based on a Scopus with the following detail: ABS(((individuality W/5 (measure OR dimension OR instrument OR test OR model)) AND (innovation))), was held. By selecting the 15 most cited papers, and analyzing the instrument used in each study, the Big Five Traits Individuality Measurement Instrument was the model most used by previous authors (Abrahams et al., 2019; Heidenreich et al., 2015; Howell et al., 2005; Hwee et al.,, 2010a; Kirton et al., 1986; Lightfoote et al., 2014; Madrid et al., 2014; Marcati et al., 2008b; Punnoose, 2012; Reader et al., 2016; Uher, 2013) (Rauschnabel et al., 2015; Seibert et al., 2001)to evaluate individual or individual characteristics in innovation studies. For this reason, this instrument was selected as an individual profile representation of the model.

This instrument considers the following aspects: openness, extroversion, conscientiousness, agreeableness, and neuroticism. The variables in each aspect, according to the studies selected, were similar. However, to identify the indispensable and specific variables in each aspect, a co-occurrence analysis was made, obtaining as a result, a list with basic variables for each aspect of the instrument.

The variables in each dimension, according to the studies selected, were similar. However, to identify the indispensable and specific variables in each aspect, a co-occurrence literature analysis was made. It was based on the papers resulting of the literature review of the instrument. From the 15 papers, the ones that used the Big Five were strictly analyzed. For each dimension, a list of variables that the author used were grouped in a unified list. Obtaining as a result, a list with basic variables for each aspect of the instrument.

2.5.3. Competences profiles model for each innovation process stage

Each competence proposed in each innovation stage was matched with one of the respective lists of the Big Five aspects, according to the similitude in the meaning of the variables and significance.

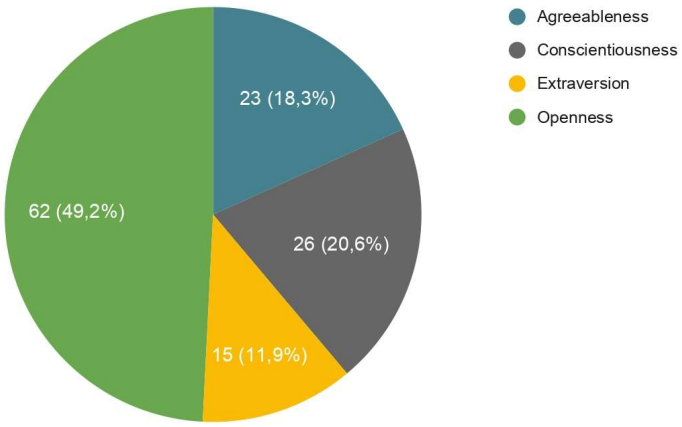
It means, that each innovation stage consider in the model, has already a Big Five trait or competences identified. As a result, a proposal of individuality profiles required in each innovation stage was identified.

After the process of correspondence between the individual competences with the Big Five variables, the following Model of a person’s competences profiles in each innovation process stage is presented.

2.5.3.1. Profile for stage 1: Identify opportunities

In this stage, a profile results from the correspondence of the individual competences and the Big Five variables. It is explained in detail as follows:

Figure 26 **Profile for Stage 1. Identify Opportunities**



Note. Source : Own creation

Between the variables of the Big Five (47) and the variables of stage 1 (14), 126 matches were established, reflecting the concordance of meanings in those variables. According to the figure most variables are in Stage 1. Identify Opportunities and match them with the variables of Openness (49.2%). Following by Agreeableness and Conscientiousness, aspects that suggest 18.2% and 20.6% respectively. Extraversion was represented just at 11.9%.

Beginning with Stage 1. Identify Opportunities, having almost 50% Openness and according to the definition of this trait, the proposed profile for a person in charge to attend the first stage should present profile characteristics as a high level of creativity, imagination, and exploratory tendency. Correspondingly, it would include versatile, divergent thinking and not being afraid of new challenges, and affinity towards the novelty of new experiences.

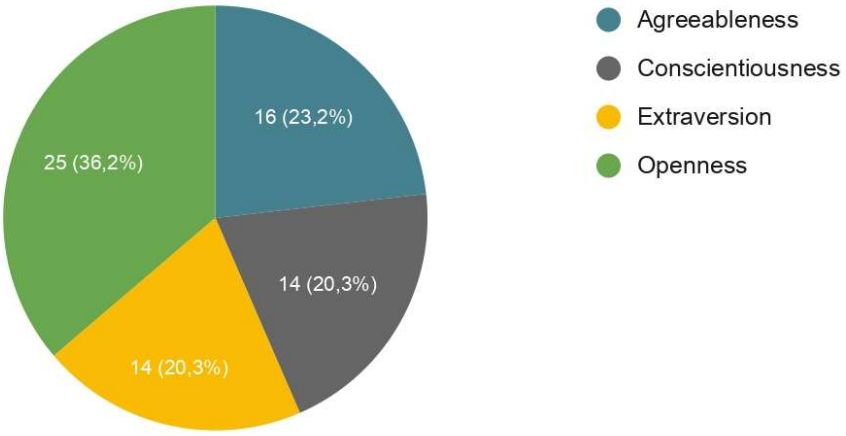
For this Stage, the results suggest a lower percentage of Agreeableness and Conscientiousness It means, a person with some characteristics of good listening, patience, empathy, and also characteristics of goal-oriented or necessity of achievement, industriousness, and a methodical way to work(Hwee et al., 2010). Extraversion features are not as important as those mentioned before. It represents 11.9% and would include some features such as assertiveness, social and emotional control, and communication skills. It is congruently to the Stage's aims, where the innovation initiative started, and the knowledge of a necessity or problem to be solved is presented (Rogers, 2003); thus, open thinking, creativity, and affinity

toward new solutions are needed. To achieve this, it is also significant to be a good listener to infer the demands and necessities.

2.5.3.2. Profile for stage 2. Create

For Stage 2, a profile results from the correspondence of the individual competences and the Big Five variables. It is explained in detail as follows:

Figure 27 Profile for Stage 2. Create



Note. Source : Own creation

In Stage 2. Create, a total of 69 matches were developed. Compared with the results in Stage 1, as **Figure 27** indicates, this Stage expresses a more balanced distribution between the aspects of the Big Five. From those, Openness got the 36,2% of the total, followed by Agreeableness (23,2%), Conscientiousness (20.3%), and Extraversion (20.3%). Neuroticism has not been represented in this stage according to the obtained results.

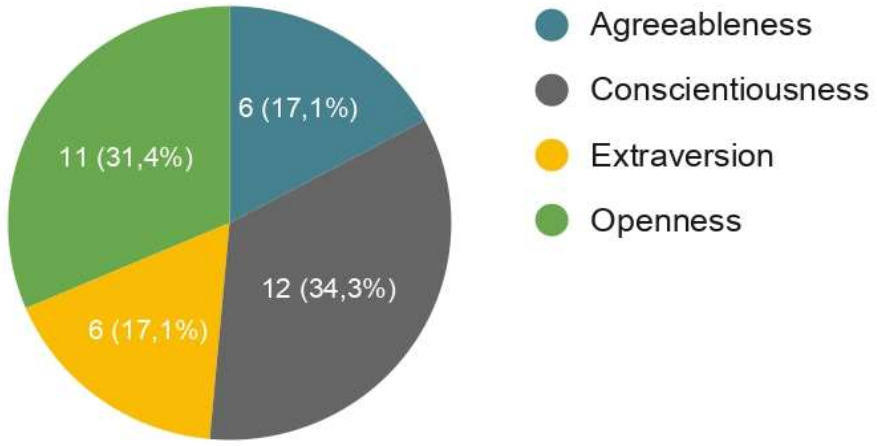
Passing to Stage 2, the profile suffers some changes. The highlight of Openness is equilibrated with the other's individuality traits; however, Openness maintains the highest percentage. It means that some characteristics such as creativity, imagination, curiosity, and divergent thinking still been imperative; nevertheless, this time it has almost the same importance as others belonging to extraversion, agreeableness, and consciousness. For example, Extraversion has the aspect that most growth from stage 1 to stage 2. It involves some features: social interactions, assertiveness, social skills, etc. Some Agreeableness characteristics, as good listening, social skills, and cooperative behavior(Hwee et al., 2010), share almost the same importance. As well as Conscientiousness features; for example, rules/processes thinking way, industriousness, achievement thoughts, etc.

Considering Stage 2 as the stage of the proposal of the potential solutions, concepts, or ideas generation, is expected to need managers with high levels of Openness, as a propulsor of new ideas(Hwee et al., 2010); nonetheless, this person should also manage leadership skills which are related mainly to Agreeableness, Openness, and equilibrium with Conscientiousness and Extraversion; because, it should allow the person, not just to draw the solution, but establish an action plan as well. It also involves working with a team and collaboration; consistently, it supposes a reinforced relation with Agreeableness and Extraversion features, also reflecting a perfect stage for co-creation, co-innovation, and also open innovation.

2.5.3.3. Profile for stage 3. Validate

For Stage 3, a profile results from the correspondence of the individual competences and the Big Five variables. It is explained in detail as follows:

Figure 28 Profile for Stage 3. Validate



Note. Source : Own creation

According to the results presented in **Figure 28** the aspect of Conscientiousness has been increasing while the innovation process advance. In the first stage, it represents just 19.8, then for Stage 2 it was 20.3% but in Stage 3, it attains 34.3%.

In this Stage 3, a total of 35 matches were realized, and the second major trait in this stage is Openness, followed by Agreeableness and Extraversion, both with the same percentage. Once again, Neuroticism was not present in this stage.

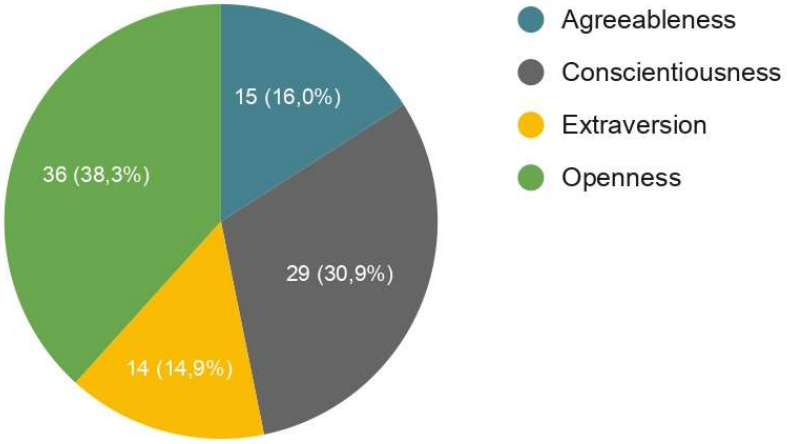
The profile found for Stage 3. Validate, suggesting for this stage an increase in Conscientiousness, it gathers a profile most focused on meticulousness, well

organization, industriousness, and conformance with rules/procedures, compared with the first stages. In view of this Stage, it assumes the selection of the idea, and processes to decrease the uncertainty of technical, financial, marketing, and organizational aspects, and the risk considerations. Therefore, it implies a profile with more facilitation for the method, organization, and focus than a profile more projected as Agreeableness. For example, because it is not always a stage that requires vast social skills or social interaction to take the solution. Nevertheless, it still has been interesting a requirement for a high level of Openness at this stage. It could be related to the fact that it is needed an affinity towards novelty, tolerance for new ideas, or divergent thinking, to realize the necessary path to decrease uncertainty.

2.5.3.4. Profile for stage 4. Develop

For this stage, a profile results from the correspondence of the individual competences and the Big Five variables. It is explained in detail as follows:

Figure 29 Profile for Stage 4. Develop



Note. Source : Own creation

Based on a total of 94 matches in Stage 4. Develop, as **Figure 29** represents, Openness leads the results with 38.3%, then the 30.9% for Conscientiousness, and similar results for Agreeableness and Extraversion, both with a fewer percentage than its results in Stage 3.

At Stage 4. Develop, once again, Openness leads the percentage, suggesting an affinity towards novelty of new experiences, versatile thinking, creativity, and exploratory tendency and similar. Nonetheless, this time maintaining some Conscientiousness aspects such as industriousness, or need for achievement (Hwee et al., 2010), for example. In addition, on a fewer but significant level, some features of Agreeableness and Extraversion are proposed.

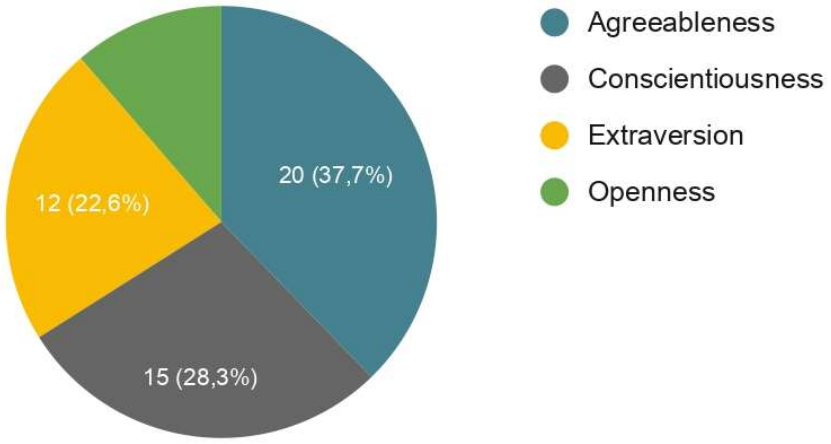
This profile harmonizes the aim of this stage, as the materialization of the concept and converting ideas into a real solution and considering the participation of stakeholders to help the creative process and validate its acceptability. It means not only a creative and exploitation process but also a social one to execute leadership, assertive communication, and a sociable and positively affective approach (Costa et al., 1980). The extraversion referees, in the process, reflecting in accordance with the proposed profile.

The differences between the profiles proposed for stage 4 and stage 3 are similar and the differences are minimum, so those profiles could be considered as the same if the case requires it.

2.5.3.5. Profile for stage 5. Deploy

For Stage 5, a profile results from the correspondence of the individual competences and the Big Five variables. It is explained in detail as follows:

Figure 30 Profile for Stage 5. Deploy



Note. Source : Own creation

For this Stage, **Figure 30** implies an increment in Agreeableness, in comparison with results it has had in the previous stages. From a total of 53 matches, this trait represents 37.7%. In the case of Openness, it has a decrease in this stage and just represents the 11.3%. While Extraversion has a 22.6%, higher than its results in Stage 4.

For Stage 5. Deploy, a significant decrease of 27% in Openness is noticeable. It gives more importance to Agreeableness, and it features related to patience, thrusting, kindness, harmoniousness in social relations, etc.(Judge et al., 2014).

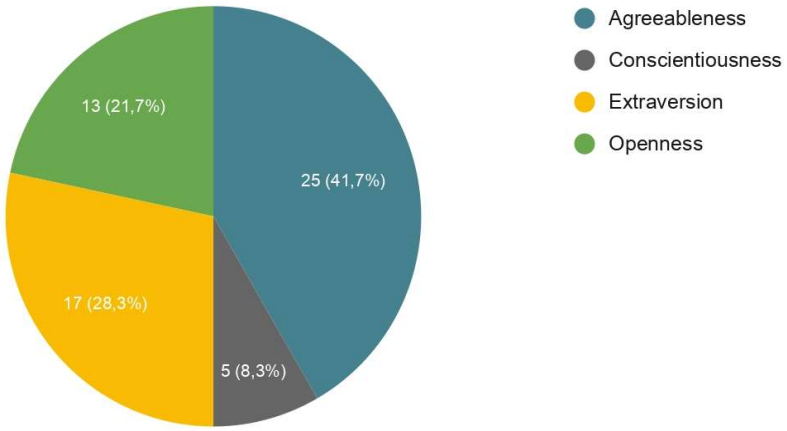
As the second competences for this Stage, Conscientiousness is presented highlighting the responsibility feature, industriousness, and some related as the need for achievement. Extraversion features are present, suggesting assertive, positive, and outgoing performance.

Correspond with Stage 5. Deploy goal of implementing and communicating the idea realized, and it required stakeholder relations. It resembled the proposed profile though, considering the important relationship with the client when the product is in the implementation process, and the trust, resilience, adaptability, and responsibility to assure a great implementation of the product. In the meantime, the aspects of Conscientiousness are present, it could be related to the necessity to achieve an upright understanding but also the best implementation hastily.

2.5.3.6. Profile for stage 6. Review

For Stage 6, a profile results from the correspondence of the individual competences and the Big Five variables. It is explained in detail as follows:

Figure 31 Profile for Stage 6. Review



Note. Source : Own creation

In the last Stage, from a total of 60 matches executed, Agreeableness stay leading with 41.7%. While Extraversion increases its percentage (28.3%), and Conscientiousness as well. In the case of Openness, it duplicates the percentage in Stage 5 and expresses a 21.7% in this last stage of their innovation process.

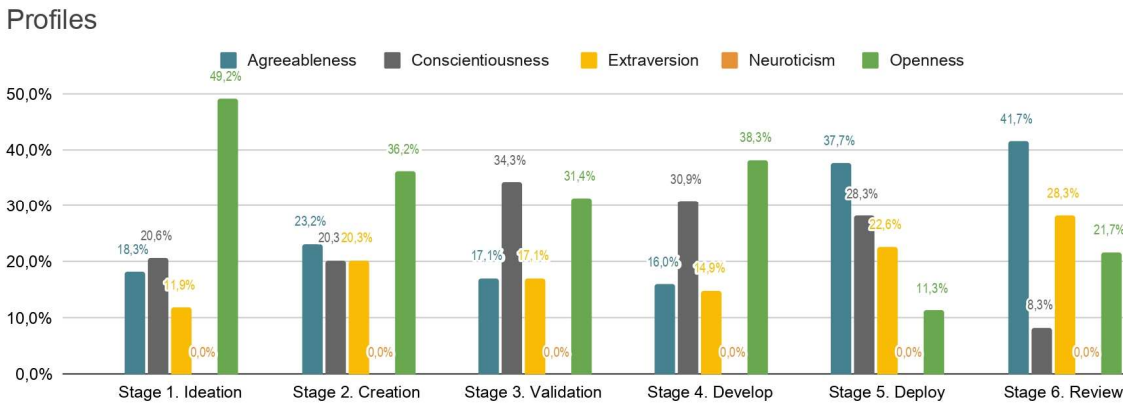
In view of the results of the last innovation Stage 6: Review, the Conscientiousness aspect decreased and now represents just 8.3%. While Openness grows from Stage 5 to Stage 6, focusing now on an affinity towards new ideas, versatile thinking, creativity, etc. (Marcati et al., 2008) Besides, in some Extraversion features grow meaning that now the profile is more outgoing, social, and assertive.

