Universidade de Aveiro
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Inês Vieira Oliveira Onofre

FATORES CRÍTICOS DE SUCESSO NA GESTÃO DO CONHECIMENTO: UM ESTUDO DE CASO BASEADO NA IMPLEMENTAÇÃO DE UMA ACADEMIA DO CONHECIMENTO

CRITICAL SUCCESS FACTORS IN KNOWLEDGE MANAGEMENT: A CASE STUDY BASED ON THE IMPLEMENTATION OF A KNOWLEDGE ACADEMY

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CRITICAL SUCCESS FACTORS IN KNOWLEDGE MANAGEMENT: A CASE STUDY BASED ON THE IMPLEMENTATION OF A KNOWLEDGE ACADEMY

Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Engenharia e Gestão Industrial, realizada sob a orientação científica da Doutora Leonor da Conceição Teixeira, Professora Associada do Departamento de Economia, Gestão, Engenharia Industrial e Turismo da Universidade de Aveiro

Dedico este trabalho à minha mãe e irmã.

o júri

presidente

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agradecimentos

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A todos, obrigada!

palavras-chave

Gestão do Conhecimento, Fatores Críticos de Sucesso, Revisão Sistemática da Literatura, Processos de Gestão do Conhecimento

resumo

Atualmente o conhecimento é considerado um recurso chave para as organizações, crucial na obtenção de competitividade sustentável a longo prazo. Alinhado com este princípio, muitas organizações estão a fazer esforços no sentido de implementarem iniciativas de gestão do conhecimento (GC), reconhecendo que a sua base competitiva reside na forma eficaz de captar, reter, armazenar e partilhar conhecimento. Desta forma, o presente trabalho tem por objetivo compreender como as organizações podem implementar iniciativas de GC, elencando num estudo exaustivo de identificação de fatores críticos de sucesso, e tendo por base um projeto prático de implementação de uma academia de conhecimento numa organização multinacional.

Por forma a alcançar tal objetivo, a metodologia adotada neste trabalho compreendeu, em primeiro lugar, uma revisão sistemática da literatura, de forma a identificar os fatores críticos de sucesso que mais influência têm na implementação de práticas de GC. Seguidamente, e tendo por base os resultados encontrados com esta abordagem teórica, foi possível identificar e analisar, num contexto prático no âmbito de uma empresa multinacional, os fatores críticos que mais contribuíram para o sucesso da implementação de uma academia de conhecimento, projeto onde a autora deste trabalho esteve envolvida. Os resultados encontrados sugerem que fatores relacionados com a organização e com as pessoas, tais como, a definição de uma estratégia clara, a definição de medidas de performance para avaliar e acompanhar a estratégia, o envolvimento da gestão de topo, ou mesmo a própria cultura organizacional, representam alguns dos fatores que mais influência têm na implementação bem-sucedida de práticas e iniciativas de GC.

Espera-se, assim, com este estudo, contribuir numa perspetiva teórica para a área da GC através da compilação, categorização e classificação de um conjunto de fatores críticos de sucesso reportados na literatura e, posteriormente, analisados e validados num contexto prático. Numa perspetiva prática, espera-se que estes resultados possam contribuir com uma ferramenta consultiva de apoio à preparação de estratégias nesta área, por parte das organizações que pretendam implementar iniciativas de GC.

keywords

Knowledge Management, Critical Success Factors, Systematic Literature Review, Knowledge Management Processes

abstract

Nowadays, knowledge is considered a key resource for organizations, crucial for obtaining long-term sustainable competitive. In line with this principle, many organizations are making efforts toward the implementation of knowledge management (KM) initiatives, recognizing that their competitive foundation lies in the effective way to capture, retain, store and share knowledge. Thus, this research aims to understand how organizations can implement KM initiatives, with a comprehensive study to identify critical success factors, and based on a practical project to implement a knowledge academy in a multinational organization.

