Determinant factors of innovation management in the manufacturing industry of Pichincha, Ecuador

Juan Ibujés-Villacís[1*], *Antonio Franco-Crespo*[1]

Abstract

A permanent challenge for business organizations is to transform, adapt to the environment and innovate, so knowing the factors that influence the ability to innovate is relevant information. In this sense, the objective of this article is to determine and conceptualize the decisive factors that interact in a systemic way in the management of innovation in the manufacturing industry. The research has a qualitative approach, with a descriptive and transversal scope. In the first place, a review of the literature was carried out that allowed delimiting the management of innovation in the company in three main categories. Second, the categories were characterized, and subcategories and properties were identified, taking the manufacturing companies of Pichincha, Ecuador as the subject of study. This characterization was carried out through a qualitative study that takes the Grounded Theory as a reference, using research techniques: questionnaires, interviews, and documentary research. The results reveal that the relevant factors for the management of innovation in the company can be grouped into three main categories: knowledge management (KM), innovation capabilities (IC) and financial performance (FP). The subcategories that explain KM are policies and strategies, organizational structure, technology, people, incentive systems, organizational culture, and communication. The subcategories that explain IC are research and development capacity, management capacity, resource availability, human talent management, staff skills and technological capacity. The subcategories that explain the FP are sales and costs. This research contributes to the field of innovation management with new information and theory for action and emphasizes the systemic vision of innovation management and the key factors for the development of innovations in the Ecuadorian industrial sector, with the purpose of strengthening the theoretical and empirical advances of innovation management in the company.

Keywords: financial performance; innovation capabilities; knowledge management; manufacturing industry

Submitted: September 14th, 2021 / Approved: January 17th, 2022

Introduction

From the 1970s to the present day, a new logic of accumulation has emerged in the capitalist mode of production; this logic has to do with changes in value creation (Bettiol *et al.*, 2020; Concilio et al., 2019). In the field of business management, these variations have ranged from a mass reproduction of low differentiation goods to a regime progressively inclined towards product innovation, in which a new role emerges for knowledge and innovation in the processes of the addition of value (Baumgarten & Ivanochko, 2021; Kodama, 2018; Syed *et al.*, 2018).

With globalization and digitization, public institutions and non-governmental organizations have realized that maintaining competitive advantage or achieving objectives requires taking advantage of all the creative potential and knowledge of all members of the organization (Rip, 2018; Saulais & Ermine, 2019). This new reality has caused the management of the business ecosystem to be increasingly systemic, since it has been transformed from an environment dominated fundamentally by resource management, to another in which the management of capabilities related to the creation, capture, exchange and use of knowledge, and which, in turn, interact internally and with the organizational environment (García, 2019; Hacker, 2017; Helms *et al.,* 2017). In this new ecosystem, one of the issues of business organizations is the lack of knowledge of the most important factors that must be present to innovate. These concerns are related to the lack of knowledge regarding the variables of the organizational dimensions, which are essential when making innovations, variables that depend on the economic sector and the size of the analyzed company (Melendez *et al.*, 2019).

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Therefore, this research aims to determine and conceptualize the essential factors that interact systemically in the management of innovation in the manufacturing industry. For purposes of better understanding, these factors have been grouped around three main categories: knowledge management (KM), innovation capabilities (IC) and financial performance (FP). To achieve this goal, in a first phase of the investigation, a review of the literature is carried out; then, in a second phase, a qualitative study on manufacturing companies is fulfilled to contrast theoretical advances and formulate those new specific factors and properties that are part of the innovation management of this type of industry.

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In Ecuador, the indicators show that the problem of lack of innovation persists in the business ecosystem (Cornell University et al., 2020); For this reason, innovation is a corporate phenomenon that requires intense study. There are few studies on the management of innovation in the Ecuadorian industry (Quintero Sepúlveda et al., 2021). This article contributes with a new theory for action based on the empirical study carried out on manufacturing companies, which represent 26% of innovative companies in the country (SENESCYT-INEC, 2015).

This article has a first phase, in which a review of the literature and a deductive categorization are carried out on three constructs: KM, IC and FP, and their relevant factors. In a second phase, a qualitative study is fulfilled on the manufacturing companies of Pichincha, in which data is collected, coded, and interpreted inductively on the business practices related to these constructs or categories. In a third part, the theoretical advances are compared with the results of the qualitative study, the results are discussed, and the conclusions are drawn.

Theoretical elements

The systemic organization

The closest conceptualization to reality, to describe what today's organizations face —complexity, constant change and uncertainty— is the organization as a system (Kast y Rosenzweig, 1972). Bertalanffy (1968) proposed the system as a complex of reciprocally interacting elements, where "dynamic interaction" is the basic problem of all fields of science. This proposal has been the starting point to address the systemic organization and at the same time has allowed a more holistic view of organizations in the field of social sciences.

From the theory of complexity, the management of organizations as a complex system is understood as a regulation mechanism that allows the development of plans that guide action in pursuit of specific objectives within a certain period, and that these in turn can be permanently monitored (Hernández et al., 2007). According to these authors, the management of an organization cannot be treated as the execution of plans and activities to separately achieve the solution of an individual problem; but the management of a complex system such as the organization implies the management of a set of problems in which the different interactions of internal and external elements influence at the same time as cause and effect, indistinctly.

Regarding innovation management, the set of factors that contribute to the development of technological innovation processes in organizations must be understood as variables of the different dimensions of the organization, which interact in a broader system, which becomes more complex as measure that places the organization within a social, economic and political environment (Ortiz y Zapata, 2006). Consequently, many of these variables will be cause and effect at the same time, without the possibility of accurately determining their role.

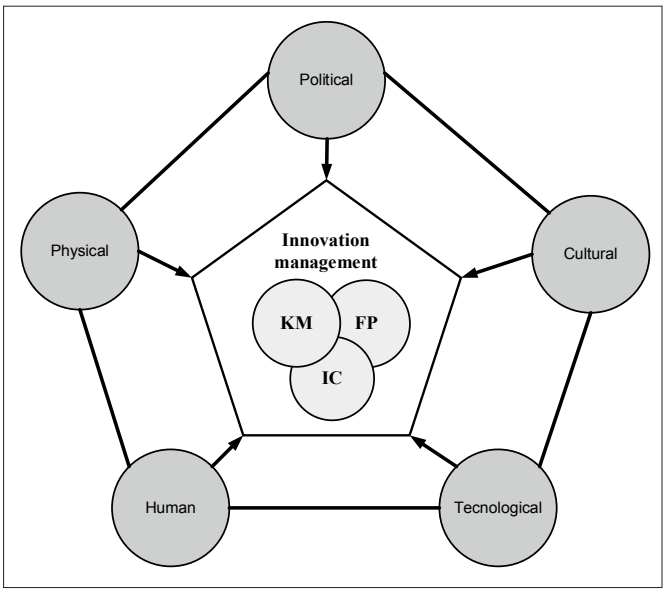
The organizational dimensions

When referring to the internal components of organizations, Matos Martins (2011) mentions that the organizational space is multidimensional, made up of five dimensions: material or physical, human or people, technological or processes, politics or power, and the symbolic or cultural. These dimensions focus the management of organizations from a different slant, which allows organizational analysis from the complexity and synergistic capacity.

If we consider business organizations as multidimensional systems focused on innovation, with a constant relationship with their complex and changing environment (Kodama, 2018; Singh et al., 2020), then it is required that each of the variables of those organizational dimensions adapt to both internal changes and those of their environment (Camarena-Martínez, 2016).

It is appropriate to mention that innovation processes are not only the product of the internal management of organizations, but also of management that considers the environment, that takes into account those factors that are related to legal, economic, environmental, social and economic policies (Espindola & Wright, 2021). The interactions of all these combined factors can set up an environment of advantages or barriers in the innovation processes of organizations (Farhana & Swietlicki, 2020). Figure 1 outlines this consideration, it shows that innovation management is the result of the systemic and synergistic interaction of the qualitative and quantitative variables of each of the dimensions of the organizational space.