Considering that Stage 6 involves the revision of the right function of the product as well as the identification of new opportunities is consistent with the proposal of a more extroverted profile. Those characteristics are congruent because, in this stage, active listening, client center attention, empathy, and flexibility are needed actions to succeed and look for new opportunities.

2.5.3.7. Resume of profile per stage

The following figure a resume of the profiles for stage is detailed.

Figure 32 Resume of profile per stage



Note. Source : Own creation

Those profile descriptions, for each stage, allow us to display it as a proposal for an in-charge person's profile according to the innovation process.

2.6. Conclusion

Some common and incorrect perceptions in the industry and academy is that of the innovation process, the individual competences should be related just to creativity or openness. We present evidence and a model that contrast that perception by supporting and specifying essential competences profiles considering each stage's requirements and aims.

By applying theoretical and empirical approach, a hypothesis that the competences profile of the innovation managers could change according with the innovation stage, was verified. In fact, a model of individual competences' profiles in each innovation process stage results as a principal outcome of this study.

To assuring not just a theoretical profile but an empirical approach profile, the following methodology was carried on:

- First, with the aim of suggesting a unification of concepts and theoretical constructs a systematic literature review was held.
- Furthermore, to guarantee the most specific set of competences as possible, a process analysis to identify the innovation process stages was developed. Six stage innovation process results of the theoretical review and its aims and expected outcomes are defined.
- Then, a theoretical approach using a co-occurrence analysis was developed, identifying the most relevant and required competences of the person in each innovation stage, according to the literature.
- After that, an empirical multiple-case study was realized, having as an outcome the competences requirements identification of the person in each innovation stage from empiric results.
- Consequently, it was developed a content analysis to make unification of the theoretical and enterprise approach.
- Finally, by using a common individual profile instrument used in innovation studies (Big Five Traits Instrument), and each stage requirements resulting in the last step, six innovation stages profiles were developed considering each stage-specific requirement. So, a Model of individual competences profiles per each innovation stage is generated.

Now, the third aspect of this reserach (behavioral perspective) is clarified, have a model with specific indicators and also an instrument to measure it. Thus, the global objective of generate a guide for the SMEs so they can analyzed the contextual impacting factors from the behavioral and sectorial perspective has its firs phases completed, as the three big factors of this study are identified, has a model and a measure.

The next step is to integrate them into an analysis guide. This is developed in to the section.

3. Conception of the Behavioral and Sectorial contextualization approach

3.1. Introduction

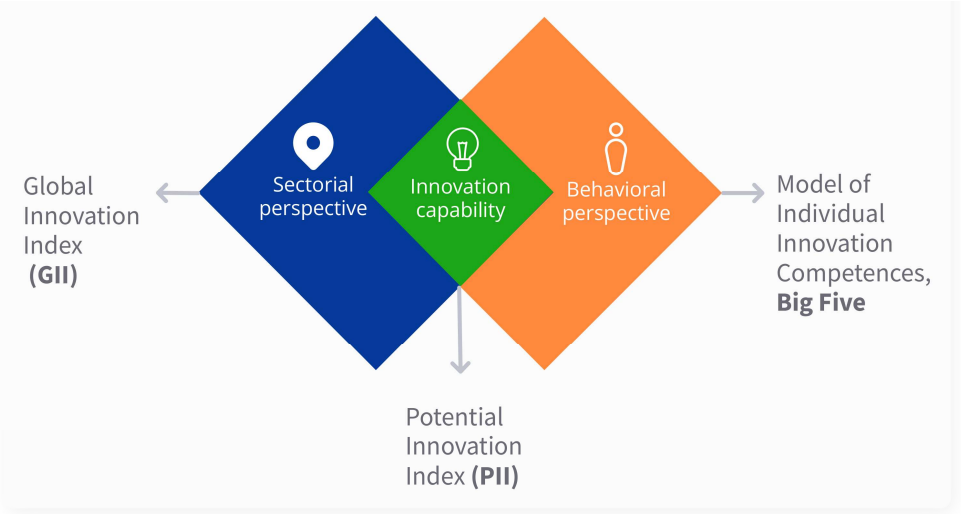
As the global aim of this reserach is to propose a guide to analyze the impacting factors of the sectorial and behavioral perspective within the innovation capability, three big dimensions had to be identified by having a model and a measure to evaluate them: sectorial perspective, innovation capability and behavioral perspective. This process is already completed and now is time to create the proposal of analysis that could integrate all the work until now.

The objective of this section is to develop this integration by a projecting a proposal of guide to measure and evaluate the impact of the contextualization approach from the sectorial and behavioral perspective, in the innovation capability. The conception of the contextualization of the innovation capability in the sectorial and behavioral perspective, allows the enterprise to know more about the different factors that could be impacting the innovation performance. With a developed model of competence profiles per each innovation stage and considering the environmental factors, the innovation capability could be seen as a holistic and integrative system.

3.2. Proposal of the contextualization analysis of the innovation capability

As suggested since the introduction, the innovation capability can be considered as a multifactorial phenomenon. The sectorial perspective offers an external analysis of the impacting factors, and the behavioral perspective offer one of the starting points of the innovation. Based on the results developed in this research, this approach of the innovation capability is detailed in the following figure:

Figure 33 Approach for the contextualization of the innovation capability



Note. Source : Own creation

The following steps are proposed as a guide to analyze the contextualization of the innovation capability:

Table 15 Guide to analyze the contextualization of the innovation capability.

Perspective	Instrument	ID	Step
Part 1. Sectorial perspective	Global Index Innovation	1	Verify the position of the country in the overall GII
		2	Identify the input weakness
		3	Establish strategies to deal the eventual impact in the organization
Part 2. Innovation capability	PII	4	Complete the questionnaire and Identify the categorization of the innovation capability
		5	Integrate the recommendations into the organizational strategy
Part 3. Behavioral Perspective	Big Five	6	Complete the Big Five questionnaire (for the person in charge of the innovation)
	Model of innovation competences	7	Read the Model of innovation competences and its profile for each stage. Verify if the enterprise has all the stages, and all are well defined; if not, a recommendation should be made to integrate it
		8	Verify in which of the stages this person is used to be more involved. Compare that stage profile with the person profile.
		9	Verify the distribution of the supervising responsibility in the company, and propose the recommendation for the innovation team / supervisor

Note. Source : Own creation

3.2.1. Part 1. Sectorial Perspective

In the case of the Step 1, 2 and 3, those are related with the sectorial perspective.

3.2.1.1. Step 1.

Specifically, in the step 1, consisted in identifying the country position in the overall GII. The purpose of this step is to have an overview of the country situation related with other countries with similar financial, geographical, or other external impacting factors in the innovation. Thus, an awareness of the international position could offer an important condition to integrate an analysis from the sectorial perspective. Likewise, a country comparative analysis could be made with other country of interest. Some criteria could be chosen to select the country or countries to compare. For example, by selecting the country where the competitors are. By identifying the country of future extension of the business or considering other country of interest according to the SMEs strategy or study purpose.

3.2.1.2. Step 2

In the second step, an identifying of the input weakness of the country should be accomplished. Those weaknesses are detailed by the GII. The recommendations are the choose the three outputs with the lower score or values. Thus, the inefficient outputs are selected. Here, an analysis of how those weaknesses could be affecting the company should be made. The objective is to be aware of the company's implication due to the weakness described and to have a clear scenario to propose some strategies are described in Step 3.

3.2.1.3. Step 3.

A strategy in the step 3 could be made, to face and deal with the eventual impact of the weakest country innovation factors in the organization. The resulting strategies help the companies with the sectorial factors impact. Those would offer an awareness of how the external factors are impacting the innovation capability, a resistance to deal with them, and an approach to overcome them.

3.2.2. Part 2. Innovation capability

In the step 4 and 5, the innovation capability is integrated.

3.2.2.1. Step 4

At this point, the innovation capability itself is evaluated and measured and a detail of the reality of the PII of the company is provided. With this information, the companies can have a diagnostic of their level and the opportunities for improvement as well. Additionally, the weakness and strength of the companies' innovation practices are identified and described as a part of this analysis.

3.2.2.2. Step 5

Some recommendations based on the PII results are proposed to improve their innovation capability. The aim of this step is that the company can have some strategies to advance and progress in their innovation capability level.

3.2.3. Part 3. Behavioral Perspective

The last three steps are focused on the behavioral perspective.

3.2.3.1. Step 7

Step 7 includes the focus on the identification of the proposed stages and the recommendations to have a completed innovation process. This step is significant due to the specific actions that each stage should realize to allow an efficient and complete innovation process, considering all the stages and tasks proposed for the innovation.

3.2.3.2. Step 8

Then, a verification in which this person is used to be more involved is incorporated during step 8. In this step a comparison with the person profile is proposed. The more compatible the person's is with the profile of the stage in which is frequently involved, the more efficient results of that stages can be. That's why this comparative is required. If the profile of the person doesn't match with the proposed profile, some recommendations are proposed.

3.2.3.3. Step 9

In the last step, a brief analysis of the responsibilities' distribution in the innovation process is accomplished. Some recommendations are included to handle the nature of the availability of resources in the companies but attending at the same time the proposed model.

At the end of this analysis, the enterprise could have a plan to improve the factors that are impacting their innovation capability and its capability itself.

3.3. Conclusion

Due to the importance of the contextualization of the innovation capability, and the innovation as a multifactorial phenomenon, it results essential for the companies to understand and to develop the knowhow of a holistic analysis of their organizational innovation capability.

In this section, a guide to analyze the contextualization of the innovation capability in the sectorial and behavioral perspective, was developed.

This guide includes a step-by-step divided in three parts, each one focused on the big three dimensions proposed in the introduction of this document: sectorial perspective, innovation capability and behavioral perspective.

Considering that at this point a model with clear indicators and how to measure it is proposed for each of those dimensions a process of how to use this critical information to analyze the context of the innovation capability is essential.

The first three steps are related with the sectorial perspective, and offer to the companies the path to identify the impacting factors of the environment and how those could be affecting them. But more important, the space to propose specific strategies that can help to improve those weakness.

Then, the second part includes step 4 and 5. Those are based on the innovation capability its self. An intern view of the innovation process practices is made by implementing the PII. Correspondingly, the recommendations this index could highlight should be implemented to improve the performance.

The last part is related with the behavioral perspective. Here the reference of the proposed model of individual competences and verification of the stages and their definitions, can offer a clear view of the gaps the company could have in terms of individuals perspective, team's conformation and definition of process.

It could allow the enterprise to be aware of the different factors impacting their innovation capability and incorporate specific and detailed strategies to improve their innovation performance. Also, the innovation capability could be seen now as a holistic and integrative system since the behavioral and sectorial perspective have been studied.

To validate the proposal developed in this chapter, the objective of the following chapter proposes is to implement and analyze how in the empirical and day-to-day life of a company, this guide could be used.

Chapter III. Implementation of the Behavioral and Sectorial contextualization approach

1. Introduction

A guide to make an analysis of the sectorial and behavioral factors impacting the innovation capability is proposed. To apply and to test the pertinence of the proposed approach, this Chapter suggested an implementation in SMEs from Costa Rica and France.

In this Chapter, the selection and justification of the use of the case study methodology is made. Then, the cases are analyzed to improve the pertinence of the analysis approach.

2. Case study methodology presentation

This qualitative methodology is a strategy to be used in the real context, in where the limits between the phenomena and the context could be not clear (Yin, 2018). Also, this methodology is used when a holistic and exhaustive explanation is required (Zainal, 2007). The methodology of case study is centered in the description and deep analysis of one or more unities and its context in a systematic and holistic manner. If required this methodology could include a comparison between the cases (Hernández et al., 1991).

In this research, the case study methodology allows us to implement the approach of the contextualization, identify in each case the proposed factors and compare them. The objective is to test and improve the pertinence of the proposed contextualization approach.

As sectorial perspective was included, the section of the 5 cases were identified in Costa Rica and in France. The Costa Rican SMEs are from the manufacture sector and one from IT services. The French SMEs are one from IT services and two from manufacturing.

For the data collection, a semi-structured interview with the innovation lead or supervision or, in the defect, the person more related with the innovation in the enterprise was handled. In order to have the flexibility to track emerging interesting queries and and going dep to unpredicted ways in the interview this instrument was selected (Williams et al., 2013). This semi-structured interview was conducted in video communication sessions, whit an active camera, it is useful as a face-to-face interview (de Villiers et al., 2021).

A guide for interview has developed to assure the comparable results and analysis coherence, for more detail see Annex 5. The time of the interview was 1 hour approximately. The interview followed that guideline built based on the scheme of following information required:

1. Specific questions about a description of the innovation process:
    - Detail of the innovation stages used in the SMEs.
    - The person in charged in each stage.
    - And the level of definition or formalism of those stage with a Likert scale (Clearly defined, realized but not defined, partially realized, Not included)

2. To complete the Diagnostic of the PII (in the same interview or offline). This was made within a platform used to evaluate this index.
3. To complete the Big Five Questionnaire (offline). This was made in an instrument online based on this instrument.

Besides, the information regarding the sectorial perspective was identified.

As proposed in the guide and supporting in the theoretical section of this document, the GII is analyzed.

3. Implementation in selected cases

3.1. Case 1. Manufacturing sector, French SME

The company profile is the following:

Table 16 FR1 Company profile

Identification	FR01
Sector	Manufacturing
Employees	From 10 to 24
Country	France

Note. Source: Own creation

The following are the steps proposed in the Guide to analyze the contextualization of the innovation capability:

- **Step 1. GII position**
    - Analysis of the company's GII position:

The GII position for this enterprise corresponds to France position. For 2023 this country has been positioned as number 11. This position is one of the best 15 positions of the 132 in the ranking, meaning the great innovation performance France has been developing during the 2023. Part of this positive position is due the strong factor Institution and their market sophistication. Being the trade, diversification, and market scale a strength in the market sophistication.

    - Comparative with Costa Rica:

In this case our study includes Costa Rican SMEs to infer and apply the model. As an exercise the comparative between France and Costa Rica result interesting.

The GII position for Costa Rica has been positioned as number 74. It means France has a greatest position regarding the innovation. The French external impacting factors and the strategy to dealing with those factors in a more positive and optimistic context for the French SMEs than the Costa Rica one.

The strengths for each country are for Costa Rica the Institution outputs and for France the same. It means that the Regulatory environment, Business environment and the institutional environment represent a positive scenario for both countries.

In the case of the French, weakness with the lower value or score for the innovation are Infrastructure, Human Capital and Research, and Business Sophistication. Costa Rica shares two of those weakness: Human Capital and Research and Business Sophistication and also integrates the Marketing Sophistication. It means that for both countries the topics of education, tertiary education and R&D could represent a challenge that block at some point the innovation. Moreover, Business sophistication represent a common output to overcome, for France mostly for the Knowledge absorption area and for Costa Rica mostly for the Knowledge workers. Whereas in Costa Rica Infrastructure represent the second strengths, in France it represents the weakness.

Those differences highlight and clarify the differences between both countries. For the companies the French scenario results more positive than the Costa Rican one to support and maintaining the innovation in their business due the different policies, contextualization, economy, country strategies and multifactorial elements present in the sectorial perspective.

- **Step 2. Input weakness**

The following is the detail of the input weakness (marked with ○).

Figure 34 GII details

- **Weakness**

Infrastructure		57.2	22
3.1	**Information and communication technologies (ICTs)**	**84.1**	**23**
3.1.1	ICT access*	83.7	60 ○
3.1.2	ICT use*	95.6	9 ●
3.1.3	Government's online service*	86.4	20
3.1.4	E-participation*	70.9	37
3.2	**General infrastructure**	**48.1**	**22**
3.2.1	Electricity output, GWh/mn pop.	8,069.8	18
3.2.2	Logistics performance*	81.8	13
3.2.3	Gross capital formation, % GDP	24.9	56 ○
3.3	**Ecological sustainability**	**39.3**	**33**
3.3.1	GDP/unit of energy use	12.2	46 ○
3.3.2	Environmental performance*	73.9	12
3.3.3	ISO 14001 environment/bn PPP$ GDP	1.9	48 ○

Human capital and research		54.0	17
2.1	**Education**	**60.3**	**35**
2.1.1	Expenditure on education, % GDP	5.4	25
2.1.2	Government funding/pupil, secondary, % GDP/cap	25.1	19
2.1.3	School life expectancy, years	15.9	41 ○
2.1.4	PISA scales in reading, maths and science	493.7	25
2.1.5	Pupil–teacher ratio, secondary	13.4	64 ○

Business sophistication		56.1	17
5.1	**Knowledge workers**	**69.1**	**7 ●**
5.1.1	Knowledge-intensive employment, %	47.7	14
5.1.2	Firms offering formal training, %	67.9	2 ●◆
5.1.3	GERD performed by business, % GDP	1.5	17
5.1.4	GERD financed by business, %	56.8	19
5.1.5	Females employed w/advanced degrees, %	25.3	19

Note. Source : GII

- **Step 3. Establish strategies to deal to the eventual impact in the organization.**

Even if those are external factors and the enterprise do not have a control over them, it's important to establish some strategies to reduce the impact into the company.

The following are the proposed strategies to deal with an eventual impact in the organization:

- For the ICT access weakness:
  - Develop technological adaptation capacity. Focusing on the internal capacity to have the potential of adapt and migrate if necessary to others available technologies in the country.
  - Suppliers' diversity. Also, by creating strategic plans for alliances with diverse suppliers for specific technology could give a risk reduction of the risk of have not access.