In order to achieve this objective, the adopted methodology in this research first went through a systematic literature review in order to identify the critical success factors with most influence on the implementation of KM practices. Then, based on the results found with this theoretical approach, it was possible to identify and analyse, in a practical context within a multinational company, the critical factors that contributed the most to the success of a knowledge academy implementation, a project in which the author of this study was involved. The results found suggest that factors related to the organization and people, such as the definition of a clear strategy, the definition of performance measures to evaluate and monitor the strategy, the involvement of top management, or even the organizational culture itself, represent some of the factors that have the most influence on the successful implementation of KM initiatives.

With this research, it is expected to contribute from a theoretical perspective to the KM area through the compilation, categorization and classification of a set of critical success factors reported in the literature and subsequently analyzed and validated in a practical context. From a practical perspective, it is expected that these results can contribute as a consultative tool to support the preparation of strategies in this area by organizations wishing to implement KM initiatives.

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1. General Introduction

This chapters aims to contextualize and define the main objectives of the present study, based on a case study developed in a multinational wood-based panels company, as part of the curricular internship of the Integrated Master in Engineering and Industrial Management, University of Aveiro.

1.1. Introduction and Motivation

In recent decades, there has been a growing interest for organizations in knowledge management (KM), as a field of study. Nowadays, knowledge is considered a key resource for organizations, critical for obtaining long-term sustainable competitive advantage (Girard & Girard, 2015; Obeso et al., 2020; Shivakumar & Pradeepkumar, 2019). Many organizations are making efforts toward effective management activities, focusing not only in key processes, but also in knowledge management, in order to improve their efficiency (Bitkowska, 2015). A large part of the existing knowledge in a company is resident only in employees' mind, with a high risk of losing key knowledge with the exit of skilled employees (Slagter, 2007). For this reason, companies seek to convert individual knowledge, the combination of experiences and personal understanding, into organizational knowledge (Obeso et al., 2020). Therefore, it is crucial for organizations to have mechanisms to ensure the utilization of useful knowledge. According to Paliszkiewicz (2011), to obtain a competitive advantage, a company must create and acquire new knowledge, transfer it to the right parts of the organization, interpret and integrate it with existing knowledge, to finally be used and achieve better performance.

The development of knowledge management initiatives is supported by several tools and techniques for better managing knowledge processes, such as Communities of Practices, Knowledge Bases (e.g. Wiki) and Lessons Learned (Young, 2010). Although companies are increasingly competing based on their ability to effectively manage knowledge, there are still numerous challenges for organizations that intend to implement a knowledge management system. Some of the most significant challenges facing organizations adopting knowledge management initiatives are related to people and culture (Yang et al., 2010). The lack of a "sharing" culture and understanding of KM benefits are great examples of obstacles to implementation (Yang et al., 2010). Thus, for a successful implementation of knowledge management, it is crucial to understand which factors are critical for the effectiveness of knowledge management processes and lead to competitive advantage. The identification of these enabler factors will support organizations to better evaluate the status of knowledge management implementation and identify improvements (Theriou et al., 2011).

Therefore, the main goal of this research is to understand how organizations can implement KM initiatives, with a comprehensive study to identify critical success factors and based on a practical project to implement a knowledge academy in an organization. The practical project was developed in a multinational wood-based panel organization, focusing on knowledge management adoption, with the integration of a consulting company. The organization was facing problems related mainly to the loss of critical knowledge, due to several reasons. The work was developed under the support

of a team responsible for the implementation project. As a team member, it was possible to interact directly with the client and develop several initiatives in order to capture, document and transmit knowledge within the organization.

1.2. Objectives and Research Methodology

As previously mentioned, this study aims to identify critical success factors, based on a project to implement a knowledge management strategy developed for a large company, henceforth known as Company A, for reasons of confidentiality. The project started in 2018, and the author only jointed the implementation team in September 2019. The key challenges of the project were capturing the business-specific knowledge that resides in experienced employees' minds and transmitting it to others.