Figure 1. Diagram of innovation management in companies.



Source: adapted from (Matos Martins, 2011).

This scheme is based on organizing the variables of the dimensions of the organizational space into main categories, or constructs, to facilitate the understanding of how organizations create or modify their products and processes, since, as the complexity of the organization intensifies, management of organizations, it is required to understand the behavior and interaction of the variables of the organizational space in superior structures of analysis as constructs. The main categories that are part of the proposed scheme are knowledge management (KM), innovation capabilities (IC) and financial performance

(FP). These categories represent one of the possibilities of innovation management in business organizations, whose approaches related to the context of innovation in organizations are summarized below.

Knowledge management

For many authors, knowledge is treated as an object with attributes and properties, as well as a process that articulates a set of cognitive activities that individuals or organizations carry out in order to create value (Davenport & Prusak, 1998; Saulais & Ermine, 2019), and as a tangible or intangible resource that facilitates decision-making (North & Kumta, 2018; Weed-Schertzer, 2020), among other definitions.

Value in organizations is recognized as the main purpose of a business model, which, when examined through different theoretical lenses, represents: marketing (value for the customer); economics (profits and margins); strategy (competitiveness); organization (organizational efficiency), entrepreneurship (innovation) and an institutional lens (the efficiency of the market structure) (Andreini & Bettinelli, 2017).

In the field of organizational management, there is practically a consensus that the strategically most important resource of organizations is knowledge (Bolisani & Bratianu, 2018b; Davila et al., 2019; Kesavan, 2021; North & Kumta, 2018); therefore, knowledge management is one of the most important organizational capabilities of organizations, since it is key to business growth and the strength of profitability in the 21st century (Manning & Manning, 2020), as well as to improve efficiency and to innovate (Newell, 2015).

KM is multidimensional. On the one hand, in the static dimension, the organization proposes to maintain, replicate and exploit the available knowledge as an internal capacity of the organization through the exploitation of internal human talent and the use of its technological infrastructure, basically (Endres, 2018; Kaur, 2019). On the other hand, in the dynamic dimension, the organization executes a set of activities such as acquiring, converting, and applying the knowledge that arises outside the company. These activities allow the organization's competencies to be continuously adapted to deal with changes in the environment (Kodama, 2018; Singh et al., 2020).

Innovation capabilities

If innovation is becoming a survival condition for business organizations, then the growing importance of what is called innovation capabilities is justified (Kaur, 2019; Nakamori, 2020). Since innovation takes place in changing environments, with rapid technological advances and intense competition, companies have been forced to adopt non-traditional techniques and tools to remain competitive (Endres, 2018).

For this reason, companies require new and dynamic capabilities integrated into knowledge processes, such as accumulation, acquisition, integration, use, reconfiguration and transformation (Bykova & Jardon, 2018; Kodama, 2018; Piening & Salge, 2015), which overcome daily rigidities and allow new organizational routines to be acquired, integrated and recombined to generate novel value creation strategies (Bettiol et al., 2020; Ermine, 2018; North & Kumta, 2018; Singh et al., 2020).

These capabilities represent the exploitation of the potentiality of organizational knowledge, requires companies to introduce planned strategies for the collection, systematic documentation of ideas, contributions from their employees and corporate experience. In any case, developing ICs aims to create and strengthen new intra- and inter-organizational learning systems (Bogodistov et al., 2017; Bykova & Jardon, 2018; Kodama, 2018; Newell, 2015; Piening & Salge, 2015).

Financial performance

One of the constant concerns of business organizations is to evaluate the results with respect to the resources that companies allocate to innovation activities and analyze the level of effectiveness and efficiency of their use (Bykova & Jardon, 2018; OECD & Eurostat, 2018; Singh et al., 2020). Therefore, evaluating the effects that KM and ICs have on product quality, customer satisfaction or financial performance is one of the constant concerns of business organizations (Chen et al., 2018; Zaim et al., 2019).

For some authors, innovative organizations should not only settle for obtaining good results by doing the right thing, but should focus on all parts of the organization, optimizing the use and effectiveness of all its resources and capabilities, in such a way that it is possible to survive in a competitive environment and perform excellently (Manning & Manning, 2020).

Methodology

This research, which has a qualitative approach, is divided into three phases. In the first phase, a review of the literature on innovation management in business organizations was carried out, in which KM, IC, and FP were identified as the main categories associated with business management. In a second stage, a qualitative study was carried out that takes the Grounded Theory as a reference (Corbin & Strauss, 2015; Glaser & Strauss, 2006), in order to determine and conceptualize the subcategories and properties of the main categories that manufacturing companies recognize as relevant. Finally, in a third phase, the results were systematized through an innovation management model for the company.

First phase. Literature review

A review of the literature was carried out to know the state of the situation on the factors related to KM, IC, and FP in business organizations. Publications indexed to the main scientific databases such as Scopus, Web of Science, Latindex, SciELO, RedALyC, among others, were reviewed. Consultation terms such as: knowledge management, innovation capabilities and financial performance, knowledge management and innovation, knowledge management and financial performance, knowledge management and innovation capabilities were used. The time horizon chosen for the publications was from 2015 to 2021, except for those relevant publications in the field of knowledge.

From the bibliographic population, 90 articles were chosen, of which 44 were related to KM, 25 to IC and 11 to FP. From the analysis of these articles, the relevant factors of KM, IC and FP in business organizations were determined.