- For the Gross capital formation weakness:
  - Maximizing the existing internal resources of capital, by measuring the capital have been used efficiently and not underestimated.

- For Ecological Sustainability weakness:
  - Propose internal strategies that could help the ecological sustainability of the own products and process, so a kind of autonomy could be created in this sense.
  - Internal education for the personal to impulse them to propose improvements to help environment and society.

- For the Foreign Direct Investment (FDI) net inflows
  - Establish own alliances with international partners, so an FDI could be directly positioned for the enterprise or the sector. This could be made by participate in networking and international activities.

- For education weakness:
  - Retaining the talents into the organization could help to reduce the rotation and not be affected directly with the school-life expectancy and pupil-teacher radio.
  - Establish alliances with educational institution to create or adapt programs that can have the capacity of fulfill the company requirements. It could be made as a part of a group of similar interests within a sectorial group.

- **Step 4. Complete the PII questionnaire and identify the categorization of the innovation capability.**

The categorization of the innovation capability of the enterprise is Reactive. It is considered as a level 2 from 4 possible. Being the fourth the best scenario. This assessment indicates that even if this company can respond to changes and have a defensive approach, it could experience difficulties to develop disruptive projects.

In a deep analysis, this company has a weakness in the innovation practice Human Resources, specifically in Encouraging innovation and learning and skills management. Furthermore, as a strength this company has the innovation practice Knowledge Management precisely in the Sharing and appropriation of knowledge.

- **Step 5. Integrate the recommendations into the organizational strategy.**

The recommendation to improve the PII should be focus on exploit the strengths to maintaining them and to make them sustainable in the time.

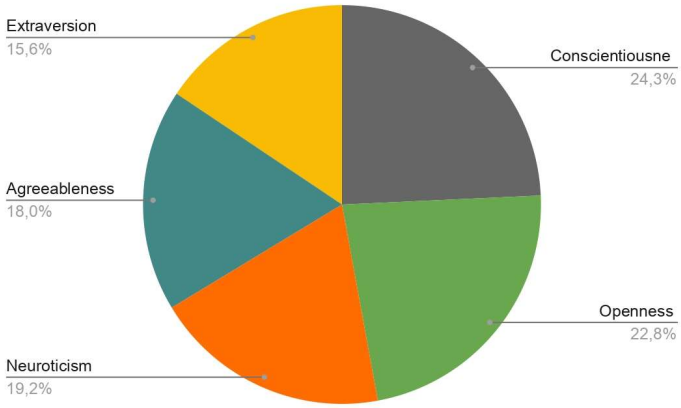
Also, the weakness can be attending and rectify. In this case the Skills management should be worked and the behavioral analysis that is offered in the behavioral perspective could help with it improvement.

- **Step 6. Complete the Big Five questionnaire (for the person in charge of the innovation)**

The person interviewed was the most related with the innovation process in the enterprise or the supervisor of this process.

The results of its Big Five questionnaire are detail as follows:

Figure 35 FR1 Big five results



Note. Source : Own creation

- **Stage 7. Verify if the enterprise has all the stages, and all are well defined; if not, a recommendation should be made to integrate it.**

This enterprise has all the stages included in their innovation process; however, those are realized but there is not any definition, protocol, process statements or formalization of those stages as a process.

Figure 36 FR1 Stages verification

Stage	Definition	FR1
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
1	Not included	
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
2	Not included	
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
3	Not included	
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
4	Not included	
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
5	Not included	
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
6	Not included	

Note. Source : Own creation

As a recommendation for the current way this process has been handled, is proposed:

- Keep the six stages as recommended in the Model.
- Formalize the stages to create a clear procedure and protocols to standardize the process. So, the knowledge acquired in previous projects could be used. Also, the process could be more efficient as all the stages and procedures are clearly defined.

- **Stage 8. Verify in which of the stages this person is used to be more involved. Compare that stage profile with the person profile.**

The person interviewed indicates to be more involved in Stage 4, but that usually is involved in all the stages.

The current profile of the person is accurate to the Stage 3. However, as stage 4 is equal in terms of distribution than the Stage 3, as was mentioned in the Model in previous sections, both stages could be attended for the current profile.

- **Stage 9. Verify the distribution of the supervising responsibility in the company and propose the recommendation for the innovation team / supervisor.**

The current distribution of the leading responsibility in the innovation process stage is the following:

Figure 37 **FR1 Stages leading** responsibility.

Stage	FR1
1	Specialized team depending of the project
2	Specialized team depending of the project
3	Specialized team depending of the project
4	Specialized team depending of the project
5	Specialized team depending of the project
6	Specialized team depending of the project

Note. Source : Own creation

In all the stages a specialized team is proposed, and the same team carried all the stages. So, there is not a supervising person per stage, as normal in SMEs considering the limited human and capital resources. However, as the person interviewed is involved in Stage 3, and according to the recommended profile it is consistent to Stage 3 and Stage 4, the following recommendations are proposed to optimize the performance in the innovation process:

- Keep the supervisor leading the stage 3 and 4, and if necessary, the rest of the process.
- For the rest of the process, as a specialized team is established depending on the project, is recommended to delegate the tasks according to the profile and competences of the involved people. So, a person of the team with the most similar profile to the Stage one for example, could be more attentive or supervisor of that stage,

even if there is a team for that stage. In consequence, the team could be supported with someone according to each stage.

- An identification of each team member Big Five profile is recommended to better set responsibilities.
- Competences training in the stages there is not a profile accuracy could be considered, so for future projects a more consistent profile could oversee the rest of the stages.

3.2. Case 2. IT sector, French SME

The company profile is the following:

Table 17 FR2 Company profile

Identification	FR02
Sector	IT services
Employees	From 10 to 24
Country	France

Note. Source : Own creation

The following are the steps proposed in the Guide to analyze the contextualization of the innovation capability:

- **Step 1. GII position**

Same detail that the Case 1.

- **Step 2. Input weakness**

Same as in Case 1, Step 2.

- **Step 3. Establish strategies to deal the eventual impact in the organization.**

Same as in Case 1, Step 3.

- **Step 4. Complete the questionnaire PII and Identify the categorization of the innovation capability.**

The categorization of the innovation capability of the enterprise is Reactive. It is considered as a level 2 from 4 possible. Being the fourth the best scenario. This assessment indicates that even if this company can respond to changes and have a defensive approach, it could experience difficulties to develop disruptive projects.

In a deep analysis, this company has a weakness in the innovation practice Human Resources, specifically in Learning and skills management. Furthermore, as a

strength this company has the innovation practice Generating new ideas precisely in the Involvement of customers and suppliers.

- **Step 5. Integrate the recommendations into the organizational strategy.**

The recommendation to improve the PII should be focus on exploit the strengths to maintaining them and to make them sustainable in the time.

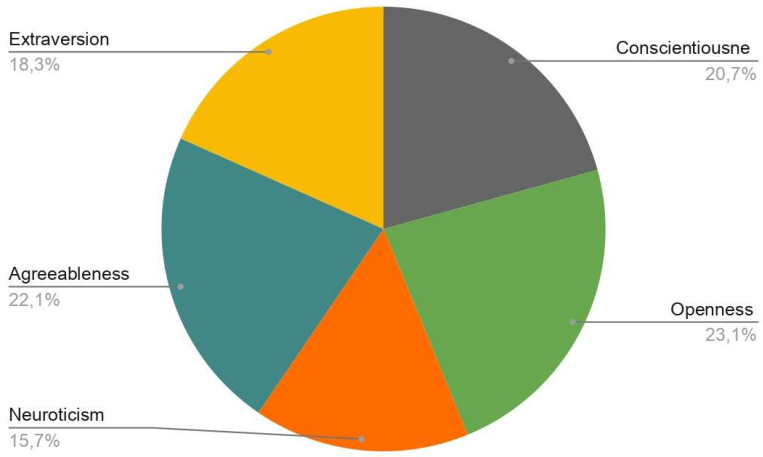
Also, the weakness can be attending and rectify. In this case the Skills management should be worked and the behavioral analysis that is offered in the behavioral perspective could help with its improvement.

- **Step 6. Complete the Big Five questionnaire (for the person in charge of the innovation)**

The person interviewed was the most related with the innovation process in the enterprise or the supervisor of this process.

The results of its Big Five questionnaire are detail as follows:

Figure 38 FR2 Big five results



Note. Source : Own creation

- **Stage 7. Verify if the enterprise has all the stages, and all are well defined; if not, a recommendation should be made to integrate it.**

This enterprise has all the stages included in their innovation process. However, the stage 1, 4 and 5 area realized but there is not any definition, protocol, process statements or formalization of those stages as a process. Additionally, the stage 2, 3 and 6 are partially realized. It means those could be not realized as the stages description details. Some elements of those stages could be missed and/or combined with other stages.

Figure 39 FR2 Stages verification

Stage	Definition	FR2
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
1	Not included	
	Clearly defined	
	It is realized but not defined	
	Partially realized	x
2	Not included	
	Clearly defined	
	It is realized but not defined	
	Partially realized	x
3	Not included	
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
4	Not included	
	Clearly defined	
	It is realized but not defined	x
	Partially realized	
5	Not included	
	Clearly defined	
	It is realized but not defined	
	Partially realized	x
6	Not included	

Note. Source : Own creation

As a recommendation for the current way this process has been handled, is proposed:

- Keep the six stages as recommended in the Model.
- Formalize the stages to create a clear procedure and protocols to standardize the process. So, the knowledge acquired in previous projects could be used. Also, the process could be more efficient as all the stages and procedures are clearly defined.

- **Stage 8. Verify in which of the stages this person is used to be more involved. Compare that stage profile with the person profile.**

The person interviewed indicates to be more involved in Stage 1, stage 2 and stage 6. The current profile of the person is accurate to the Stage 2. It means that is consistent the current involvement with the stage 2. However, for the other stages this person is involved in, is not the preferable decision due to this person's competences profile.

- **Stage 9. Verify the distribution of the supervising responsibility in the company and propose the recommendation for the innovation team / supervisor.**

The current distribution of the leading responsibility in the innovation process stage is the following:

Figure 40 FR2 Stages leading responsibility.

Stage	FR2
1	All the team, stakeholders, open innovation
2	CEO or CTO
3	Specialized team depending of the project
4	Project Manager (proposed for each project)
5	Specialized team depending of the project
6	Specialized team depending of the project

Note. Source : Own creation

There is proposed a specialized team, and the same team carried the stage 3, 5 and 6. For stage 1 there is not a supervisor or specific team. For stage 2 and stage 4, some a specific person supervises the process, and is proposed depending on the project. So, there is not a supervising person per stage, as normal in SMEs considering the limited human and capital resources. However, as the person interviewed is involved in Stage 1, 2 and 6, but according to the recommended profile it is consistent just to Stage 2, and in stage 2 is already delegated to the CEO or CTO. The following recommendations are proposed to optimize the performance in the innovation process:

Verify if the CEO or CTO profiles are adequate to the stage 2 profiles. If not, the person interviewed could lead this stage.

- The assignation of the person for stage 4, is recommended to be consistent with the recommended profile.
- For the rest of the process, as a specialized team is established depending on the project, is recommended to delegate the tasks according to the profile and competences of the involved people. So, a person of the team with the most similar profile to the Stage one for example, could be more attentive or supervisor of that stage, even if there is a team for that stage. In consequence, the team could be supported with someone according to each stage.
- An identification of each team member Big Five profile is recommended to better set responsibilities.
- Competences training in the stages there is not a profile accuracy could be considered, so for future projects a more consistent profile could be in charge of the rest of the stages.

3.3. Case 3. Manufacturing sector, Costa Rican SME

The company profile is the following:

Table 18 CR1 Company profile

Identification	CR1
Sector	Manufacturing
Employees	From 10 to 24
Country	Costa Rica

Note. Source : Own creation

The following are the steps proposed in the Guide to analyze the contextualization of the innovation capability:

- **Step 1. GII position**
    - Analysis of the company's GII position

The GII position for this enterprise corresponds to Costa Rica position. For 2023 this country has been positioned as number 74. This position is one right on the middle positions of the 132 in the ranking, meaning the regular innovation performance Costa Rica has been developing during the 2023. Part of this position is due the strong factor Institution and their infrastructure. Being the Ecological sustainability one of their strengths in that last factor.

    - Comparation with Costa Rica

Same analysis than the case 1.

- **Step 2. Input weakness**

The following is the detail of the input weakness (marked with ○).

Figure 41 GII details

- **Weakness**

Human capital and research 27.9 79

2.1	**Education**		**58.3**	**44**
2.1.1	Expenditure on education, % GDP	⏲	6.7	9 ●◆
2.1.2	Government funding/pupil, secondary, % GDP/cap		25.1	21 ●
2.1.3	School life expectancy, years	⏲	16.5	27 ●◆
2.1.4	PISA scales in reading, maths and science		414.8	59
2.1.5	Pupil–teacher ratio, secondary		12.8	59
2.2	**Tertiary education**		**19.8**	**91**
2.2.1	Tertiary enrolment, % gross	⏲	57.7	56
2.2.2	Graduates in science and engineering, %		15.9	95 ○
2.2.3	Tertiary inbound mobility, %	⏲	1.2	86
2.3	**Research and development (R&D)**		**5.5**	**72**
2.3.1	Researchers, FTE/mn pop.	⏲	345.0	78
2.3.2	Gross expenditure on R&D, % GDP	⏲	0.4	68
2.3.3	Global corporate R&D investors, top 3, mn USD		0.0	40 ○◇
2.3.4	QS university ranking, top 3*		12.1	62

Market sophistication 27.2 90

4.1	**Credit**	**21.7**	**[88]**
4.1.1	Finance for startups and scaleups†	n/a	n/a
4.1.2	Domestic credit to private sector, % GDP	60.4	58
4.1.3	Loans from microfinance institutions, % GDP	n/a	n/a
4.2	**Investment**	**2.4**	**99** ○
4.2.1	Market capitalization, % GDP	3.4	76 ○
4.2.2	Venture capital (VC) investors, deals/bn PPP$ GDP	0.0	62
4.2.3	VC recipients, deals/bn PPP$ GDP	0.0	81 ○
4.2.4	VC received, value, % GDP	0.0	84 ○
4.3	**Trade, diversification and market scale**	**57.5**	**69**
4.3.1	Applied tariff rate, weighted avg., %	1.5	48
4.3.2	Domestic industry diversification	79.5	78
4.3.3	Domestic market scale, bn PPP$	129.9	82

Business sophistication 28.7 63

5.1	**Knowledge workers**		**18.5**	**104** ◇
5.1.1	Knowledge-intensive employment, %		21.4	72
5.1.2	Firms offering formal training, %		n/a	n/a
5.1.3	GERD performed by business, % GDP	⏲	0.1	58
5.1.4	GERD financed by business, %	⏲	2.3	86 ○◇
5.1.5	Females employed w/advanced degrees, %		11.8	65

Note. Source : GII

- **Step 3. Establish strategies to deal the eventual impact in the organization.**

Even if those are external factors and the enterprise do not have a control over them, it's important to establish some strategies to reduce the impact into the company. The following are the proposed strategies to deal with an eventual impact in the organization:

- For Human capital and research weakness:
  - Retaining the talents into the organization could help to reduce the rotation and not be affected directly with the school-life expectancy and pupil-teacher radio.
  - Establish alliances with educational institution to create or adapt programs that can have the capacity of fulfill the company requirements. It could be made as a part of a group of similar interests within a sectorial group.
  - Create networking to found global research investors and have an internal structure capable to include a research culture.

- For the Gross domestic expenditure on R&D (GERD)
  - Maximizing the networking and collaboration with institutions for examples universities so projects could be handled together in R&D.
  - Participate in international funding that allows the enterprise to have more R&D projects and improve the innovation.

- For the investment's weakness:
  - Enhance the collaboration with national and international institutions that contact enterprise with investors, for example PROCOMER. So new projects could have investments to execute the requirements.

- **Step 4. Complete the questionnaire PII and Identify the categorization of the innovation capability.**

The categorization of the innovation capability of the enterprise is pre-active. It is considered as a level 3 from 4 possible. Being the fourth the best scenario. This assessment indicates that even if this company can develop innovation projects and have a strategy vision anticipating future changes, it could experience difficulties to keep a constant innovation level.

In a deep analysis, this company has a weakness in the innovation practice Human Resources, specifically in Learning and skills management. Furthermore, as a strength this company has the innovation practice Design.

- **Step 5. Integrate the recommendations into the organizational strategy.**

The recommendation to improve the PII should be focus on exploit the strengths to maintaining them and to make them sustainable in the time.

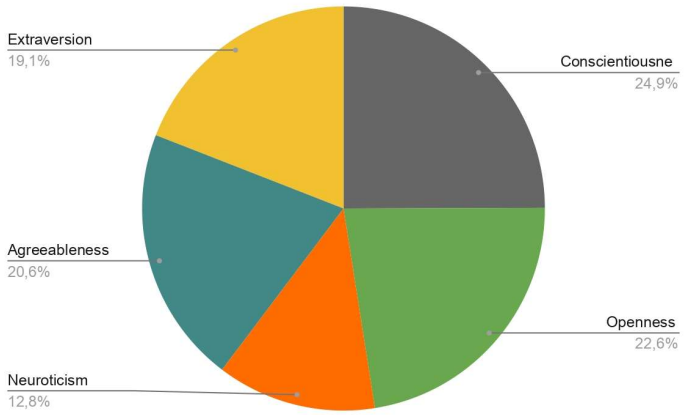
Also, the weakness can be attending and rectify. In this case the Skills management should be worked and the behavioral analysis that is offered in the behavioral perspective could help with its improvement.

- **Step 6. Complete the Big Five questionnaire (for the person in charge of the innovation)**

The person interviewed was the most related with the innovation process in the enterprise or the supervisor of this process.