This research was designed to address two main questions:

1. What are the main critical success factors (CSFs) for the implementation of KM in organizations?
2. How can organizations prepare and implement a KM strategy?

Indeed, one of the main objectives of the practical project was to implement a KM strategy in Company A in collaboration with its management and staff. In doing so, the author also wanted to investigate the CSFs identified in the existing literature and contribute to this knowledge area with an empirical example. In this area, it is well known that, for the success of any project, the identification of CSFs is very important (Yang et al., 2010).

In order to achieve the proposed objectives, a methodological approach with three main streams was adopted (Figure 1). After an integrative literature review on the main concepts and methods underlying the subject matter of the study, a systematic literature review on the critical success factors of knowledge management implementations was conducted, in order to have a broader knowledge on this specific subject. An integrative literature review generally aims to synthesize the literature on a research topic, combining perspectives and insights from different fields, not covering all articles ever published on the topic (Snyder, 2019). On the other hand, a systematic review is an overview of scientific researches on a topic adopting explicit and reproducible methods, allowing rapid assimilation of large amounts of information and more reliable and accurate conclusions (Greenhalgh, 1997). Finally, as previously mentioned, a case study was carried out, where the author was involved in the project implementation team and had the opportunity to conduct research, capture and share new knowledge. According to Rashid, Rashid, Warraich, Sabir, & Waseem (2019), a case study consists of a detailed investigation with empirical material collected from a well-defined case, providing an analysis of the context and processes. It is a good strategy when the focus is on contemporary phenomenon within some real-life context. The theoretical phases of literature review provided support to the case study of this research, as the author was able to reflect on the experience of other authors in similar KM projects and extend existing theories that identify KM strategies implementations and CSFs for KM.

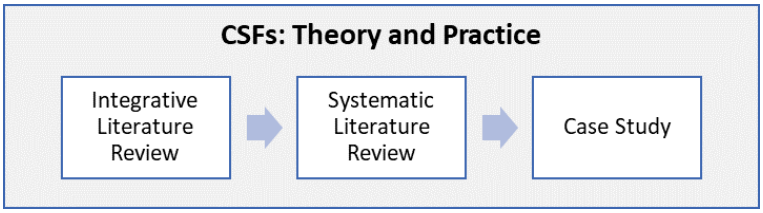

Figure 1 - Methodological Approach

1.3. Structure of the Report

This document (dissertation) is structured in 5 chapters, defined in accordance to the methodology described previously.

In chapter 1, a general introduction is provided as a general overview of this research, where the authors' motivation, research questions and goals are presented. Furthermore, the methodology used is also presented.

In chapter 2, a theoretical background, based on an integrative literature review about the most relevant topics related to knowledge management, is provided.

Chapter 3 provides a systematic literature review about critical success factors of knowledge management implementation in organizations. This section presents the methodology adopted and the content analysis of papers selected in the review process.

In chapter 4, it is presented the work developed around the case study. Firstly, it contains relevant information about the organization where the project took placed, as well as its main issues related to knowledge management. This chapter also presents the research findings based on the empirical study, with the focus on the methodology followed. Finally, a reflection is made on the critical success factors for KM identified in the case study, based also on the work developed in chapter 3.

In chapter 5, the main conclusions and limitations are described, as well as further suggested research.

2. Theoretical Background: Knowledge Management

This chapter presents the main concepts behind the development of this study. The theoretical background is divided in three main topics. First, it defines basic concepts regarding knowledge and knowledge management, exploring also the existent types of knowledge in organizations. Second, it presents the main knowledge management processes. Finally, the implementation of knowledge management in organizations is also addressed, with the main advantages and difficulties, strategies and critical success factors.