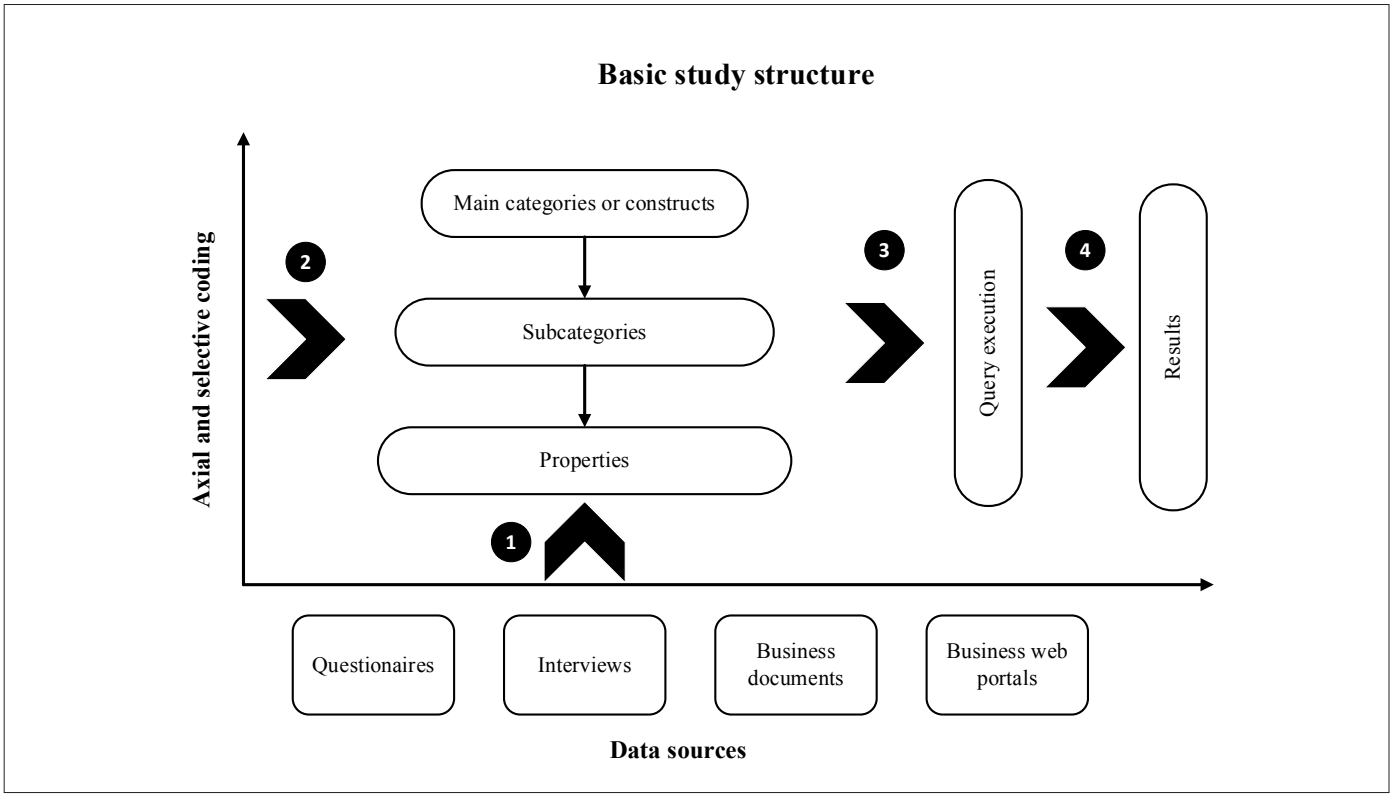
Second phase. Qualitative study

The qualitative study aims to determine which subcategories and properties of KM, IC and FP coexist in the management of manufacturing companies, based on the description of the meanings and actions carried out by their individuals. To carry out the study, the structure of the study was initially proposed, then the data sources were determined, and finally, through coding and consultation, it was possible to identify the subcategories and properties of the main categories: KM, IC, and FP.

This study has the Grounded Theory as reference, which is a research methodology in which the theory emerges from the data and uses a series of procedures that, through induction, generate an explanatory theory of a certain phenomenon studied (Glaser & Strauss, 2006). This methodology is well known and widely used in many qualitative research studies (Chun Tie *et al.*, 2019).

Structure of the qualitative study. The structure of the qualitative study was carried out through four procedures that respond to the application of the Grounded Theory methodology, as shown in figure 2; These are: choice of data sources, axial and selective coding, query execution and result finding.

Figure 2: Structure of the qualitative study.



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Data sources. The subject of the qualitative study are the companies of the manufacturing economic sector. This economic sector was chosen since its contribution of 14.2% to the total production of Ecuador makes it the largest contributor to the country's economy (Ministerio de Producción, 2021). According to the latest national innovation survey, this economic sector allocated 85.06 million dollars in research and development (R&D), which represents 44.65% of the total expenditure on these activities at the national level, ranking in the first place ahead of sectors such as services, commerce and mining (SENESCYT-INEC, 2015).

For the study, the medium-sized manufacturing companies of the province of Pichincha were chosen, whose administrative capital, Quito, is also the capital of Ecuador. This province generated the highest income in manufacturing activities between 2013 and 2017, reaching an average of 41.8% participation in sales nationwide (SUPERCIAS, 2018).

The data sources correspond to a triangulation of the data obtained through the application of research techniques used in qualitative studies such as questionnaires, semi-structured in-depth interviews and

documentary research in business documents and internet portals. In this initial stage of the study, triangulation —which is a strategy to improve the validity of the results (Flick, 2018; Taylor *et al.*, 2016)— made it possible to guarantee an important critical mass of data for the coding process.

For the application of the research techniques to the companies, a non-probabilistic process was carried out (for convenience), so a group of companies that had been in operation for at least five years was chosen. The selection criteria were established as the companies that are best located in the 2019 business ranking of the Superintendence of Companies, Securities and Insurance, considering the following empirical evidence: business organizations that apply knowledge management obtain better results (Abuaddous & Al Sokkar, 2018; Bykova & Jardon, 2018; Chang *et al.*, 2017; Davila *et al.*, 2019; Durmic, 2017; Maduekwe & Kamala, 2016; Roldán et al., 2018; Singh *et al.*, 2020; Zaim *et al.*, 2019). The manufacturing companies studied belong to different economic activities, as shown in table 1.

Table 1: Interviewed companies by economic activity.

Division	Economic activity	Quantity
C10	Manufacture of food products	3
C11	Manufacture of beverages	2
C13	Manufacture of textiles	1
C14	Manufacture of wearing apparel	2
C17	Manufacture of paper and paper products	1
C18	Printing and reproduction of recorded media	2
C20	Manufacture of chemical and chemical products	5
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	1
C22	Manufacture of rubber and plastic products	1
C23	Manufacture of other non-metallic mineral products	1
C24	Manufacture of basic metals	2
C25	Manufacture of fabricated metal products	5
C27	Manufacture of electrical equipment	2
C28	Manufacture of machinery and equipment	3
C29	Manufacture of motor vehicles, trailers, and semi-trailers	2
C30	Manufacture of other transport equipment	2
C33	Repair and installation of machinery and equipment	6
	Total	**41**

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The data was collected through a semi-open questionnaire with the application of research techniques such as interviews supplemented with questionnaires to the directors of the chosen companies. Among the positions of the directors who participated in the study were administrative managers, technical managers, sales directors, marketing coordinators, purchasing directors, project directors, planning directors, among others. All participants had an average of three years of experience in their positions. The questionnaires were carried out through a Google form and the interviews through the videoconference application with the Zoom software, from November 2020 to February 2021. Each interview lasted approximately 50 minutes.

The questionnaire used is made up of a set of questions referring to the main constructs or categories obtained from the literature review. The structure of the questionnaire shown in Appendix 1 has nine questions for the KM, eight questions for the IC and three questions for the FP. While the interviews were carried out, documentary information was received from secondary sources, such as web portals and documents received by email. This information was obtained mainly from the mission, vision, strategic objectives, organizational culture, plans and management systems of the companies under study.

Coding and query of data. Once the data from the different sources was obtained, the axial and selective coding was carried out following the methodology of the Grounded Theory. Coding is the analytical process by which concepts are identified and the subcategories, properties, and dimensions of the main categories are discovered in the data (Chun Tie *et al.*, 2019; Corbin & Strauss, 2015; Ghodoosi et al., 2021). For the cited authors, the concepts are fundamental foundations of the theory, the categories are concepts that represent the central ideas of the data, the subcategories are concepts that belong to a category that give it additional clarity and specificity, and the properties are characteristics of a category, whose delineation defines it and gives it meaning.

In this research, the starting point was the axial coding around the constructs or categories found in the literature review. This coding made it possible to relate the categories and link each category with the subcategories in terms of their properties. It was then selectively codified, a process that consisted of integrating and refining the theory supported by memorandums, notes, diagrams, and matrices that made it possible to demonstrate the depth and complexity of the concepts of the main categories. Open coding was not carried out at the beginning of the coding process, since a literature review was previously carried out that allowed determining the main constructs or categories such as KM, IC and FP associated with innovation management in business organizations.

Due to the large amount of data obtained from the different sources of information and the ease and efficiency in the coding and analysis process provided by the computer, the Nvivo software was used (O'neill *et al.*, 2018; QSR, 2019). The use of the software was carried out in accordance with the literature regarding the application of qualitative methodology in scientific research (Creswell & Creswell, 2018; Lune & Berg, 2017).

As the data was coded according to criteria such as relevance, exclusivity, complementarity, specificity, and exhaustiveness, the amount of relevant information stabilized at what is called the theoretical saturation point (Creswell & Creswell, 2018; Glaser & Strauss, 2006). The visual summaries and queries of data in tables, graphs and diagrams generated within the software's database made it possible to detect patterns, establish relationships between data and facilitate the presentation of results.

Results

The results of the research have been divided into two parts: the first shows the scope of the literature review, and the second describes the implications of the qualitative study carried out on manufacturing companies.

Literature review results

The results of the literature review reveal that the relevant factors for the management of innovation in the company can be grouped into three main categories: knowledge management, innovation capabilities and financial performance. Theoretical advances reveal that each of these categories are explained by subcategories, as detailed in the following paragraphs.