The results of its Big Five questionnaire are detail as follows:

Figure 42 CR1 Big five results



Note. Source : Own creation

- **Stage 7. Verify if the enterprise has all the stages, and all are well defined; if not, a recommendation should be made to integrate it.**

This enterprise has all the stages included in their innovation process, and all of them have definition, protocol, process statements or formalization of those stages as a process.

Figure 43 CR1 Stages verification

Stage	Definition	FR2
1	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
2	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
3	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
4	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
5	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
6	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	

Note. Source : Own creation

As a recommendation for the current way this process has been handled, is proposed:

- Keep the six stages as recommended in the Model.

- **Stage 8. Verify in which of the stages this person is used to be more involved. Compare that stage profile with the person profile.**

The person interviewed indicates to be more involved in Stage 2 and Stage 4.

The current profile of the person is accurate to the Stage 3. However, as stage 4 is equal in terms of distribution than the Stage 3, as was mentioned in the Model in previous sections, both stages could be attended for the current profile. However, for the other stages this person is involved in, is not the preferable decision due to this person's competences profile.

- **Stage 9. Verify the distribution of the supervising responsibility in the company and propose the recommendation for the innovation team / supervisor.**

The current distribution of the leading responsibility in the innovation process stage is the following:

Figure 44 CR1 Stages leading responsibility

Stage	CR1
1	Project Manager (proposed for each project)
2	Project Manager (proposed for each project)
3	Project Manager (proposed for each project)
4	Specialized team depending of the project
5	Project Manager (proposed for each project)
6	Project Manager (proposed for each project)

Note. Source : Own creation

In all the stages except the stage 4, the Project Manager proposed for an innovation project, carried the supervision of the stages. So, there is not a supervising person per stage, as normal in SMEs considering the limited human and capital resources. However, as the person interviewed is involved in Stage 2 and 4, and according to the recommended profile it is consistent to Stage 4, the following recommendations are proposed to optimize the performance in the innovation process for the rest of the stages:

- For the rest of the process, as a project manager is established depending on the project, is recommended to delegate the tasks according to the profile and competences of the involved people. So, a person of the team with the most similar profile to the Stage one for example, could be more attentive or supervisor of that stage, even if there is a team for that stage. In consequence, the team could be supported with someone according to each stage.
- An identification of each team member Big Five profile is recommended to better set responsibilities.
- Competences training in the stages there is not a profile accuracy could be considered, so for future projects a more consistent profile could be in charge of the rest of the stages.

3.4. Case 4. Manufacturing sector, Costa Rican SME

The company profile is the following:

Table 19 CR2 Company profile

Identification	CR2
Sector	Manufacturing
Employees	From 1 to 4
Country	Costa Rica

Note. Source: Own creation

The following are the steps proposed in the Guide to analyze the contextualization of the innovation capability:

- **Step 1. GII position**
    - Analysis of the company's GII position

Same analysis than case 3.

    - Comparation with Costa Rica

Same analysis than the case 1

- **Step 2. Input weakness**

Same as in Case 3, Step 2.

- **Step 3. Establish strategies to deal the eventual impact in the organization.**

Even if those are external factors and the enterprise do not have a control over them, it's important to establish some strategies to reduce the impact into the company. The following are the proposed strategies to deal with an eventual impact in the organization:

- For Human capital and research weakness:
  - Retaining the talents into the organization could help to reduce the rotation and not be affected directly with the school-life expectancy and pupil-teacher radio.
  - Establish alliances with educational institution to create or adapt programs that can have the capacity of fulfill the company requirements. It could be made as a part of a group of similar interests within a sectorial group.
  - Create networking to found global research investors and have an internal structure capable to include a research culture.

- For the Gross domestic expenditure on R&D (GERD)
  - Maximizing the networking and collaboration with institutions for examples universities so projects could be handled together in R&D.
  - Participate in international funding that allows the enterprise to have more R&D projects and improve the innovation.

- For the investment's weakness:
  - Enhance the collaboration with national and international institutions that contact enterprise with investors, for example PROCOMER. So new projects could have investments to execute the requirements.

- **Step 4. Complete the questionnaire PII and Identify the categorization of the innovation capability.**

The categorization of the innovation capability of the enterprise is Passive. It is considered as a level 1 from 4 possible. Being the fourth the best scenario. This assessment indicates that this company is focused on basic improvements more than an innovation, it could experience difficulties to being differentiated from the competence. In a deep analysis, this company has a weakness in the innovation practice Design. Furthermore, as a strength this company has the innovation practice Strategy.

- **Step 5. Integrate the recommendations into the organizational strategy.**

The recommendation to improve the PII should be focus on exploit the strengths to maintaining them and to make them sustainable in the time.

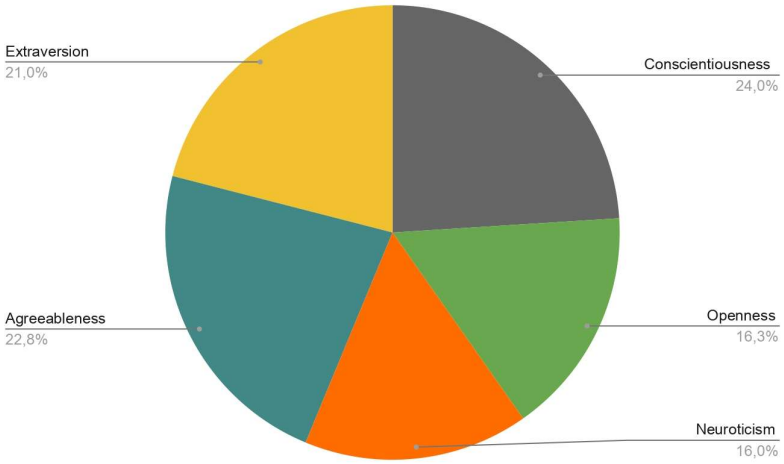
Also, the weakness can be attending and rectify.

- **Step 6. Complete the Big Five questionnaire (for the person in charge of the innovation)**

The person interviewed was the most related with the innovation process in the enterprise or the supervisor of this process.

The results of its Big Five questionnaire are detail as follows:

Figure 45 CR2 Big five results



Note. Source : Own creation

- **Stage 7. Verify if the enterprise has all the stages, and all are well defined; if not, a recommendation should be made to integrate it.**

This enterprise has all the stages included in their innovation process, except the Stage 6. The Stage 1, 2, 5 are realized but there is not any definition, protocol, process statements or formalization of those stages as a process.

The stage 3 and 4, are partially realized. It means those could be not realized as the stages description details. Some elements of those stages could be missed and/or combined with other stages.

Figure 46 CR2 Stages verification

Stage	Definition	CR2
1	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	
2	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	
3	Clearly defined	
	It is realized but not defined	
	Partially realized	x
	Not included	
4	Clearly defined	
	It is realized but not defined	
	Partially realized	x
	Not included	
5	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	
6	Clearly defined	
	It is realized but not defined	
	Partially realized	
	Not included	x

Note. Source : Own creation

As a recommendation for the current way this process has been handled, is proposed:

- Keep the six stages as recommended in the Model.

- **Stage 8. Verify in which of the stages this person is used to be more involved. Compare that stage profile with the person profile.**

The person interviewed indicates to be involved all the stages.

The currently profile of the person is accurate to the Stage 5. However, for the other stages this person is involved in, is not the preferable decision due to this person's competences profile.

- **Stage 9. Verify the distribution of the supervising responsibility in the company and propose the recommendation for the innovation team / supervisor.**

The current distribution of the leading responsibility in the innovation process stage is the following:

Figure 47 CR2 Stages leading responsibility

Stage	CR2
1	All the team
2	Project Manager (proposed for each project)
3	Project Manager (proposed for each project)
4	Specialized team depending of the project
5	Specialized team depending of the project
6	NA

Note. Source : Own creation

In stage 1, a teamwork is created attending this stage. Stage 2 and 3 are supervised for a Project Manager proposed for each project. And for 4 and 5 a specialized team is proposed. So, there is not a supervising person per stage, as normal in SMEs considering the limited human and capital resources. However, as the person interviewed is involved in all the stages, and according to the recommended profile it is consistent just to Stage 5. The following recommendations are proposed to optimize the performance in the innovation process for the rest of the stages:

- For the rest of the process, as a project manager or team is stablished depending on the project, is recommended to delegate the tasks according to the profile and competences of the involved people. So, a person of the team with the most similar profile to the Stage one for example, could be more attentive or supervisor of that stage, even if there is a team for that stage. In consequence, the team could be supported with someone according to each stage.
- An identification of each team member Big Five profile is recommended to better set responsibilities.
- Competences training in the stages there is not a profile accuracy could be considered, so for future projects a more consistent profile could be in charge of the rest of the stages.

3.5. Case 5. Manufacturing sector, Costa Rican SME

The company profile is the following:

Table 20 CR3 Company profile

Identification	CR3
Sector	Manufacturing
Employees	From 5 to 9
Country	Costa Rica

Note. Source : Own creation

The following are the steps proposed in the Guide to analyze the contextualization of the innovation capability:

- **Step 1. GII position**
    - Analysis of the company's GII position

Same analysis than case 3.

    - Comparation with Costa Rica

Same analysis than the case 1.

- **Step 2. Input weakness**

Same as in Case 3, Step 2.

- **Step 3. Establish strategies to deal the eventual impact in the organization.**

Same as in Case 3, Step 3.

- **Step 4. Complete the questionnaire PII and Identify the categorization of the innovation capability.**

The categorization of the innovation capability of the enterprise is pre-active. It is considered as a level 3 from 4 possible. Being the fourth the best scenario. This assessment indicates that even if this company can develop innovation projects and have a strategy vision anticipating future changes, it could experience difficulties to keep a constant innovation level.

In a deep analysis, this company has weakness in the innovation practice Design. Furthermore, as a strength this company has the innovation practice Project Management.

- **Step 5. Integrate the recommendations into the organizational strategy.**

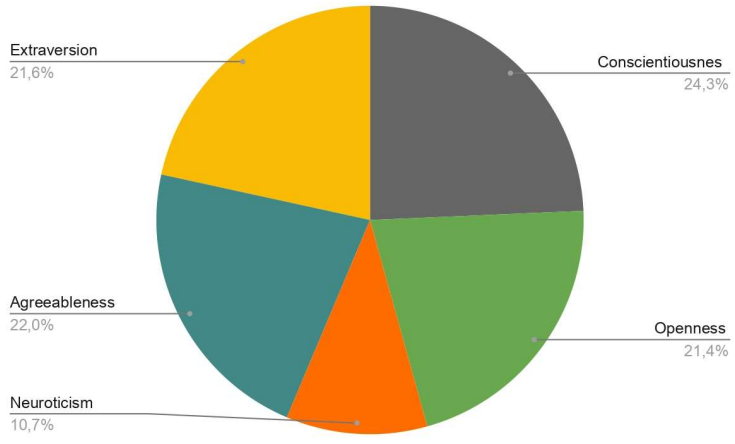
The recommendation to improve the PII should be focus on exploit the strengths to maintaining them and to make them sustainable in the time.
Also, the weakness can be attending and rectify.

- **Step 6. Complete the Big Five questionnaire (for the person in charge of the innovation)**

The person interviewed was the most related with the innovation process in the enterprise or the supervisor of this process.

The results of its Big Five questionnaire are detail as follows:

Figure 48 CR3 Big five results



Note. Source : Own creation

- **Stage 7. Verify if the enterprise has all the stages, and all are well defined; if not, a recommendation should be made to integrate it.**

This enterprise has all the stages included in their innovation process. From Stage 1 to 5, those are realized and are clearly defined with the respective definition, protocol, process statements or formalization of those stages as a process. The stage 6 is included in their innovation process; however, those are realized but there is not any definition, protocol, process statements or formalization of those stages as a process.

Figure 49 CR3 Stages verification

Stage	Definition	CR3
1	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
2	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
3	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
4	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
5	Clearly defined	x
	It is realized but not defined	
	Partially realized	
	Not included	
6	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	

Note. Source : Own creation

As a recommendation for the current way this process has been handled, is proposed:

- Keep the six stages as recommended in the Model.

- **Stage 8. Verify in which of the stages this person is used to be more involved. Compare that stage profile with the person profile.**

The person interviewed indicates to be involved in stage 1, 2 and 3.

The current profile of the person is accurate to the Stage 5. Involve this person in other stages, is not the preferable decision due to this person's competences profile.

- **Stage 9. Verify the distribution of the supervising responsibility in the company and propose the recommendation for the innovation team / supervisor.**

The current distribution of the leading responsibility in the innovation process stage is the following:

Figure 50 CR3 Stages leading responsibility

Stage	CR3
1	Project Manager (proposed for each project)
2	Project Manager (proposed for each project)
3	CEO
4	Specialized team depending of the project
5	Specialized team depending of the project
6	Specialized team depending of the project

Note. Source : Own creation

The stage 1 and Stage 2 are supervised for a Project Manager proposed for each project. And for 4, 5 and 6 a specialized team is proposed. For stage 3, the CEO is the supervisor. So, there is not a supervising person per stage, as normal in SMEs considering the limited human and capital resources.

The person interviewed is involved in stages 1, 2 and 3, and according to the recommended profile it is not consistent because its profile is adjusted just to Stage 5.

The following recommendations are proposed to optimize the performance in the innovation process for the rest of the stages:

- For the rest of the process, as a project manager or team is established depending on the project, is recommended to delegate the tasks according to the profile and competences of the involved people. So, a person of the team with the most similar profile to the

Stage one for example, could be more attentive or supervisor of that stage, even if there is a team for that stage. In consequence, the team could be supported with someone according to each stage.

- An identification of each team member Big Five profile is recommended to better set responsibilities.
- Competences training in the stages there is not a profile accuracy could be considered, so for future projects a more consistent profile could oversee the rest of the stages.

3.6. Case 6. IT sector, Costa Rican SME

The company profile is the following:

Table 21 CR4 Company profile

Identification	CR4
Sector	IT services
Employees	From 50 to 149
Country	Costa Rica

Note. Source: Own creation

The following are the steps proposed in the Guide to analyze the contextualization of the innovation capability:

- **Step 1. GII position**
    - Analysis of the company's GII position

Same analysis than case 3.

    - Comparation with Costa Rica

Same analysis than the case 1.

- **Step 2. Input weakness**

Same as in Case 3, Step 2.

- **Step 3. Establish strategies to deal the eventual impact in the organization.**

Same as in case 3, Step 3.

- **Step 4. Complete the questionnaire PII and Identify the categorization of the innovation capability.**

The categorization of the innovation capability of the enterprise is Reactive. It is considered as a level 2 from 4 possible. Being the fourth the best scenario. This assessment indicates that even if this company is able to respond to changes and have a defensive approach, it could experience difficulties to develop disruptive projects. In a deep analysis, this company has a weakness in the innovation practice Ideas Generation. Furthermore, as a strength this company has the innovation practice Design.

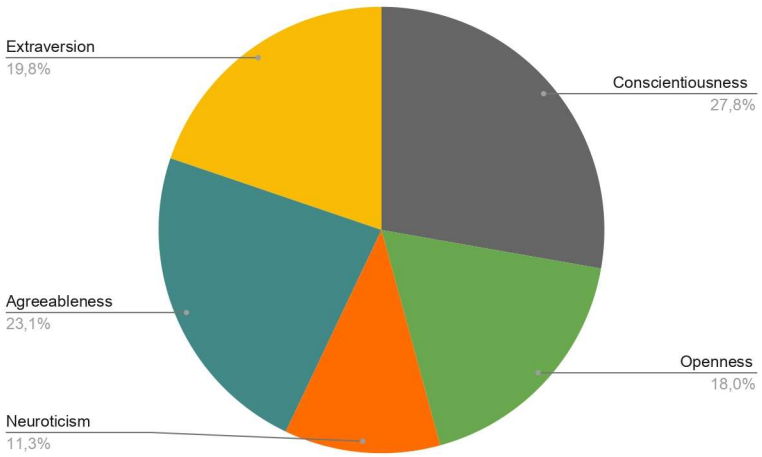
- **Step 5. Integrate the recommendations into the organizational strategy.**

The recommendation to improve the PII should be focus on exploit the strengths to maintaining them and to make them sustainable in the time. Also, the weakness can be attending and rectify.

- **Step 6. Complete the Big Five questionnaire (for the person in charge of the innovation)**

The person interviewed was the most related with the innovation process in the enterprise or the supervisor of this process. The results of its Big Five questionnaire are detail as follows:

Figure 51 CR4 Big five results



Note. Source : Own creation

- **Stage 7. Verify if the enterprise has all the stages, and all are well defined; if not, a recommendation should be made to integrate it.**

This enterprise has all the stages included in their innovation process; however, those are realized but there is not any definition, protocol, process statements or formalization of those stages as a process.

Figure 52 CR4 Stages verification

Stage	Definition	CR4
1	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	
2	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	
3	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	
4	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	
5	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	
6	Clearly defined	
	It is realized but not defined	x
	Partially realized	
	Not included	

Note. Source : Own creation

As a recommendation for the current way this process has been handled, is proposed:

- Keep the six stages as recommended in the Model.
- Formalize the stages to create a clear procedure and protocols to standardize the process. So, the knowledge acquired in previous projects could be used. Also, the process could be more efficient as all the stages and procedures are clearly defined.

- **Stage 8. Verify in which of the stages this person is used to be more involved. Compare that stage profile with the person profile.**

The person interviewed indicates to be involved in stage 3.
The currently profile of the person is accurate to the Stage 5. Involve this person in other stages, is not the preferable decision due to this person's competences profile.