Category 1: Knowledge management. If the main purpose of knowledge management is the creation of value through innovation (Espindola & Wright, 2021; Manning & Manning, 2020; Newell, 2015; Obeidat et al., 2016), then KM in companies is geared towards production (physical transformation of inputs into outputs), mainly because this is the most important and complex matter of value creation. Table 2 describes the most relevant factors related to CG according to the literature review. Table 2: knowledge management factors.

Table 2: knowledge management factors.

Knowledge management		
Factor	**Main idea**	**Supported by**
People	The human dimension is a substantial element for creating knowledge and adding value to business organizations. The exchange and dissemination of knowledge implies an intentional action on the part of individuals towards the organization.	(Papa et al., 2018). (Chouikha, 2016). (Edwards, 2015). (Sedighi et al., 2015). (Nonaka, 1994). (Nonaka & Takeuchi, 1995). (Medina Nogueira et al., 2019).
Incentive systems	Incentive systems and personnel policy elements represent tools that are favorable for knowledge management, thus maximizing the intellectual capital of the staff and the company.	(Papa et al., 2018). (Chouikha, 2016). (Sedighi et al., 2015). (Marulanda et al., 2016). (Hacker, 2017).
Organizational culture	Having an organizational culture focused on the culture of knowledge that creates and exchanges knowledge within the organization allows for common expectations, shared experiences, and social norms, which shape attitudes and behaviors.	(Calvo, 2018). (Edwards, 2015). (Sedighi et al., 2015). (Durmic, 2017). (Hacker, 2017). (Medina Nogueira et al., 2019). (North & Kumta, 2018).
Technology	Technological tools must have useful functions, and users in the organization perceive them as such. As companies become more dependent on technology, they store knowledge in different ways that they will become more dependent on in their growth and development.	(Chouikha, 2016). (Edwards, 2015). (Sedighi et al., 2015). (Durmic, 2017). (Newell, 2015). (Helms et al., 2017). (Hacker, 2017).

Policies and strategies	The policies and business strategies planned and executed by the managers of the organizations must be on the corporate level, since they promote an organizational climate with the aim of promoting efficient processes and activities of creation, application, knowledge exchange and memorization.	(Edwards, 2015). (Sedighi et al., 2015). (Marulanda et al., 2016). (Helms et al., 2017). (Osorno Balbín et al., 2016). (Hacker, 2017). (Kim et al., 2018) (Agudelo & Valencia, 2018). (Bolisani & Bratianu, 2018a). (Hock-Doepgen et al., 2021). (North & Kumta, 2018).
Knowledge processes	The knowledge processes help to have a dynamic organizational capacity and support all the processes of the organization, which allow to identify, generate, acquire, encode, store, share, distribute and apply organizational knowledge.	(Edwards, 2015). (Sedighi et al., 2015). (Marulanda et al., 2016). (Durmic, 2017). (Handzic & Durmic, 2015). (OECD & Eurostat, 2018). (Hacker, 2017). (Medina Nogueira et al., 2019). (Agudelo & Valencia, 2018). (Ermine, 2018). (Zaim et al., 2019). (North & Kumta, 2018).
Organizational structure	The organizational structure as an internal capacity has several structural characteristics that favor or limit the creation and sharing of knowledge. The number of hierarchical levels, autonomy, interdependence of tasks, work processes, size and professional characteristics are important components.	(Chouikha, 2016). (Sedighi et al., 2015). (Marulanda et al., 2016). (Hacker, 2017). (Bolisani & Bratianu, 2018a). (Ermine, 2018). (North & Kumta, 2018).
Communication	Communication has a positive social relationship with the success of a project, it is an essential attribute in the transfer of knowledge and occurs with oral communication and the use of body language. Explicit and tacit knowledge is built and negotiated through social interactions, which can be formal and informal in the organization.	(Nonaka, 1994). (Nonaka & Takeuchi, 1995). (Polanyi, 1966). (Erdil et al., 2018). (Hacker, 2017).

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From the literature review, it is evident that the main category, or construct, called knowledge management is represented by eight factors or subcategories: people, incentive system, organizational culture, technology, policies and strategies, knowledge processes, organizational structure, and communication.

Category 2: Innovation capabilities. Knowing the capabilities that companies have is of vital importance to determine if they are innovative. Table 3 describes the most relevant factors related to IC according to the literature review.

Table 3: Innovation capability factors.

Innovation capabilities		
Factor	**Main idea**	**Supported by**
Resources	Companies with tangible and intangible resources improve their capacity for innovation and are intended to strengthen the execution of all innovation activities. Intangible resources that contribute to profitability are part of the intellectual capital of companies.	(Del Carpio Gallegos & Miralles, 2019). (Tello, 2017). (OECD & Eurostat, 2018). (Qian & Wang, 2017). (Marulanda et al., 2016). (Papa et al., 2018). (Laudon & Laudon, 2020). (Kim et al., 2018).
Management capability	Management capability influences the ability of an organization to undertake innovation activities, introduce significant changes, modify functions and processes, and establish synergistic relationships with the environment to generate innovation results.	(Del Carpio Gallegos & Miralles, 2019). (Tello, 2017). (OECD & Eurostat, 2018). (Musiolik et al., 2018). (Bourke & Roper, 2017). (Kim et al., 2018). (Qian & Wang, 2017). (Piening & Salge, 2015). (Cepeda-Carrion et al., 2017). (Marulanda et al., 2016). (Papa et al., 2018). (Pingali et al., 2017).
Staff skills	Data on workforce skills is important to analyze the role of labor markets, education, and human talent for innovation. Staff skills are part of the human capital of companies.	(Del Carpio Gallegos & Miralles, 2019). (Tello, 2017). (OECD & Eurostat, 2018). (Qian & Wang, 2017). (Piening & Salge, 2015). (Marulanda et al., 2016). (Papa et al., 2018). (Pingali et al., 2017). (Bogodistov et al., 2017).
Talent management	The knowledge base of a company resides in its people, so human dimension management practices influence a company's ability to benefit from the creative potential and skills of its workforce to develop innovations.	(Del Carpio Gallegos & Miralles, 2019). (OECD & Eurostat, 2018). (Piening & Salge, 2015). (Marulanda et al., 2016). (Papa et al., 2018). (Laudon & Laudon, 2020). (Pingali et al., 2017). (Bogodistov et al., 2017).
Technology capabilities	Technological capabilities internally contribute to significant change in the organization, easing the learning process of new tasks and skills of the staff. Externally, they support the creation of new markets and opportunities for innovation.	(Del Carpio Gallegos & Miralles, 2019). (Tello, 2017). (OECD & Eurostat, 2018). (Qian & Wang, 2017). (Piening & Salge, 2015). (Papa et al., 2018). (Laudon & Laudon, 2020). (Bogodistov et al., 2017).

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From the review of the literature, it is evident that the main category called IC is made up of five factors or subcategories: resources, management capacity, staff skills, human talent management and technological capabilities.

Category 3: Financial performance. Table 4 describes the most relevant factors related to corporate performance focused on financial results, according to the literature review.

Table 4: Financial performance factors.

Financial performance		
Factor	**Main Idea**	**Supported by**
Sales	The volume of sales is a quantitative indicator that reflects the results of business management considering the contribution of the KM and IC. In the first part of the study, it is important to know if the existence of the relationship is perceived, to quantify it in the second part and verify the fulfillment of the innovation objectives.	(OECD & Eurostat, 2018). (Bortagaray & De Montevideo, 2016). (Maduekwe & Kamala, 2016). (Piening & Salge, 2015). (Abuaddous & Al Sokkar, 2018). (Piening & Salge, 2015).
Costs	It is relevant to determine whether the KM and ICs of the companies led, directly or indirectly, to a reduction in operating costs (per unit of production or per operation). Innovations that improve efficiency should result in lower costs in the production process.	(Li et al., 2019). (OECD & Eurostat, 2018). (Bortagaray & De Montevideo, 2016). (Maduekwe & Kamala, 2016). (Piening & Salge, 2015). (Abuaddous & Al Sokkar, 2018). (Piening & Salge, 2015).

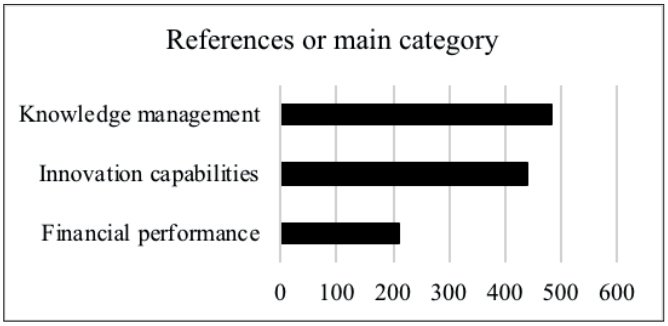
Prepared by the authors.

As a result, it is determined that the main category called FP is signified by two factors or subcategories: sales and costs.

Results of the qualitative study

This study used the Grounded Theory methodology to analyze and generate theory about innovation management. This resulting theory consists of generating or finding one of the possible explanatory models of innovation management. As a result of the application of selective coding, three main categories were identified: KM, IC, and FP; these categories, with the number of references obtained from the coding of interviews, forms, and company documentation, are shown in figure 3.

Figure 3: Main categories with their coded references.



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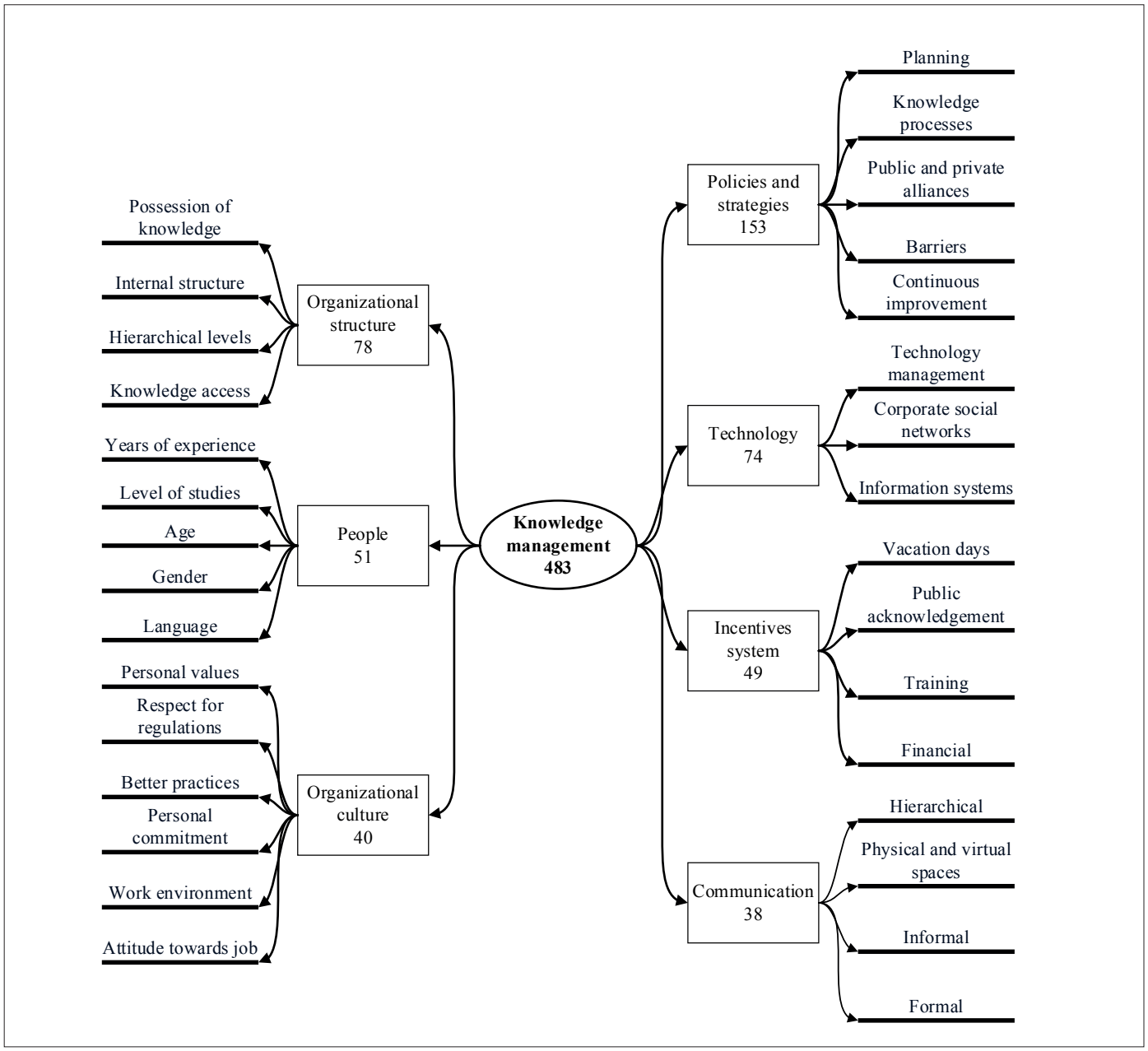
After identifying the main categories, the subcategories that are related to KM, IC and FP were obtained through axial coding, in which the subcategories were ranked and grouped with their respective properties around the main categories.

Subcategories and properties of knowledge management. Figure 4 shows graphically the result of the analysis and the development of the KM together with its seven subcategories and properties; the number of references found in the coding for the subcategories is included.

Figure 4: Map of subcategories and properties of knowledge management.



Note: Subcategories in rectangles and properties in thick lines.
Prepared by the authors.

According to Figure 4, KM can be explained by the subcategories: Policies and strategies, Organizational structure, Technology, People, Incentive systems, Organizational culture, and Communication. In turn, each subcategory can be determined by its properties, which are detailed below along with a sample of the information obtained from the participants.

Policies and strategies. It was determined that business policies and strategies are described by the planning of programs and projects focused on access, sharing and use of knowledge, the intensity with which knowledge processes are executed, the ability to make alliances with public and private institutions to develop new knowledge, the identification and mitigation of the barriers that impede the access and use of knowledge, and the promotion of continuous improvement in activities of creation, accumulation, application and exchange of organizational knowledge.

Opinions such as those of participant 6 contributed to this subcategory: "*here are political barriers for the manufacturing sector that have prevented carrying out investment projects and not accessing new manufacturing technologies*", and those of participant 22: "*Every year we carry out a strategic planning , with metrics, measured and quantified objectives; By having a management system, continuous improvement is permanent, due to it, processes, products and services are constantly updated*".

Organizational structure. The organizational structure favors or limits the creation, sharing and use of organizational knowledge, so there are properties on which it depends, such as: the equitable possession of knowledge, the flexibility of the structure to share knowledge, the hierarchical levels of management and the equal access to knowledge of all company structures.

When referring to the application limitations of KM, participant 34 mentions: "*A limitation for knowledge management is when the organizational structure is too large for the line of business, because bureaucratic processes hinder the processes. Knowledge management has to be reflected throughout a process map*"; on the other hand, participant 1 mentions: "*The highly hierarchical organizational structure does not allow free interaction between the operational and administrative levels*".

Technology. Technology focused on knowledge management requires companies to manage technology, specifically information and communication technologies with high priority; in addition, that they use information systems and corporate social networks to access, share, use and preserve organizational knowledge.

Regarding this subcategory, participant 13 mentions: "*The usefulness of ICTs today is of great benefit, since it improves the speed of internal communication, strengthens teamwork, there is greater cohesion among staff, and increases interest and motivation for work*". For participant 29: "*Today the most important thing for sales is social networks*".

People. The human dimension contributes to knowledge management according to a set of properties that, in order of priority, are years of experience, educational level, age, ease of working with different languages and the gender of the worker.