- **Stage 9. Verify the distribution of the supervising responsibility in the company and propose the recommendation for the innovation team / supervisor.**

The current distribution of the leading responsibility in the innovation process stage is the following:

Figure 53 CR4 Stages leading responsibility

Stage	CR4
1	Project Manager (proposed for each project)
2	Project Manager (proposed for each project)
3	Project Manager (proposed for each project)
4	Project Manager (proposed for each project)
5	Project Manager (proposed for each project)
6	Project Manager (proposed for each project)

Note. Source : Own creation

The all the stages a Project Manager is proposed. The person interviewed is involved in stages 3, and according to the recommended profile it is not consistent because its profile is adjusted just to Stage 5. The following recommendations are proposed to optimize the performance in the innovation process for the rest of the stages:

- For the rest of the process, as a project manager or team is established depending on the project, is recommended to delegate the tasks according to the profile and competences of the involved people. So, a person of the team with the most similar profile to the Stage one for example, could be more attentive or supervisor of that stage, even if there is a team for that stage. In consequence, the team could be supported with someone according to each stage.
- An identification of each team member Big Five profile is recommended to better set responsibilities.
- Competences training in the stages there is not a profile accuracy could be considered, so for future projects a more consistent profile could be in charge of the rest of the stages.

4. Comparative analysis of the study cases

On the six cases analyzed in the previous section, some similarities, congruences and differences showed up. Some important highlights are presented supporting proposed Behavioral and Sectorial Perspective Analysis for the Innovation Capability.

4.1. Synthesis of the study cases

Six study a case where examined. A resume of the results is describing as follows:

Table 22 Synthesis of the study cases

Country	Company information		Sectorial Perspective (GII)			Innovation Capability (IIP)			Behavioral Perspective			
	ID	Sector	GII ranking of the country	GII Factors (Strength)	GII Factors (Weakness)	IIP	IIP Practices (Strength)	IIP Practices (weakness)	Innovation stages Clearly defined	Proposed stage for the interviewed person's profile	Current involvement of the person	% of the affinity that the person has between the current role and the role they should assume according to the recommended stages
France	FR1	Manufacture	11	**Institutions** Market sophistication	**Human capital and research** **Business sophistication** Infrastructure	Reactive	Knowledge Management	Human Resources	0%	Stage 3 or Stage 4	Stage 4 and also the others	33%
	FR2	IT Services	11			Reactive	Generating new ideas	Human Resources	0%	Stage 2	Stage 1, 2 and 6	33%
Costa Rica	CR1	Manufacture	74	**Institutions** Infrastructure	Market sophistication **Business sophistication** **Human capital and research**	Pre-active	Design	Human Resources	83%	Stage 3 or Stage 4	Stage 2 and Stage 4	50%
	CR2	Manufacture	74			Passive	Strategy	Design	0%	Stage 5	All	16%
	CR3	Manufacture	74			Pre-active	Project Management	Design	100%	Stage 5	Stage 1, 2 and 3	0%
	CR4	IT Services	74			Reactive	Generating new ideas	Design	0%	Stage 5	Stage 3	0%

Note. Source : Own creation

In the last table some highlights are relevant to analyze the relation between the cases and the two perspectives impacting the Innovation Capability.

The objective of using the study cases was to test and improve the pertinence of the proposed contextualization approach. This objective was achived as the pertinence of the proposed guide was applied and is verified the applicability and huge contributions for the companies by stablish strategies that close gaps beween the curent reality and a beeter scenario that they could have regardin the contextualization of the innovation capability. Also the pertinces is supported by the different conections found in the summary of the cases, reveling the affinity with our theoretical base and the reserach proposal used. Those conection are analyzed as follows.

4.2. Connections and similarities between GII and PII

Two of the companies were from France and four from Costa Rica. In the French SMEs, one was from the manufacture sector and one from the IT Services Sector. In the case of the Costa Rican SMEs, three of them were from the manufacture sector and one from the IT Services Sector.

Based on the sector, a fact is interesting to underline. Both companies reflect in the PII evaluation for their Innovation Capability, that their principal innovation practice strength was generating new ideas. This strength is common in both scenarios and could suggest a positive internal practice in this kind of sector due to it nature in this study.

Concerning the strengths of the GII in both countries, the element Institution constitute a positive asset for both countries, but mostly for France. This element includes the institutional environment, regulatory environment, and the business environment variables.

Human Capital and research, as well as Business Sophistication, are two important elements that are present as a weakness in both countries. In our study a relation between the GII weakness and the PII weakness could be present. The GII weakness Human Capital and Research is present in both countries, as well as the PII weakness Design and Human Resources.

An interpretation of this fact is that since the individual variables studied into each element, PII variables concepts for Design and Human Resources concepts are consistent with the IIG variable concept Human Capital and Research. Into the Human Capital and research element is considered: education, tertiary education and Research and development. In Design practice the Research and Development, Experimentation capacity, Methods for design and integration of digital resources are evaluated. In the case of Human resources, it integrates the Encouraging innovation, communication on innovation and management skills.

In other words, the GII element of Human Capital and Research could be related with the Design and the Human Resources practices in the studied SMEs, due by their conceptualization but also for the consistent disposition among the cases.

In the case of Business Sophistication, it integrates Knowledge workers, innovation linkages, and knowledge absorption. This GII element is a weakness for both countries. The weakness in the PII of each SMEs can also be related due the compatibility of the studied variables.

For example, the Knowledge of workers can be related with the Human Capital practice and its variables, the Knowledge absorption is suitable with the Design practices in terms of experimentation, methods and so on.

In conclusion, it can be deduced that the weakness found in the GII for both countries and the weakness found in the PII of the SMEs are suitable and consistent. So, a relation between those elements is settle for the studied cases in this thesis.

4.3. Connections and similarities between Behavioral perspective and PII

Focusing the Behavioral Perspective, some facts have been highlighted in the table.

The SME CR1 and CR3 are the only cases that have the innovation stages clearly defined. CR1 have an 83% of their stages defined, and CR3 have the six stages clearly defined. This is the positive scenario for the SMEs due the analysis realized in this thesis, suggesting the six stages should be established and clearly defined for a better innovation performance level.

There is an interesting piece of information, consistent with the two SMEs that have the higher percentage in defined stages. This is the PII results of those SMEs, are both of them pre-active. The pre-active level represents the second preferable and positive possible scenario in the PII classifications.

The data detailed above could be related at least in this study. The Pre-active SMEs studies have as well a higher percentage of the innovation stages defined. Furthermore, when the innovation stages are not clearly defined, two of the more pessimistic scenarios in the PII categorization are reveled for those SMEs: Reactive and Passive.

It can be deduced the relation between the definition of the stages in the SMEs and the overall innovation capability of the SMEs, been the most defined stages are, the more positive category the company obtain in the PII.

Another fact that should be pointed is the percentage of affinity that the interviewed person has in its current role, and the role they should assume according to the recommended stages based on the individual profile.

The three higher percentage of affinity coincide with the PII weakness of Human Resources. While the three-lower percentage coincide with the PII weakness Design. It could suggest that in the cases studied in this thesis, a connection between the affinity of the person in the role based on the suggested profile and stage, and the PII weakness could exist.

This can be supported by the fact that the Human Resources Practice which integrates management skills is compatible with the subject of affinity between the profile of the person and the role, which is also related with the management skills. Thus, a low percentage of affinity is not a positive scenario of the SMEs nor is it a weakness of Human Resource Practice.
Regarding the lowest percentage or cero percentage of affinity, this fact matches with the weakness of Design innovation practice in those SMEs. This could be

interpreted that when a low percentage of affinity (less than 16% in these cases), is concordable not now with a weakness of Human Resource Practice but with a weakness in the Design practice. In other words, it isn't now just related with skills but also could be related with the SMEs experimentation capacity, Methods for design and integration of digital resources.

It could be inferred that the is cero or low affinity of the person's profile in charge of the innovation process in the studied SMEs and the stages this person is involved in. It would impact the experimentation capacity, methods for design and integration of digital resources.

4.4. Considerations for contextualization analysis

As this approach of contextualization analysis of the innovation capability is proposed to evaluate the environmental factors (sectorial perspective) and the individual factors (behavioral perspective), the case study allows us to verify the pertinence of that proposal. Improving the questions and looking for an assertive individual analysis.

The previous section reaffirms the existing connection and impact the sectorial and behavioral perspective have in the innovation capability of the SEMs. In the case of the cases studied some highlights could be made based on the comparative and similitudes revel by the comparative analysis of the six study cases. Those are synthesis as follows:

- The GII weakness and the PII have a connection and are compatibles. Supported in the results and the previous literature and empirical analysis made in this thesis, and the comparative results, that the GII weakness has also been reflected in the PII weakness of those six cases. In other words, the weakness found in the GII for both countries and the weakness found in the PII of the SMEs are suitable and consistent, so a relation between those elements is settle for the studied cases in this thesis. It supports the impact the sectorial perspective has in the PII as proposed in the theoretical bases of this thesis.

- It also has been deduced the relation between the definition of the stages in the SMEs and the overall innovation capability of the SMEs. Been that the most defined stages are, the more positive category the company obtain in the PII, in the studied cases. It supports the behavioral perspective impact in the innovation capability.

- The results of the six SMEs studied advise there is a connection between the affinity of the person in the role based on the suggested profile and stage, and the PII weakness. This also support the impact of the behavioral perspective in the studied SMEs.

These connections synthesized in last paragraphs, confirm, and verify the consistence of the proposed guide with the theoretical and empirical scheme made in this thesis. The Behavioral and Sectorial contextualization approach propose a new guide to identify the environmental and individual aspects that affect and impact the innovation. The context of the innovation as a multifactorial phenomenon could be analyzed using the model, instruments and index suggested in the guide. In addition, the recommendations for specifics elements could be made regarding the impacting factors.

As feedback of the study case, we can deduce the followings comments:

- The model proposes 6 stages, and as the study case showed are commonly used of the SMEs, however the nature of the Model of individual competences profiles 'propose 5 different profiles. In the field, the SMES can't handle a human and capital resources to cover this proposal. That's why the training, teamwork and strategic situational leadership should be considered.

- The pertinence as a guide or instrument to help consultants and internal members to analyze the context of their innovation capability has been supported by the case study. Specific recommendations were made and those could be considered in the strategy of the enterprise.

- The impact of the country weakness detailed in the GII could have an impact in the SMES weakness. It would warrant a reflection and support in the step 3, where the strategies to deal with the country weakness are developed. So, a comparation to match the company weakness and the GII weakness can be connected and worked with the same line of effort.

- The step 7 of the guide acquires also more relevance, due the found connection of the clear definition of the innovation process stages with the SMEs PII result. This deserves a deep analysis and crucial strategies for the company to better define the stages, so it could contribute with a better PII categorization.

- The 8 and 9 steps are also backed by the findings of the comparation analysis. The affinity of the proposed profile with the stages that person is currently be involved can be related with the PII weakness. The affinity by training the team or distribute the responsibilities using the profile references, can have a positive effect in reduce the PII weakness.

- As improvement of the guide, the cases allow us to offer those recommendations but in a multidisciplinary session with different

authorities of the enterprise and the collaborators the scope of the guide would be exponential in benefit of the company.

Some conditions and limitation of this guide have to be considered.

- The guide is not a relational or dependent variable. This guide is an integrative approach from the sectorial to the behavioral perspective, but the relation between the variables is not representative as it was not the principal objective. The cases and its comparation revels some ideas a signal of the connection and those are descripted before but are not representative because or the size of the target. With a representative sample of these cases, perhaps new connections and relation between the variables could be made.

- The analysis made between the countries was made because of the selective decision of the researcher and was made with academic proposes. The SMEs can have that as an example, but each company should select the best country to compare and if it is required, as it is optional.

- This guide was proposed for SMEs. For bigger companies some analysis has to be deeper analyzed and integrating strategic stakeholders to be implemented.

5. Conclusions

This Chapter proposed an implementation of the Behavioral and Sectorial contextualization approach for SMEs analysis.

The pertinence and test of this proposal was analyzed by using the case study methodology. This methodology was explained and its nature to analyze the deep individuality of a phenomenon allow us to understand and improve the guide.

Six SMEs were analyzed and guide step by step to identify, measure and analyzed the innovation impacting factors of the environment and from the individual aspect. A comparative analysis of the results from the six SMES revels some connections an implication. Those are detailed in this chapter.

A comparative analysis between the cases result in connections and similarities between the GII and PII, making them compatibles. Specifically, the weakness found in the GII for both countries and the weakness found in the PII of the SMEs are suitable and consistent.

Similarly, some connections emerged from the the relation between the definition of the stages in the SMEs and the overall innovation capability of the SMEs, been the most defined stages are, the more positive category the company obtain in the PII.

Likewise, a deductive connection between cero or low affinity of the person's profile in charge of the innovation process in the studied SMEs and the stages this person is involved, would impact the experimentation capacity, methods for design and integration of digital resources.

Those connections and the results in this implementation process, supports the impact the sectorial perspective has in the PII as proposed in the theoretical bases of this thesis and also the behavioral perspective impact in the innovation capability. This results and conclusion are for the study cases selected.

Some limitations of generalization of those results are present since the reduced number of cases. The next chapter would detailed more of those limitations.

Conclusions

1. General conclusion

The current reality of companies in general and especially the SMES, involves facing important challenges in their labors and in the context, they are facing. Considering the innovation, it represents a key element of their strategy, the hope of maintaining their competitive advantages and an optimistic way deal with those challenges. However, the innovation management requires a deep understanding not just of the innovation practices itself but also the impacting factors within this multifactorial phenomenon. One conceptual approach that integrates the complexity of this multifactorial phenomena is innovation capability. Unfortunately, just few references exist about how to interpret and consider the contextualization of the innovation capability.

Through this thesis, we have pursued to understand and clarify the contextualization impact in the company's innovation capability and how to take advantage to deal with it. Specifically, the gaps that was tried to be attended were: the insufficient information about the impact of the contextualization of the innovation capability and how to improve it. Moreover, the weak clarity existing about which individual competences are essential to be considered within the behavioral perspective, for the optimal innovation capability. And finally, there is a need to guide the companies to their own analysis of the impact of the contextualization in their innovation capability, to support them to have strategic information to improve it.

To solve those gaps the following process was carried on:

- **Insufficient information about the impact of the contextualization of the innovation capability**

A specific objective was defined as follows: To establish the factors and measure of the sectorial perspective that impact the organizational innovation capability, by integrating a systematic literature review. This objective could respond the question about which are the factors of the sectorial perspective that impact the innovation capability and how to measure them.

In order to answer that question, a systematic literature review was made to understand which were the prominent factors that the authors proposed. Then, a comparison between the different existing measures and index that integrate the found factors was made.

- **Weak clarity existing about which individual competences are essential to be considered within the behavioral perspective.**

The specific objective was defined: To propose a Model of Individual Competences for the behavioral perspective of the organizational innovation capability, by incorporating a literature systematic review and empirical approach. The aim of this

objective was to answer how to integrate in one model the set of essential individual competences for the optimization in the innovation capability.

To answer that question a systematic literature review and content analysis are developed to identify the existing theoretical constructs proposals.

- **Necessity to guide the companies in order to analysis the impact of the contextualization in their innovation capability.**

This specific objective was proposed: To develop analysis guidance for companies by integrating the proposed behavioral and sectorial contextualization factors. This objective tried to answer how a company could analyze the Behavioral and Sectorial contextualization of its innovation capability to improve it.

The process to answer it was made by integrating the results of the previous specific objectives. A structure of step by step framework has been developed and presented as a guide for the companies to analyze the impact of the context in their innovation capability.

- **Application to a particular type of companies: the SMEs**

Finally, an experimentation was conducted in order to highlight how the proposed guide could be applied within a specific type of companies: the SMEs. An empirical approach mobilizing a multiple case study method has been implemented, within a sample of 6 SMEs from Costa Rica and France. This experimentation enables us to explore the specificities of these small companies regarding the contextualization of their innovation capacity.

While each process and objective were achieved, important contribution were presented. Those are detailed in the next subsection.

2. Contributions

The contributions for this project are presented as follows:

- **Identification of a suitable Index to measure the Sectorial Perspective in the contextualization for the Innovation Capability.**

The first objective was proposed to establish the factors and measure of the sectorial perspective that impact the organizational innovation capability.

In order to make this, the first step was defined the core concept of the project was defined by using literature definition. Its definition and its levels were explained. It allows us to focus our project on the innovation as an action that improves the context that uses it new or changed solution at the organizational level. Moreover, the Organizational Innovation Capability was explained. The elements required to explain its constitution suggest a multifactorial approach. With an analysis and comparative with other models, the PII Model was selected to better define it.

Once the Innovation Capability was well defined, the sectorial perspective was analyzed.

The detailed process carried in the Chapter I by using the systematic literature review technic, allows us to identify the factors and measure that better fit with the analysis of the sectorial perspective. It has been considered the proposal of the Contingency Theory, and its environment and age-size factors were analyzed. Correspondingly, some commonly missing factors in the sectorial perspective were considered. After comparing four of the robust existing models to evaluate the sectorial perspective the GII was selected.

This Global Innovation Index complete the diversity of factors affecting the external impacting elements in the sectorial perspective and results being the most suitable index for the context of the innovation capability.

This contribution is a huge advance because the sectorial perspective could be now easier to analyze and evaluate by the companies. The definitions and features of innovation, innovation capability and the external factors summarized in the sectorial perspective are now supported, and updated base of our project that have been developed.

It represents a clear and enough data about the impact of the contextualization of the innovation capability, closing the first gap founded.

- **Construction of a model of individual competences for the innovation process**

The second objective proposed was the construction of a Model of Individual Competences for the behavioral perspective of the organizational innovation capability. By incorporating a literature systematic review and empirical approach this objective was completed accomplished.

In the Chapter II, a theoretical approach was developed. It included the analysis of the most common and recommended theoretical construct for individual innovation: Innovative Behavior, Entrepreneurial Behavior, Psychological Innovation and Managers innovation profile. As some contradictions were found within those constructs, it was necessary to make a process to unify the common perspective of the four constructs in one model. That's how a comparative analysis for the variables categories and a content analysis was realized. A Framework of categorization variables for individual innovation competences was established.

This framework represents another contribution related with this objective. The Framework allows having a unified and well systematized framework of the categorization of the essential variables for the individual innovation capabilities.

Then, a clarification of the stages was required the identification of a set of competences could be specific for each stage and not for the whole process, as it would represent a generalization bias. After a Scopus systematic literature review, a process with six stages is proposed, due to the multiples and variety of innovation stages proposed by authors and norms.