Insights such as those of participant 11 contribute to the identification of properties of this subcategory: *"Currently, the level of knowledge that the applicant has in the technical area, physical principles of magnitudes, handling of computer tools, basic-intermediate calculation level is considered; additionally, development with clients is considered*". According to participant 17, the desirable characteristics of the staff are: *"Between 25 and 40 years old, indistinct gender, necessary experience in the field to be performed and verifiable through tests, essential B2 level of English, ability to interact with customers, research capacity and project development"*.

Incentive systems. There are incentives for workers that ease the relationship between knowing and acting to create value in companies; These are of an economic nature, such as bonuses for performance, facilities to attend training, the award of days off and public recognition.

Some contributions for this subcategory are mentioned by participant 20: "*The incentives are free English courses and specialized training*"; for participant 13: *"bonuses, days off and special food*"; and for participant 16: *"there are no incentives"*.

Organizational culture. The organizational culture focused on knowledge management recognizes that important properties are the personal values of employees, a permanent attitude towards teamwork, respect for regulations, the application of best practices, the level of personal commitment to objectives and work environment to create, store, share, and use organizational knowledge.

Contributions for this subcategory are, for example, those mentioned by participant 6: *"If there is a bank of lessons learned where employees go when they need to find the best practices or solutions to the same or similar conditions presented in the past"*; and participant 34: *"The company has a continuous improvement system where faults and actions taken for their respective correction are exposed, improving their added value day by day"*.

Communication. Communication as an essential attribute in the transfer of knowledge has two types of communication as properties: formal (regulated by the company) and informal (free of organizational formalities); In addition, it is affected by the hierarchical levels among which it is shared, it depends on the physical or virtual spaces in which it is practiced and the work environment to become the link for sharing knowledge.

Contributions to this subcategory are such as those of participant 19: *"Direct contact with management facilitates communication and decision-making"*; participant 17: *"It is necessary to work on improving formal communication between different hierarchical levels"*; and for participant 12: *"The informal exchange of knowledge occurs thanks to technology in any internal workspace and outside of it, since there is trust between collaborators"*.

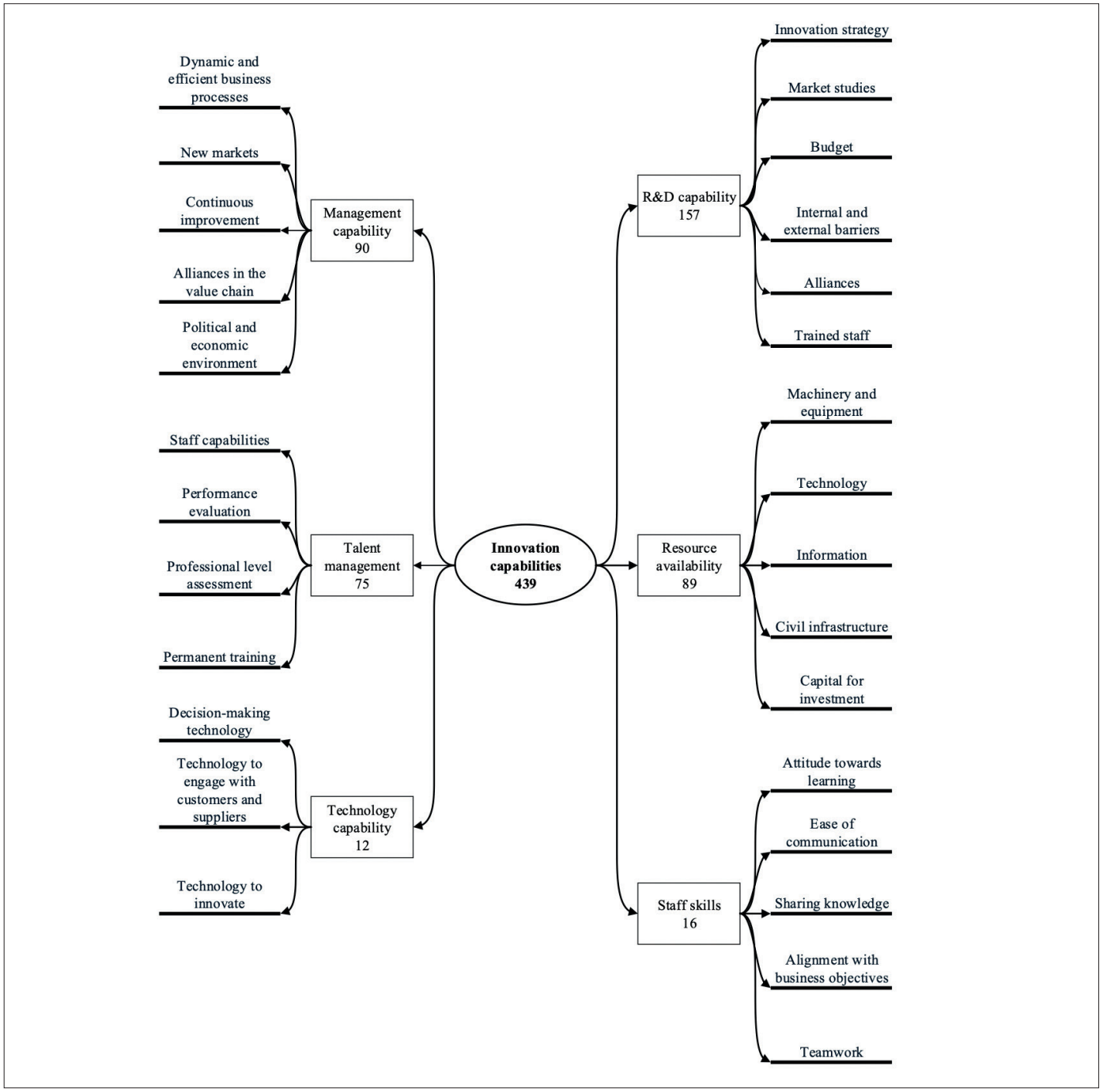
Part of coding the data is making intuitive observations of the subcategories and properties. For the KM coding as the main category, the image of the word cloud is obtained, as shown in figure 5.

Figure 5: Knowledge management coded word cloud.

Source: obtained from Nvivo v12 software.

Subcategories and properties of innovation capabilities. Figure 6 shows graphically the result of the analysis and development of the IC together with its six subcategories and properties; the number of references found in the coding for the subcategories is included.

Figure 6: Map of subcategories and properties of innovation capabilities.



Note: Subcategories in rectangles and properties in thick lines.
Prepared by the authors.

According to the figure 6, IC can be explained by the subcategories: Research and development (R&D) capability, Management capability, Resource availability, Talent management, Staff skills and Technology capability. In turn, each subcategory can be defined by its properties, as detailed below.

Research and development capability. The capacity of R&D as a faculty of innovation is characterized by having strategies to innovate products and processes, regular market studies to analyze supply and demand for new products, planning resources for innovations, planning the mitigation of internal and external barriers that affect to innovation, alliances with public or private institutions and for having trained personnel to carry out innovations.

Contributions that contribute to this subcategory are, for example, those of participant 5: *"The company has carried out basic research and software development"*; participant 25: *"What we are planning is the acquisition of tangible assets, equipment to market new products and services. We have great expectations according to the market study"*; and participant 7: *"No research is done"*.

Management capability. The management capacity influences the capacity for innovation and is identified from the execution of dynamic and efficient business processes, search for markets for new products, continuous improvement in company management, establishment of alliances in the chain of value, and for adapting the company's strategies to the political and economic environment to generate innovation results.

For this subcategory there are contributions such as those of participant 24: *"To innovate, the company updates internal and external processes according to needs"*; and participant 22: *"Every year we carry out strategic planning, with metrics, measured and quantified objectives. By having a management system, continuous improvement is permanent, and by virtue of this, processes, products and services are constantly updated"*.

Resource availability. Companies with resources substantially improve their capacity for innovation, being relevant properties the availability and use of machinery and equipment, having risk capital for investment in innovations, having technology conducive to innovate, accessing relevant information related to the business and having civil infrastructure.