This six stages innovation process is an important contribution, because there were not a common or integrated suggestion of how the innovation process should be constituted. But now considered the principal theoretical proposal and integrated them in one common model.

Subsequently since the innovation process was clarified and a framework of categorization variables for the individual innovation competences were defined, the essential competences could be now identified. The framework of categorization variables was studied by each stage. So, a list of competences in each category of the framework were found. That's how a set of individual competences for each stage was developed. Therefore, an empirical approached based on the exploratory multiple case was developed. This gives a holistic view from the theoretical but also from the real practice of the SMEs.

The set of individual competences for each stage represent one of the most important contributions of this thesis, being a proposal that clarifies how the person behind the innovation should be and which competences are recommended for this person to have. Besides, this proposal has been verified with the empirical approach to integrate a real proposal from the daily bases of the companies.

Next, an instrument to evaluate the proposed set of individual competences were required to make it practical to the companies. That's why an identification of the most used instruments according to the literature for the individual innovation was studied. The Big Five Instrument result the most suitable for the study and based on a co-occurrence analysis the match between the set of individual competences and the instrument was settled. The instrument can now be used to measure the affinity of the profile of the person in the innovation stage.

At this point a Model of individual competences profiles per each innovation stage is generated. This Model has its instrument to evaluate the profiles so the person can be compared with it. This in other important contribution. Because in the practice the person in the company can see the optimal an individual innovation profile per stage, evaluate their own profile, and easily identify the gaps to be overcome with some strategies to have the essential profile.

- **Guide the companies (and particularly the SMEs) to their own analysis of the impact of the contextualization in their innovation capability.**

The third contribution was based on the third and fourth objectives: To develop analysis guidance for companies by integrating the proposed behavioral and sectorial contextualization factors, and test it within a panel of SMEs.

Based on the empirical and theoretical approaches of the previous results, a proposal of the contextualization analysis of the innovation capability was developed. This was integrated in a Guide for the companies including the Sectorial Perspective, Behavioral Perspective and the Innovation Capability. A nine steps guide allows the companies to evaluate their innovation capability contextualization, considering the sectorial and behavioral perspective.

This contribution results essential for the companies to understand and to develop the knowhow of a holistic analysis of their organizational innovation capability. This could help the enterprise to be aware of the different factors impacting their innovation capability and incorporate specific and detailed strategies to improve their innovation performance.

To implement the Guide a Multiple Case Study was developed. By interviewing 6 SMEs from Costa Rica and France, the Guide was experimented and approved to be used in the specific context of small companies.

The comparative analysis of all the study cases revels important connections and compatibilities that support the influence and impact of the sectorial and behavioral perspective to the innovation capability, as proposed in the previous sections. It represents that the model agrees with the theoretical and empirical proposed approach and is suitable to use for the SMEs.

3. Implications

A Model of an individual competences profiles was created. The relevance of this significant outcome is the positive impact that it uses implies on the industry and the academy, since closing the gap of the differences and discrepancies between constructs, and companies' perceptions to responding to how the person in the innovation process should be profiled for the best innovation performance results.

For industry, having a supported model that guides crucial aspects of the innovation starting points, results key for the organization. Also, organizational support is essential to trigger individual innovation (Lots, 2018). Some uses and cares for the industry of the results of this study could be the delegation of the roles and tasks into the innovation teams. The conformation of the teams, the current practices to recruit personnel, the motivational strategies, and the training plans. Those aspects could directly and positively impact the individual performance once the employee's own competences fit with their assigned role requirements. Moreover, the optimization of their own competences and the appropriate team composition team conformation could impact positively the team synergy and the project's outcomes (Bradley et al., 1997).

The recruitment process could use this model as a guide to better results. Some motivational strategies as well as training plans could be adapted. Consequently, with all the elements described, an improvement of the innovation stage could result, and thus the innovation performance.

According to this, it could also have an impact on the efficiency and management of the resource's management (time, human capital, expenses), all for the optimization of the starting point of the innovation: the person (Bassey et al., 2012).

For the academy, due to the development of the model corresponding to the empirical and theoretical approaches, it represents a confident base to support other subjects such as innovation, entrepreneurship, innovative ecosystems, and in behavioral perspectives.

The gap in information about the profile of the person behind the innovation process has been analyzed. With the results, those could be used as a base for looking forward to managers' profiles and other ranges of superior roles required. Also, the utilized method to contrast and integrate theoretical and empirical perspectives could help other fields with similar initiatives to reproduce the study.

Concerning the developed guide for the contextualization analysis of innovation capability, human capital has been considered the starting point of innovation and one of the recent trendy topics. It should be considered at the same importance level as another innovation aspect since it results in a multidisciplinary concept (Jaroenngarmsamer et al.,2019.). Once giving it the importance and relevance merited, it would reinforce the base of the innovation studies and its implications for

organizational performance, competitiveness, and success: the person (Douglas et al., 2021).

Additionally, considering the environmental aspects impacting the innovation, that guide integrates the Behavioral and Sectorial contextualization. The innovation as a multifactorial phenomenon could be analyzed using the model, instruments and index suggested in the guide. This could be a handy tool for the enterprises to analyze their holistic perspective for the innovation capability.

It contributes to better understand and to develop the knowhow of a holistic analysis of companies' organizational innovation capability. They can now to be aware of the different factors impacting their innovation capability and incorporate specific and detailed strategies to improve their innovation performance.

4. Limitations and perspectives

The studies developed in this thesis have some limitations, but those at the same time open opportunities for future works and are the base for new research perspectives.

The main limitation of this work is the validation of the proposed model in terms of the connections that are between the behavioral and sectorial perspective and the innovation capability.

Even if in the comparative analysis of the study cases some facts could be interpreted compatible with the proposed approach of impact to the innovation capability, those results are specific to the six SMEs cases considered (four from manufacture and two from IT services), what represent a limited number of cases. For a representativity and generalization of those connections a bigger sample would be integrated to assure and make the probable existing connections in supported connections. However, this is an approach to a contextualization analysis, the objective is that the company can have a guide to be aware and identify the different impacting factors in their innovation capabilities.

Moreover, the proposed model of individual innovation capabilities was contrasted with the empirical approach to have not just the theoretical base for the Model but also the point of view of the enterprise. This guide and the Model for innovation capability was built in order to be applied in a generic company, but it has been experimented within SMES, in the framework of this thesis. . At this point, the results provided are convenient to be used in the same size and type of company. This is why for its use in other kind of company is necessary to conduct additional experimentations to highlight what are the specificities of SMEs in terms of innovation capacity contextualization, in comparison with bigger companies. It should be considered to adapt the guide and the model to the type of company (SMEs, bigger company) or depending on other external factors considered in this study (business sector, geographical context, …).

As mentioned since the second chapter, the contingency theory proposed that the best model for a company is that one effectively adaptable of the context features. That's why the specification of the SMEs' context is crucial for the improvement of the innovation capability.

In this study the considered SMEs have their own and shared context between them. Those are determinate in the geographical element (from Costa Rica and France), so all the economical, legal and institutional characteristics impact their environment. Also, the industry of those companies is based in IT and manufacture, so their stability and contextual challenges could be similar. The size of the company itself (SMEs) represent a contextual factor regarding the market dynamics of this kind of company. That why as a perspective of this point this same work and proposal could by tested by future researchers to a bigger group of companies in order to identify the differences according with the context.

For the sectorial perspective evaluation, the GII was selected as it was the most suitable of the possible models to use. The integration of it in the Guide proposed suggest just to include the weakness of the country in the analysis. Here, the strengths, the differences between the income group suggested in the GII, and other aspects are not included. The idea was to make it the easiest possible for the companies, so the inclusion of the weakness would represent the best way to do it. Nevertheless, for a deeper analysis and for future research, it can be recommended for the company to read the whole analysis this index gives so a holistic view of the reality of the country can be meet.

Other limitation is linked with the accessibility of the PII evaluation. Months ago, the digital evaluation tool that allows to evaluate in the automatic way, based in a questioner. Though, at this moment that platform is not available. So, the recommendations are not known automatic, those require to be generated by someone but not for the platform.

Concerning the perspectives of our study, we suggest focusing in three main perspectives. The first one is the automatization of the guide. The proposed guide represents a work and effort that the company has to do with their own knowledge.

Following the proposed steps, they can have an initial perspective of how the contextualization factors are impacting the innovation capability. Also, with the proposed principal elements to interpret the results they can have a path on how to is their realty. Nevertheless, we argue that this guide can be optimized after by using a digital system so the recommendations, the relation between the factors and other kind of analysis can be made so the bias of the person in the company do not affect the interpretation. Likewise, the suggested evaluation tools as GII, PII for example, can be integrated in one site to have all the tools in the same system. We recommend this in further studies.

The second one is proposed in reference to the relation between the GII and the PII. In this thesis the global relation between the external or sectorial perspective and the innovation capability is supported by the literature and the empirical experiences of the company. However, the GII integrates not just the outputs but the inputs of the innovation of the country. Correspondingly, each element evaluated in the GII have specific interesting data that could be used for a deeper understanding of which and how specifically those could be related with the PII.

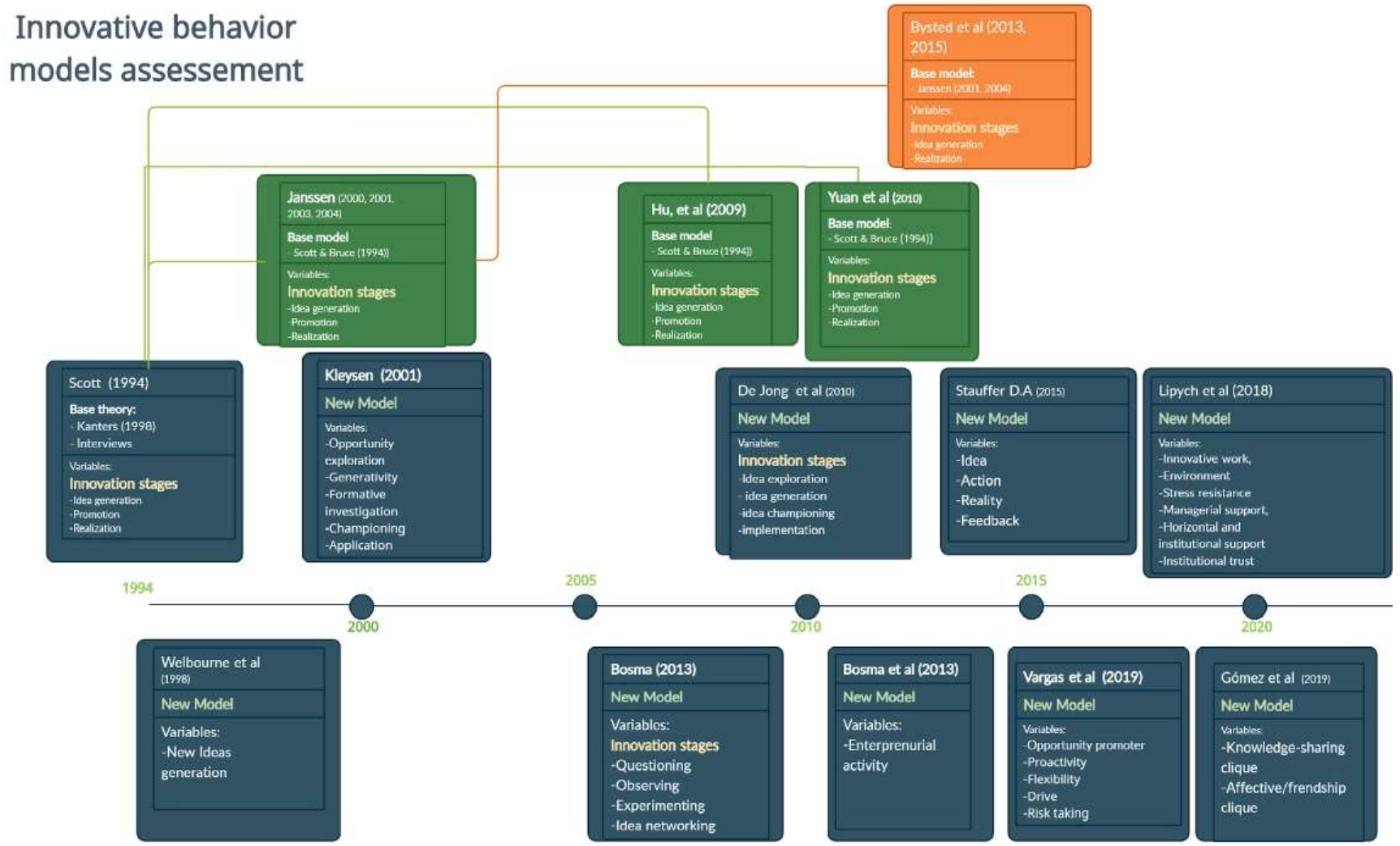
The PII practices are a multifactorial aspect, some of them could be directly related with the GII. To achieve this, is suggested: to apply the proposed guide for more and different companies so the data could be representative, and the connections would be visualized easily. Another option is by make a research study focusing on support each GII element with the PII practices by the literature. In both ways the benefits for the companies could be crucial. They can be focused in generate the strategy to improve the response of the company to deal with a specific element a

not to the whole variable of the GII. Also, the PII practices more impacted by those GII elements could be fortified.

The third perspective concerns the Model for individual innovation competences. This thesis proposes a model of individual innovation competences for companies, based on robust literature review and an empirical approach conducted within SMEs. The potential of that Model of Individual Innovation Competences would represent a solution for the human resources department or services in charge of Talent acquisition and recruitment in various sectors in the industry. That's why this perspective propose the complementation and validation of the model in other companies with various size and into other sectors. By implementing a study with the target companies the validation of the set of essential competences can be made. Then the new adapted model could be a manual or references for the companies in terms of recruitment, training, and other positive impacts as it also represents already in the SMEs studied.