For this subcategory, participant 14 mentions: *"I consider that tangible resources do contribute to the capacity for innovation, since they are an essential part of this type of business"*; and participant 1: *"The company has many resources, access to information storage clouds, updated computers, equipment and tools with advanced technology and comfortable facilities that facilitate the ability to innovate"*.

Talent management. If the organizational knowledge base of a company resides in its personnel, then the management of human talent as a subcategory of innovation capabilities has as relevant properties the capabilities of personnel to contribute to innovations, the intensity with which the staff is trained, the frequency with which the enthusiasm and commitment of the personnel to innovate is evaluated, and the way in which the professional level of the personnel dedicated to innovation is assessed.

According to participant 8: *"Human talent management seeks ways to improve production processes, through staff training"*; and for participant 9: *"Training professionals helps a lot to generate more work, not only in the field we usually work in but to look for new fields, new offers"*.

Staff skills. Within the IC set, staff skills are represented by the practice of teamwork, the attitude towards learning new knowledge and experiences, the level of ease of staff communication, the willingness to share knowledge and the alignment of the team. staff with business goals.

In this case, according to participant 15: *"Teamwork within the technical area improves work times and delivery of the final product"*; and for participant 22*: "Based on my experience, the exchange of knowledge takes place when there is teamwork, we all learn from everything"*.

Technology capability. Properties of technological capacity are the intensity with which companies use technology (hardware, software, computer networks, telecommunications, content, among others) to innovate, make decisions and interact with their environment, mainly with customers and suppliers.

Contributions for this subcategory are those of participant 1: *"In my company, one of the shortcomings is the orderly access to information found in technological media, since each area or department practically manages its own scheme or system. We are working on resolving it, since it affects our teamwork"*; and participant 23: *"By having state-of-the-art technology such as computers and up-to-date programs for the development of projects, trained professionals are required to handle these technological tools"*.

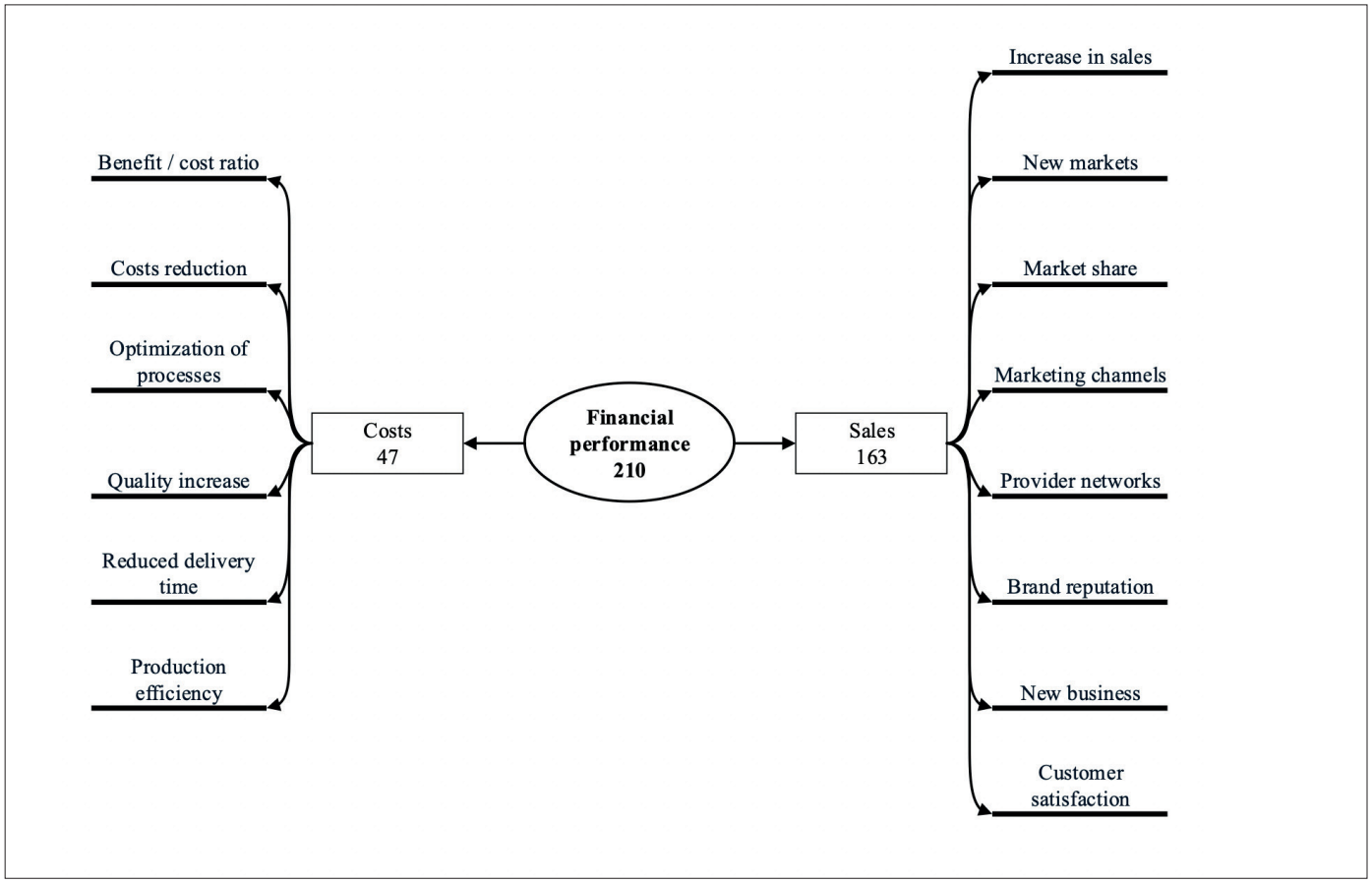
As a result of the coding of the data belonging to the IC, the word cloud is obtained that allows us to intuit about the subcategories and properties of this main category. Figure 7 shows that result.

Figure 7: Innovation capabilities coded word cloud.

Source: obtained from Nvivo v12 software.

Subcategories and properties of financial performance. Figure 8 graphically shows the result of the analysis and development of the FP together with its two subcategories and properties; the number of references found in the coding for the subcategories is included.

Figure 8: Map of subcategories and properties of innovation of financial performance.



Note: Subcategories in rectangles and properties in thick lines.
Prepared by the authors.

According to the map, the FP can be explained by the sales and costs subcategories. In turn, each subcategory can be defined by its properties, as detailed below.

Sales. To evaluate financial performance, companies need to identify the effect they have on sales, the contribution of new markets, know the participation of their products in the market, identify their marketing channels, have supplier networks, have a good reputation of the brand, focus on new business, and achieve customer satisfaction.

Contributions such as those of participant 18 help to determine the properties of this subcategory: *"Sales have increased, but so has competition, so it is necessary to continue developing new products and services"*; participant 25: *"I think that as a result of the pandemic all our products and services have been maintained, since being a productive sector our sales have not changed"*; and participant 41: *"Due to the pandemic, sales have decreased, processes have changed, and we are adapting to the changes"*.

Costs. Costs comprise a subcategory of financial performance that is identified from their behavior in the production process, so it is important to know if cost reduction is accompanied by process optimization, delivery time reduction, quality, in such a way that the results can be evidenced in an increase in the benefit / cost ratio and in an improvement in the efficiency of the company.

For this subcategory, contributions such as those of participant 3 are included: *"Knowledge management and innovation capabilities contribute a lot to the efficiency of the company, for this reason the employees are constantly training"*; and participant 34: *"Part of continuous improvement is optimizing processes, resources. Currently, cost reduction has become key in conjunction with the acquisition of new technology"*.

As part of the coding of the data for the FP, intuitive observations of the subcategories and properties were made through a word cloud image, as shown in Figure 9.

Figure 9: financial performance coded word cloud.

Source: obtained from Nvivo v12 software.