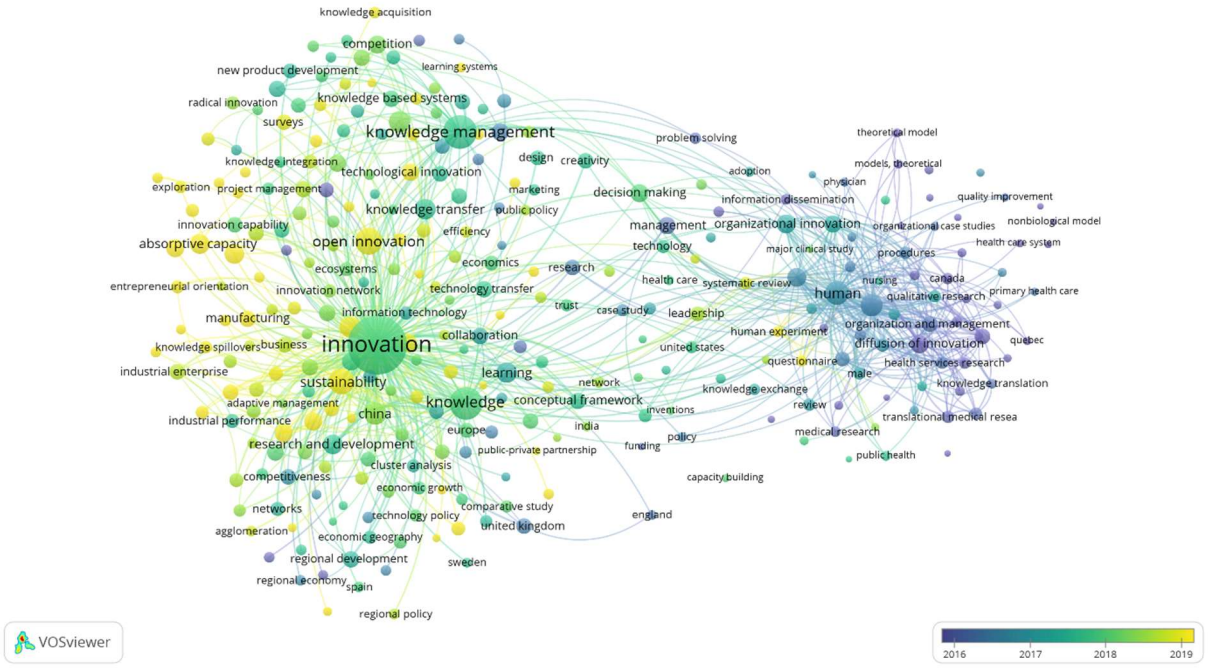
Annex

1. Annex 1. IB model

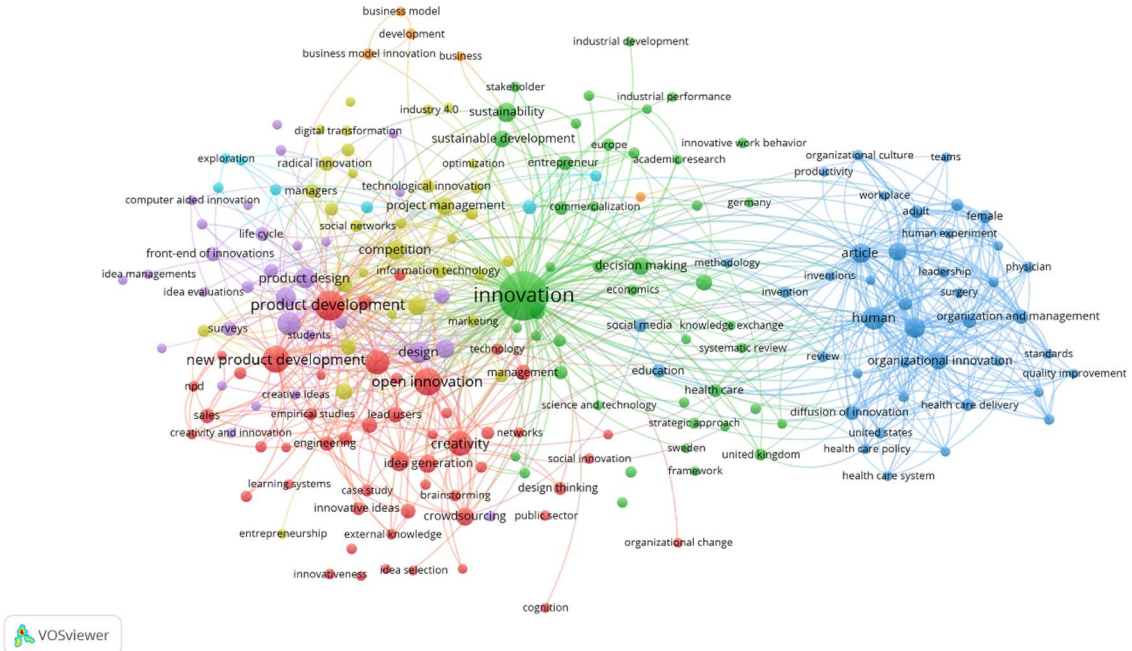


2. Annex 2. Co-occurrence maps

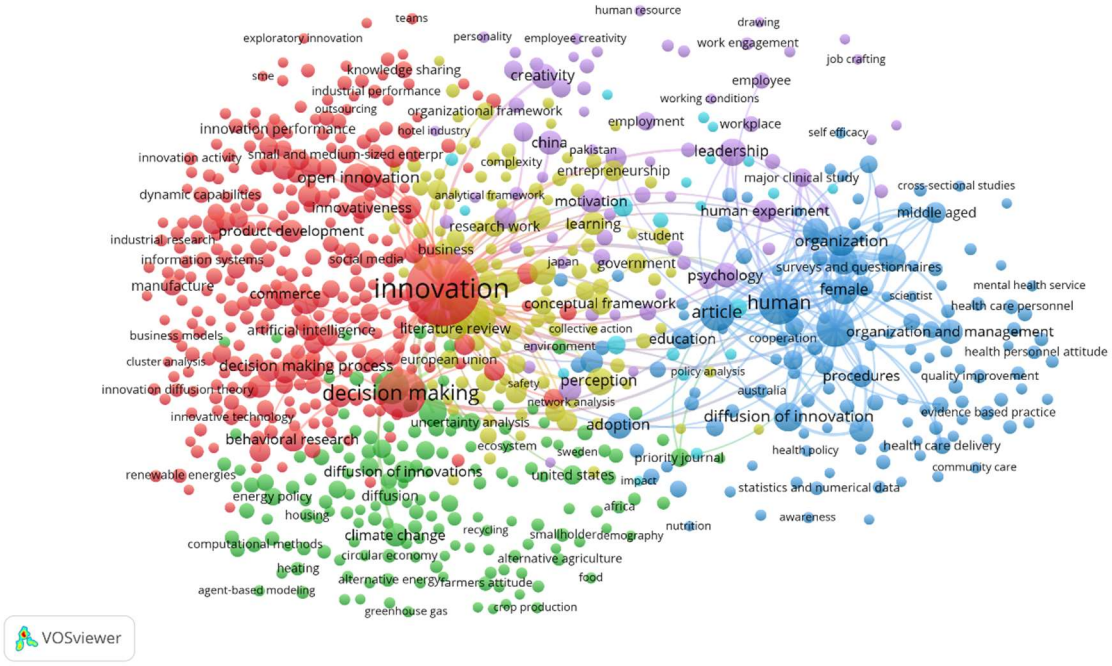
Stage 1



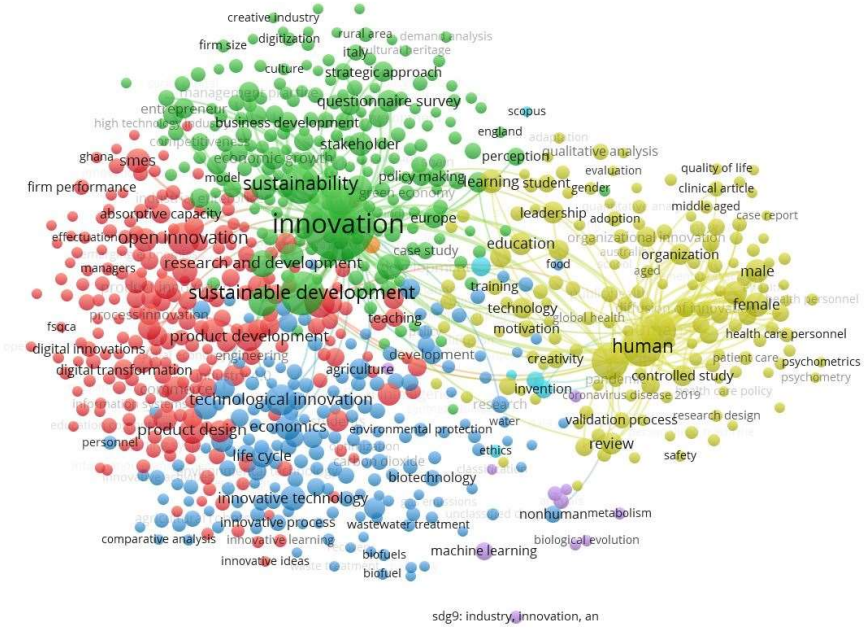
Stage 2



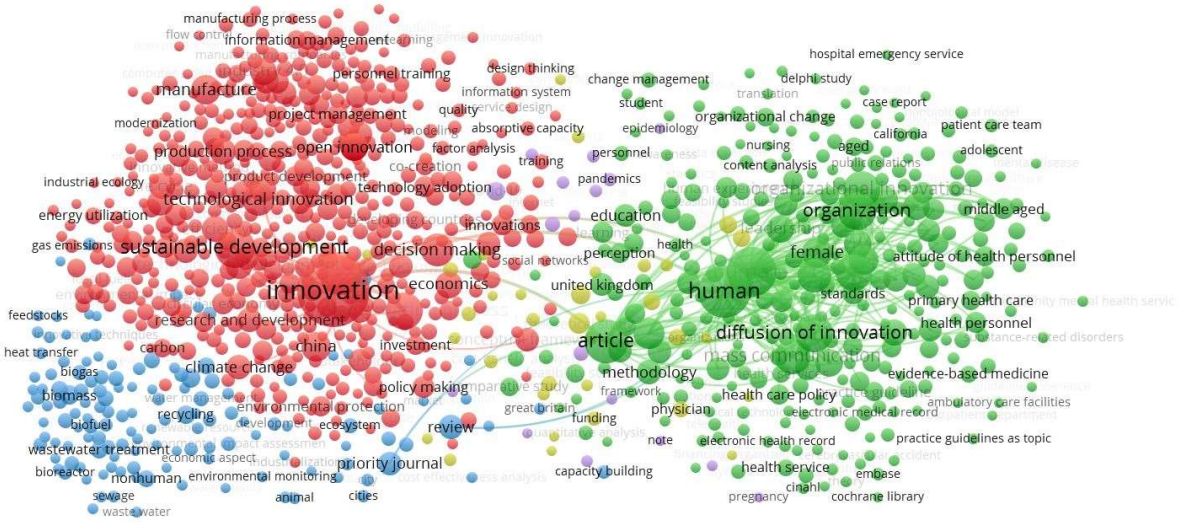
Stage 3



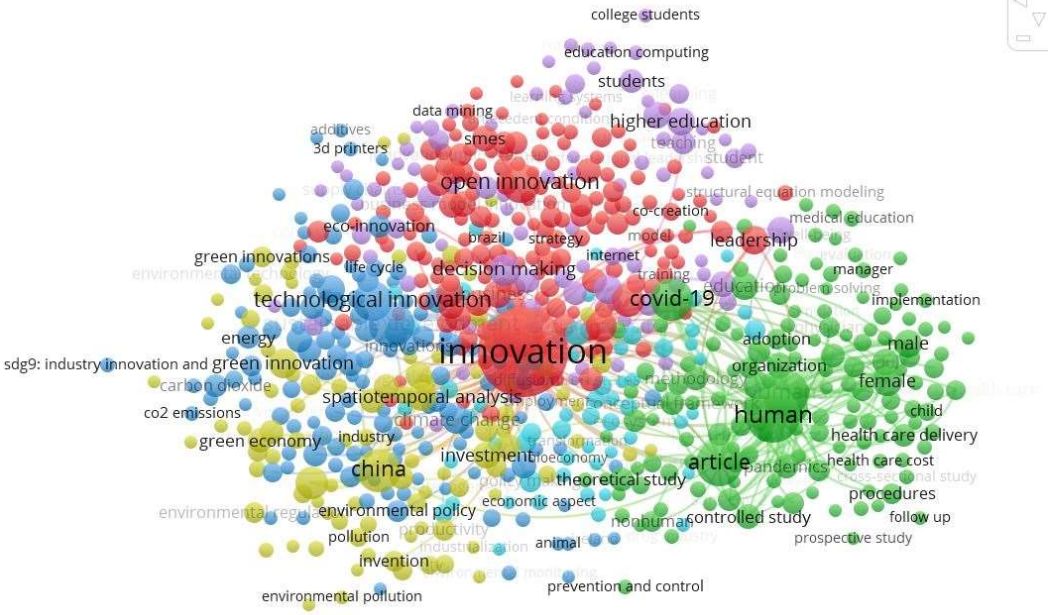
Stage 4



Stage 5



Stage 6



3. Annex 3. Theoretical individual competences for innovation

Innovation Stage:	1. Identify Opportunities		2. Create		3. Validate	
Category	**Theoretical approach Model**	**Companys approach Model**	**Theoretical approach Model**	**Companys approach Model**	**Theoretical approach Model**	**Companys approach Model**
Educational profile or studies:	Project management	Project management	Empirical studies	Technical knowledge, Technical profile	Education computing	Technical knowledge, Technical profile
	Engineering education or higher education	Sells profile	Project management studies		Educational innovation	Interdisciplinary
		Problem training, not solution training	Collaboration, teams collaboration	Teamwork	Engineering education	
		Innovation education			Project management	
		Engineering education				
Environmental/Work/Social factors that should impact:	Organizational factors: organizational innovation, organizational learning, organizational change	Team trust	Organizational factors: organizational culture, organizational innovation, organizational change		Team creativity, teamwork	Organization strategy
			Social factors: social innovation		Organizational factors: corporate entrepreneurship, organizational learning, organizational change	Market behavior and aceptance
			Networking: social networking (online), social networks		Social factors: social innovation, social influence, social change	
					Networking: social networking (online)	
Innovation stage actions required:	Planning		Planning	Action plan	Planning	Confirmation of the innovation process
	Exploration	Exploitation, new funcitonalities	Exploration: idea generation, ideation,	Exploitation, solution creation	Exploration: idea generation, ideation	Financier and Analysis study
	Exploitation	Identifing problem, exploration	Exploitation		Exploitation	
	Implementation	Planning, Prioritization, risk assessment	Idea selection		General Management: management	
	General Management: organization and management, total quality management		General Management: organization and management, total quality management		Specific Management: strategic, change, industrial, energy, human resource, risk, and technology management	
	Specific Management: enterprise resource management, human resource management, industrial management, supply chain management		Specific Management: human resource management, industrial management, enterprise resource management		Innovation management: research and development management	
	Knowledge management: information management, Knowledge transfer, Knowledge creation, Knowledge acquisition or tacit knowledge		Knowledge management: information management, Knowledge transfer, knowledge exchange		Knowledge management: information management, Knowledge transfer, knowledge exchange, knowledge acquisition	
	Innovation management		Innovation management			
	Intellectual capital					
Innovative/Entrepreneur. Behavior expected:	Innovation capability or innovativeness	Innovation capability or innovativeness	Innovation capability: innovativeness, innovative work behavior	Innovativeness	Innovation capability: innovativeness, innovative work behavior	Cocreation
	Collaborative innovation		Entrepreneurship		Collaborative innovation	
	Entrepreneurial orientation				Entrepreneurial orientation	
					Adoption of innovations	
Leadership and Manag. Skills required:	Communication	Active listening	Dynamic capabilities	Assertive communication	Prediction, expectation	Asertive communication
	Efficiency	Empatic	Leadership	Clarity	Problem solving	Strategic thinking
	Problem solving	Solution researcher, decision maker		Leadership	Efficiency	Proactive
	Risk assessment	Materialize ideas		Solution thinking	Leadership: transformational leadership, ethical leadership	
	Leadership	Communication		Agility		
	Dynamic capabilities: Capacity building or adoption	Urgency sens				
		Compromise				
		Proactive				
Psychological factors expected:	Absorptive capacity	Structurated person	Creativity	Acceptance of failure	Uncertainty	Analitic
	Creativity	Open minded	Competition	Creativity	Trust	Tidy, organiced
	Trustful	Creativity	Trust	Persistence, perseverance	Competition	
	Competition	Persistent, perseverant	Motivation		Motivation, intrinsic motivation	
	Cooperative behavior	Intelectual curiosity	Perception		Accountability	
		Abstraction capacity	Uncertainty		Adaptation, resilience	
		Patient, anxiety control			Creativity	
		Optimistic			Empowerment	
					Psychological safety	
					Risk perception: perceived risk, risk-taking	

4. Develop		5. Deploy		6. Review	
Theoretical approach Model	**Companys approach Model**	**Theoretical approach Model**	**Companys approach Model**	**Theoretical approach Model**	**Companys approach Model**
Education computing	Technical knowledge, Technical profile	Education in general	Marketing studies	Education 4.0	Customer center services studies
Educational innovation	Project Manager		Industrial engieering, Informatic engeneering	Project management	Project Manager
Engineering education	Bussiness formation				
Project management	Engineering education, Information, programmer engineering				
Higher education					
Specialization or training					
Collaboration	Stakeholder participation, clients participation	Organizational factors: efficiency organizational, organizational culture, organizational innovation	Customer center, Trust for the client, client oriented	Organizational factors: organizational innovation+organizational change+organizational learning	Client centered
Organizational factors: organizational innovation, organizational change	Teamwork	Stakeholder engagement	Marketing	Stakeholder engagement	Client relationship
Social entrepreneurship, Social innovation, Social change, Sustainable entrepreneurship		Intellectual Capital	Stakeholder participation, clients participation	Social participation, social networking	Product Marketing
Networking, social networking (online), stakeholder engagement and participation, social networking					Team compromise and engagement
Intellectual Capital					
Implementation	Exploration	Implementation	Implementation	Exploitation	Following to customer
Exploration	Strategic planification	General Management: management	Introduction process	Exploration, ideation	Exploration
Exploitation	Develop	Specific Management: financial, and change management	Training	Implementation	
General Management: management				General Management: management	
Specific Management: financial, environmental, human resource, risk, tourism and technology management				Specific Management: financial, human resource, risk, crisis, adaptative and change management	
Research and development management				Innovation management	
Knowledge management: information management, Knowledge transfer, knowledge exchange				Knowledge management, knowledge sharing, Knowledge transfer	
Innovation capability, innovativeness, innovative work behavior	Cocreation	-	Personalization focus	Entrepreneurship	Innovation capability or innovativeness
Entrepreneurial orientation				Collaboration, cocreation	
Collaborative innovation				Innovation capability, innovativeness, innovative behavior	
Communication	Effectivity	Communication	Empathy		Active listening
Strategic Planning Thinking	Assertive communication	Leadership	Solution thinking	Communication	Empathy
Leadership, transformational leadership	Efficency		Product trust	Problem solving	Product trust
Dynamic capabilities	Leadership		Communication	Leadership, transformational leadership	Care of others necesities
	Listening capacity, understanding people				Feedback acceptance capacity
	Proactive				Communication
					Proactive
Uncertainty	Detail oriented, organiced, structurated person, tidy	Awareness	Resilience	Adaptation, adoption	Patient
Absorptive capacity, awareness, adoption	Creativity	Adaptation, adoption	Responsability	Attention, awareness, absorptive capacity	Resilience, adaptative
Competition	Extroverted personality	Cooperative Behavior		Competitiveness	Visionary
Consumption behavior	Resilient	Motivation		Consumption behavior	Creativity
Creativity		Perception		Creativity	Confident or trustful person
Motivation		Responsibility		Motivation	
Perception		Satisfaction, wellbeing		Safety, Trust	
Resilience		Trust		Wellbeing	
Responsibility					
Safety, trust, empowerment					
Cooperative Behavior					

Annex 4. Exploratory multiple-case interview.

Company Name		
Interviewee		
Stage	**Category of competence**	**Ideal set of competences**
Identify Opportunities	Educational profile or studies:	
	Environmental/Work/Social factors that could impact:	
	Innovation stage actions required:	
	Innovative/Entrepreneur. Behavior expected:	
	Leadership and Manag. Skills required:	
Create Concepts	Educational profile or studies:	
	Environmental/Work/Social factors that could impact:	
	Innovation stage actions required:	
	Innovative/Entrepreneur. Behavior expected:	
	Leadership and Manag. Skills required:	
Validate Concepts	Educational profile or studies:	
	Environmental/Work/Social factors that could impact:	
	Innovation stage actions required:	
	Innovative/Entrepreneur. Behavior expected:	
	Leadership and Manag. Skills required:	
Develop	Educational profile or studies:	
	Environmental/Work/Social factors that could impact:	
	Innovation stage actions required:	
	Innovative/Entrepreneur. Behavior expected:	
	Leadership and Manag. Skills required:	
Deploy	Educational profile or studies:	
	Environmental/Work/Social factors that could impact:	
	Innovation stage actions required:	
	Innovative/Entrepreneur. Behavior expected:	
	Leadership and Manag. Skills required:	
Review	Educational profile or studies:	
	Environmental/Work/Social factors that could impact:	
	Innovation stage actions required:	
	Innovative/Entrepreneur. Behavior expected:	
	Leadership and Manag. Skills required:	
Other comments		

5. Annex 5. Study case interview

Company Name	
Interviewee	
Sector	
Employees	
Country	

Innovation process	**Definition of the stages in SMEs innovation process**				**Person in charge of each innovation stage**				
	Clearly defined (with manuals, written process or well structured)	It is realized but not defined (without manuals or instructives	Partially realized (or combined with other stages)	Not included in the process	There is a dedicated person to supervise this stage, who is different from the project manager.	The innovation manager or project manager oversees this stage.	Other option	Name of the manger, team or general supervisor of the innovation process	If there is a person in charge of different process, detail the name for each stage
Identify Opportunities									
Create Concepts									
Validate Concepts									
Develop									
Deploy									
Review									

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Résumé étendu en français

Contextualisation de la recherche

Dans la société actuelle, les entreprises ont des défis très importants à relever. La création d'opportunités ne représente pas seulement un défi en soi, mais aussi un effort important que les entreprises doivent mettre en œuvre pour les rendre durables dans un environnement dynamique (Pençe et al., 2019).

L'environnement multifactoriel de chaque entreprise est également un défi (Soltanzadeh et al., 2024). Il nécessite de prendre en compte une diversité de stratégies complexe d'un contexte organisationnel (Jackson et al., 2024). Par ailleurs, le marché compétitif dans laquelle elle évolue amène la menace constante de l'émergence d'un nouveau concurrent qui peut boulverser ce marché. Cela représente un exemple clair d'affrontement des cinq forces de Porter pour accroître sa compétitivité (Dias et al., 2023). Le compromis et l'intégration de la diversité des facteurs internes est également un élément clés à envisager. (Gehani, 2011; Wiktorsson et al., 2011; Wolf et al., 2021; Mohammad et al., 2014).

Une possibilité pour survivre dans ce contexte est l'innovation. Elle représente une clé essentielle et stratégique pour les organisations. (Rodrigues et al., 2006; Tidd et al., 2013; Wolf et al., 2021).

Toutefois, la gestion de l'innovation et de la performance n'est ni facile ni automatique (Tid et al., 2013.). En effet, elle repose sur la mise en place d'un système, de pratiques organisationnelles comme recommandé par la récente série de normes ISO ISO 56000 sur la thématique du management de l'Innovation (ISO 56000, 2020). Cette serie de normes, et notamment la norme ISO 56002 – système de management de l'Innovation, explique que le succès de l'innovation n'est pas basé sur un seul élément, mais sur la compréhension des différents aspects internes et externes de l'entreprise. Une approche conceptuelle qui intègre la complexité de ce phénomène multifactoriel est la capacité d'innovation.

L'amélioration de la capacité d'innovation de l'entreprise lui permet de développer et de coordonner le processus d'innovation et d'utiliser les inputs pour produire les outputs d'innovation (Adams et al., 2006). C'est pourquoi la capacité d'innovation et sa gestion sont devenues une priorité stratégique pour des compagnies et des institutions. La majorité des auteurs qui proposent un modèle ou une définition pour la capacité d'innovation s'accordent à dire que ce concept implique un ensemble d'éléments multifactoriels et qu'il n'est pas indépendant de la réalité du contexte de l'enterprise (Feeny et al., 2003; Francis et al., 2005; Galvez et al., 2013a; Oliveira et al., 2019; Rodrigues et al., 2006).

Toutefois, même si les études récentes sur l'innovation sont concentrées sur la création de modèles (comme l'innovation ouverte, lean, incrémental et autres…), afin d'améliorer la manière dont l'organisation met en œuvre et gère et mesure la

capacité d'innovation, peu d'entre eux étudient l'impact des facteurs liés au contexte organisationnel.

Ainsi, compte tenu de cette lacune dans la littérature et des quelques études relatives à la contextualisation de la capacité d'innovation, il devient essentiel de comprendre et de clarifier l'impact de la contextualisation sur la capacité d'innovation.

L'importance et la pertinence de la prise en compte de la contextualisation de l'innovation dans l'organisation trouvent leur origine dans la définition même de l'innovation. La norme ISO 56000 (2020) présente l'innovation comme un système qui " doit prendre en compte le contexte dans lequel il est développé ". En tant que système, certains auteurs suggèrent que l'innovation est une entité multifactorielle (Galvez et al., 2013 ; Hauge et al., 2017 ; Hou et al., 2012 ; ISO 56000, 2020), donc une visualisation globale et contextuelle est nécessaire pour comprendre l'innovation.

La capacité d'innovation est donc impactée par des facteurs contextuels (Ali et al., 2020; Voss et al., 2008), et notamment par l'impact du marché global sur l'environnement de l'organisation. La capacité d'innovation dépend donc de facteur de contingence (Damanpour, 1996; Voss et al., 2008). C'est pourquoi, dans cette thèse, une approche sectorielle a été adoptée, de façon à prendre en compte cette contextualisation de manière systématique.

La capacité à innover est également liée à des facteurs individuels, du point de vue de la personne impliquée dans l'innovation (perspective comportementale). Mais il existe peu de littérature sur les compétences individuelles, même si celles-ci sont un facteur fondamental pour trouver l'efficacité proposée dans le modèle d'innovation. Plus les compétences individuelles peuvent être améliorées, plus la capacité d'innovation peut être renforcée. (Adams et al., 2006 ; Boly et al., 2014 ; Gehani, 2011 ; Hiltunen et al., 2016).

Malgré l'importance de la perspective comportementale, il existe des lacunes et des contradictions dans les principaux modèles présents dans la littérature (Martinez et al., 2022). Ce qui met en lumière une difficulté, un modèle non uniforme ou une voie peu commune pour analyser les compétences individuelles dans le processus d'innovation, afin d'améliorer les performances en matière d'innovation.

Plus précisément, le manque d'informations sur l'impact de la contextualisation sur la capacité d'innovation, le manque de clarté des compétences essentielles pour l'innovation, et enfin le besoin de conseils pour aider à comprendre les éléments multifactoriels qui ont un impact sur la capacité d'innovation ont été identifié comme des directions de recherche nécessaires.

L'identification de ces lacunes implique que certaines pratiques relatives au recrutement, au travail en équipe, à la délégation des rôles, à la formation et aux

processus de motivation pour les processus d'innovation peuvent ne pas être ciblées et efficaces au sein des organisations.

Cette thèse de doctorat explorera la contextualisation de la capacité d'innovation des entreprises en adoptant une analyse sectorielle et comportementale dans le but de combler ces lacunes et de fournir un contexte holistique de la capacité d'innovation. Cela signifie un point de vue systématique et holistique qui intègre les aspects environnementaux et individuels de la capacité d'innovation. Un guide d'analyse de la contextualisation de la capacité d'innovation est proposé et une application spécifique au contexte des PME est réalisée.

D'autre part, une proposition de cadre de référence a été réalisée, pour la catégorisation des variables de compétences individuelle en matière d'innovation. Ce cadre fournit une catégorisation unifiée et systématique des variables essentielles pour les compétences dans le processus d'innovation.

Enfin, la contribution empirique de ce travail de recherche réside dans la création d'un guide étape par étape permettant d'analyser la contextualisation de la capacité d'innovation. Cette contribution est essentielle pour que les entreprises puissent mieux développer le savoir nécessaire pour effectuer une analyse holistique de leur capacité d'innovation. Ce guide a été testé empiriquement par une mise en œuvre opérationnelle dans le cadre d'une étude de cas multiple impliquant 6 PME en France et au Costa Rica.

Questions et objectifs de la recherche

Sur la base du contexte détaillé expliqué dans la section précédente, l'objectif principal de la recherche est considéré comme suit.

- **Lacunes dans la littérature**

L'analyse du contexte nous amène à identifier les lacunes suivantes dans la littérature :

- Il n'y a pas assez d'informations sur l'impact de la contextualisation sur la capacité d'innovation et sur la manière de l'améliorer.

- Il n'y a pas de clarté sur le chemin commun ou sur les compétences individuelles essentielles à prendre en compte d'un point de vue comportemental, pour une capacité d'innovation optimale.

- Il est nécessaire de guider les entreprises (et les PME en particulier) dans la conception de leur propre analyse de l'impact de la contextualisation sur leur capacité d'innovation, afin de les aider à acquérir des connaissances stratégiques pour l'améliorer.

- **Questions et objectifs de recherche**

Compte tenu des lacunes identifiées dans la littérature, notre question de recherche est la suivante :

> *Comment les entreprises devraient-elles améliorer leur capacité à innover en utilisant une approche comportementale et de contextualisation sectorielle ?*

Respectivement, l'objectif principal suivant est au cœur de cette thèse :

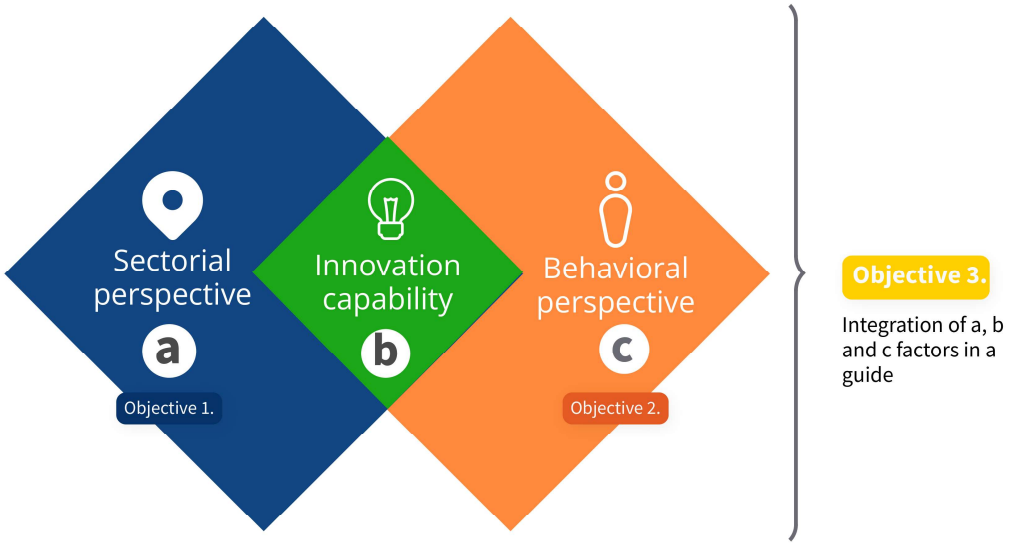
Créer un guide d'analyse de l'approche de contextualisation comportementale et sectorielle pour les entreprises, à utiliser comme aide à la décision dans l'amélioration de leur capacité d'innovation.

Cet objectif principal est subdivisé en objectifs spécifiques suivants :

> 01- Établir les facteurs et les mesures de la perspective sectorielle qui ont un impact sur la capacité d'innovation organisationnelle, en intégrant une revue systématique de la littérature.
>
> 02- Proposer un modèle de compétences individuelles pour la perspective comportementale de la capacité d'innovation organisationnelle, en intégrant une revue systématique de la littérature et une approche empirique.
>
> 03- Développer des lignes directrices d'analyse pour les entreprises, en intégrant les facteurs comportementaux et de contextualisation sectorielle proposés.
>
> 04- Le tester sur un panel de PME comme premier champ d'expérimentation dans le cadre de cette thèse.

Afin de clarifier la vue d'ensemble de ces objectifs spécifiques, chacun d'entre eux sera présenté dans les sous-sections suivantes.

Three-dimensional research approach



Note. Source : Own creation

Les trois principales dimensions à étudier dans cette thèse sont représentées : la perspective sectorielle (a), la capacité d'innovation (b) et la perspective comportementale (c).

La première (a) est la perspective sectorielle (premier objectif). Sur la base de l'objectif 1, elle devrait être étudiée afin d'identifier les éléments de la perspective sectorielle qui ont un impact sur la capacité d'innovation, et comment la mesurer.

La dimension (b) est la capacité d'innovation. Cette dimension concerne les pratiques en matière d'innovation comme base de recherche fondamentale. En effet, notre thèse s'inscrit dans une ligne de travail sur ce sujet mené par l'équipe ERPI. Ceci sera présenté dans l'état de l'art.

La dimension (c) est la perspective comportementale (deuxième objectif). Comme mentionné dans le deuxième objectif spécifique, il est nécessaire d'identifier les facteurs d'impact de la perspective comportementale. Certains concepts théoriques ont été identifiés, mais ils présentent des contradictions et des différences. La recherche a dû être approfondie car il n'y avait pas de modèle existant qui comprend tous les éléments.

Cette analyse approfondie a consisté à créer un nouveau modèle unifié des compétences essentielles à l'innovation individuelle, qui ont un impact sur la capacité à innover.

Une fois que chaque dimension et ses facteurs associés ont été étudiés, la question de leur évaluation est envisagée. Il s'agit ensuite d'intégrer toutes ces informations dans un guide pour les entreprises, comme le prévoit l'objectif spécifique n° 3. Ce guide les aidera à identifier les facteurs qui affectent leur capacité à innover et à résoudre les problèmes auxquels elles devraient être confrontées. Non seulement en termes de pratiques d'innovation interne, mais aussi en raison de l'impact des facteurs de contextualisation.

Le guide comprend un processus étape par étape pour analyser les trois dimensions proposées, les mesurer et identifier les aspects à prendre en compte pour améliorer la capacité d'innovation.

Enfin, un test est réalisé sur un échantillon de PME (objectif 4) pour aider à mettre en évidence les capacités d'innovation de ce type spécifique d'entreprise.

Résumé

Dans la société actuelle, les entreprises ont des défis très importants à relever. La création d'opportunités ne représente pas seulement un défi en soi, mais aussi un effort important que les entreprises doivent mettre en oeuvre pour les rendre durables dans un environnement dynamique (Pençe et al., 2019).

L'une des possibilités à suivre dans ce contexte est la capacité d'innovation. Celle-ci représente une clé essentielle et stratégique pour les organisations. (Rodrigues et al., 2006 ; Tidd et al, 2013 ; Wolf et al., 2021). L'amélioration de la capacité d'innovation d'une entreprise lui permet de développer et de coordonner le processus d'innovation et d'utiliser les intrants pour produire des extrants innovants (Adams et al., 2006). La majorité des auteurs qui proposent un modèle ou une définition de la capacité d'innovation s'accordent à dire que ce concept implique un ensemble d'éléments multifactoriels et qu'il n'est pas indépendant de la réalité du contexte d'innovation. (Feeny et al., 2003 ; Francis et al., 2005 ; Galvez et al., 2013a ; Oliveira et al., 2019 ; Rodrigues et al., 2006).

Cependant, même si les études récentes sur l'innovation se concentrent sur la création de modèles tels que l'innovation, ouverte, l'innovation lean, l'innovation, incrémentale et autres, afin d'améliorer la manière dont l'organisation met en œuvre, gère et mesure la capacité d'innovation, seules quelques études ont un impact sur les facteurs liés au contexte organisationnel. La capacité d'innovation est vulnérable aux facteurs contextuels et ses performances peuvent être gérées dans cet environnement (Ali et al., 2020 ; Voss et al., 2008).

La capacité à innover est également liée à des facteurs individuels, du point de vue de la personne impliquée dans l'innovation (perspective comportementale). Mais il existe peu de littérature sur les compétences individuelles, même si celles-ci sont un facteur fondamental pour trouver l'efficacité proposée dans le modèle d'innovation. Plus les compétences individuelles peuvent être améliorées, plus la capacité d'innovation peut être renforcée. (Adams et al., 2006 ; Boly et al., 2014 ; Gehani, 2011 ; Hiltunen et al., 2016). Malgré l'importance de la perspective comportementale, il existe des lacunes et des contradictions dans les principaux modèles (Martinez et al., 2022), ce qui suppose une difficulté, un modèle non uniforme ou une voie peu commune pour analyser les compétences individuelles dans le processus d'innovation, afin d'améliorer les performances en matière d'innovation. La pertinence de cette lacune implique que certaines des pratiques de recrutement, de travail en équipe, de délégation des rôles, de formation et de motivation pour les processus d'innovation peuvent être mal ciblées et inefficaces.

Cette thèse propose d'explorer la contextualisation de la capacité d'innovation des entreprises, afin de concevoir un guide intégrant l'évaluation de la dynamique d'innovation et l'analyse sectorielle et comportementale pour proposer des stratégies afin d'améliorer leur performance. Un test de notre approche est effectué au sein d'un type spécifique d'entreprises, les PME.

Mots clés: Innovation, compétences pour innover, capacité à innover, contextualisation

Abstract

Today, companies face very significant challenges. Creating opportunities is not only a challenge, but also the effort companies make to make them sufficient and sustainable in a dynamic environment (Pençe et al., 2019).

One of the opportunities to watch out for in this context is innovative capability. This is an essential and strategic key for organizations (Rodrigues et al., 2006; Tidd et al., 2013.; Wolf et al., 2021). Improving a company's innovation capability enables it to develop and coordinate the innovation process, and to use inputs to produce innovative results (Adams et al., 2006). Most authors who propose a model or definition of innovation capability agree that this concept involves a set of multifactorial elements and is not independent of the reality of the innovation context, that's why a sectorial perspective study to analyze external aspects results essential (Feeny et al., 2003; Francis et al., 2005; Galvez et al., 2013a; Oliveira et al., 2019; Rodrigues et al., 2006).

However, while recent studies on innovation focus on creating models such as open innovation, lean innovation, incremental innovation, and others to improve the way the organization implements, manages, and measures innovation capacity, only a few studies focus on factors related to the organizational context.

The innovation capability is also linked to individual factors, from the point of view of the person involved in the innovation (behavioral perspective). But there is little literature on individual competences, even though they are a fundamental factor in achieving the efficiency proposed in the innovation model. The more individual skills can be improved, the greater the capacity for innovation will be (Adams et al., 2006; Boly et al., 2014; Gehani, 2011; Hiltunen et al., 2016). Despite the importance of the behavioral perspective, there are gaps and contradictions in the main models (Martinez et al., 2022), implying a difficulty, an inconsistent model, or an uncommon path to analyze individual competences in the innovation process, in order to improve innovation performance. The relevance of this gap implies that some of the recruitment, teamwork, delegation role, training and motivation practices for innovation processes may be poorly targeted and so ineffective.

This thesis proposes to explore the contextualization of the innovation capability of companies, in order to design a guide integrating the evaluation of the innovation dynamic and sectorial and behavioral analysis to propose strategies in order to improve their performance. A test of our approach is done within a specific type of companies, the SMEs.

Keywords: Innovation, competencies to innovate, innovation capability, innovation context.