Discussion

Comparing the results of the literature review (table 2), and the study of manufacturing companies (figure 4), it is evident that KM is a multidimensional category in which the subcategory of knowledge processes appears in the literature in a separated form. In the reality of manufacturing companies, KM processes related to the creation, acquisition, exchange, and use of knowledge are poorly documented and have an incipient application, according to the criteria of their managers.

This reality agrees with what has been stated by some authors who affirm that most of the knowledge of the organization is not yet documented; it rests on the minds and experiences of the people doing the work (Manning & Manning, 2020). Additionally, unlike the theoretical review in which the KM subcategories were identified, the qualitative study contributed with the specific determination of subcategories and properties of this field of study for the manufacturing sector. KM as a field of study for many authors is dynamic, constantly changing and remains largely untapped (Cerchione et al., 2016; Handzic, 2017; Wang et al., 2018).

On the other hand, the qualitative study showed that companies require a much broader conceptual and practical approach to KM to direct their efforts towards the creation of innovative products and services for the market. Business organizations need to go beyond the vision of data and information operational management with the use of technology and development of people's skills, towards an approach that escalates to strategic components such as competition management and sustainability (Newell, 2015; Roldán et al., 2018).

Regarding innovation capabilities, if the results of the theoretical review (table 3) and the study of manufacturing companies (figure 6) are compared, then it is verified that IC is a multidimensional category and additionally the related subcategory appears with the R&D capacity, which demonstrates the importance that the development of this capacity implies for the manufacturing industry and is consistent with other similar results in Latin American industries (Ruffoni et al., 2018).

It is evident that the innovation capabilities of manufacturing companies are focused on resource management, project development, continuous training, development of new products, development of strategic alliances and search for alternative markets, which coincides with some authors who mention that in the field of business management, the study of IC should not only focus on the execution of innovation activities, such as R&D and the use of updated technology (Kim et al., 2018; Singh et al., 2020).

It follows, therefore, that this category of analysis in the field of study of innovation must focus from a vision that goes beyond the adoption of traditional techniques and tools promoted by technological changes, to another vision based on acquiring, integrating and recombining new organizational routines and learning mechanisms that allow companies to interact with the dynamic environment and develop innovations to be competitive and sustainable in the markets, a criterion that agrees with other authors who have contributed on the essential capacities for innovation (Nakamori, 2020; Schreiber et al., 2020; Singh et al., 2020), and related similar contributions in Latin American economies (Quintero Sepúlveda et al., 2021).

When comparing the results of the theoretical review (table 4) and the study of manufacturing companies (figure 8), it is inferred that FP as a category of analysis within the field of study of innovation is explained through subcategories such as sales and costs. As for sales, the study confirmed that sales as a category of analysis is structured based on variables related to access to new markets, marketing channels, supplier networks, brand reputation, new businesses, and customer satisfaction. client; Additionally, companies need to develop mechanisms to assess the contributions of KM and IC to sales, as suggested by the Oslo Manual (OECD & Eurostat, 2018).

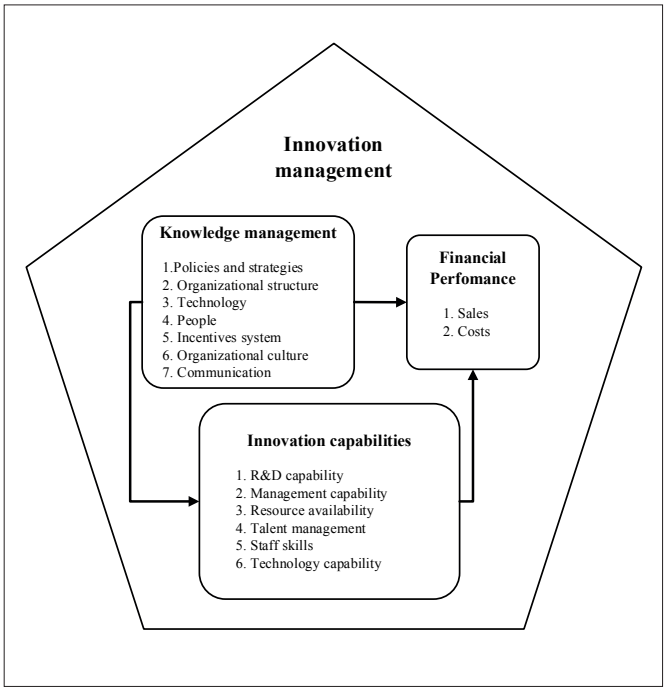
The results of the study also show that companies should focus on aspects related to cost reduction, such as process optimization, quality improvement, product delivery time reduction and the efficient use of tangible and intangible resources.

Systematizing the results of the qualitative study carried out on manufacturing companies, it is verified that these are very compatible with the theoretical advances found on innovation management. It is shown that the study of innovation management can be explained by main categories such as KM, IC, and FP. These categories are represented by seven, six and two subcategories, respectively, which in turn can be identified with an average of four properties. This multiple and broad representation of the main categories shows their important conceptual density, with which innovation management in manufacturing companies can be identified, related, and classified.

The bibliographic review and the application of the Grounded Theory has allowed us to find one of the possible explanatory models of

innovation management in the manufacturing industry, this finding being the main contribution of this research. Additionally, if the subcategories and properties of the proposed model, shown in Figure 10, are assigned quantitative dimensions and indicators, then it could be possible, in a future study, to verify that there is a systemic relationship and probable correlation between the main categories. that explain the management of innovation in industry, as has already been done in other economic realities (Hock-Doepgen et al., 2021).

Figure 10. Integration and systemic relationship of innovation management constructs.



Prepared by the authors.

Conclusions

The objective of this article is to determine and conceptualize the determining factors that interact systemically in the management of innovation in the manufacturing industry, for which the research was divided into three phases.

In the first phase of the research, a literature review on business management focused on innovation was carried out. From this process it is concluded that the organization is made up of a set of organizational dimensions that interact in a systemic way in the management of innovation and that the management of innovation in the business field requires the theoretical understanding of three main categories or constructs: KM, IC, and FP, each with their respective subcategories.

In a second phase, through a qualitative study that used a triangulation of data obtained from the manufacturing companies of Pichincha, Ecuador, the Grounded Theory was applied, which proves that innovation management requires a systemic vision, given the multidimensionality of the three main categories and the interactions that can be established between them. For this industrial sector, KM is represented in order of importance by policies and strategies, organizational structure, technology, people, incentive systems, organizational culture, and communication; IC for research and development capacity, management capacity, resource availability, human talent management, staff skills and technological capacity; and the FP for sales and costs. Each subcategory consists of its respective properties.

In the third phase, with the findings of the first two previous stages, an explanatory model of innovation management in medium-sized manufacturing companies is proposed based on KM, IC, and FP. The results of the three stages contribute to the systemic vision of innovation management in the manufacturing industry, a contribution that, with certain variations in terms of the hierarchy of the subcategories, can be extended to other sizes of companies in this industry or other sectors of the Ecuadorian economy.

Consequently, the objective of the research was fulfilled and information was contributed that proposes a new theory to understand innovation management, based on other recent research on the contribution of knowledge management and innovation capabilities to the performance of the organizations carried out in Latin America (Claver-Cortés et al., 2018; Davila et al., 2019; Del Carpio & Miralles, 2020; Del Castillo Guardamino & Egoávil, 2021; Larios & Soto, 2017; Pinochet, 2021).

Among the most important limitations of this research was the execution of the interviews between the final months of 2020 and the beginning of 2021, a period in which economic activities were impacted by the health effects of the COVID-19 pandemic, so all the interviews were conducted virtually through videoconferences, and when due to technical problems it was not possible to carry them out, they had to be complemented by consultation forms through the internet.

Finally, to expand the empirical evidence of the relationship between KM and IC on corporate results in the manufacturing industry, it would be advisable in a next stage to carry out a quantitative investigation to evaluate the correlations between the categories and subcategories found. in this investigation. In addition, this research could be extended to other sizes of companies and to other economic sectors, which in the future would allow obtaining a global vision of the management of innovation in the Ecuadorian industry.

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