2.1. Definitions of Knowledge and Knowledge Management

2.1.1. The Hierarchical View of Data, Information and Knowledge

Changing environment forces contemporary enterprises to focus on changes in the business environment in order to survive and improve their efficiency. According to Bitkowska (2015), many companies are implementing effective management methods and are viewing their organizations through interrelated business process. Knowledge plays a key role in organizational effectiveness, being a very important resource for companies. In fact, to improve organizational effectiveness it is important not only a constant focus on improving key processes, but also an effective knowledge management during the process activities (Bitkowska, 2015). Within an organization, knowledge consists not only of electronic or printed documents, but also resides in employees' mind and is embedded in the organization's processes (King, 2009).

For the effective use of knowledge management methods, it is crucial to define knowledge and distinguish its different types. In most literature, the concept of knowledge is related to the concepts of data and information. There is a consensus that these three concepts should be defined in terms of one another, although data and information act as inputs to knowledge (Rowley, 2007). Typically, information is defined in terms of data and knowledge in terms of information, creating a conceptual hierarchy (Rowley, 2007). Although less frequent, there are some authors who also add the concept of wisdom to this hierarchy (Chedid, 2019), forming a pyramid known as DIKW (data-information-knowledge-wisdom hierarchy) (Allen, 2004; Rowley, 2007), shown in Figure 2. Wisdom can be seen as accumulated knowledge that has the capacity to put into action the most appropriate behavior, taking into account ethical and social considerations (Rowley, 2007).

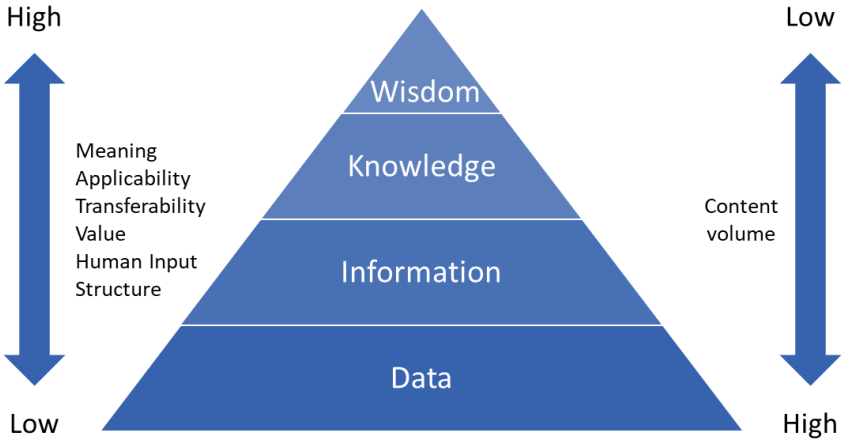

Figure 2 - Interaction of data, information, knowledge and wisdom (DIKW)
Source: Adapted from Rowley (2007)

In the first level of the pyramid, data is usually discrete, objective and unorganized facts or observations, with no dependent meaning or value (Rowley, 2007), such as "January 7, 1955, snow, temperature 21F, barometric pressure 29.12, Boston" (Allen, 2004). It is often quantitative and easily to obtain and transfer (Chedid, 2019).

Information, in turn, is accumulated and processed data for a specific purpose, being meaningful and useful to human beings (Rowley, 2007). Information derives from the interpretation of data or conclusions from experience. Going back to the previous practical example of data, processing that data it is possible to obtain the following information: In 7 January, 1995, it snowed in Boston, with a temperature of 21F and a barometric pressure of 29.12 (Allen, 2004).

Regarding knowledge, inserted in the level above information in the DIKW pyramid, its definition is more complex than data and information, since the concept of knowledge has varied over the years and can be seen from several perspectives. According to Alavi & Leidner (2001), knowledge can be viewed as: a state of mind, an object, a process, a condition of having access to information or a capability.

Knowledge is a dynamic process, since it is originated from social interactions amongst individuals and organizations (Nonaka et al., 2000). In an attempt to summarize the opinion of various authors in literature, Rowley (2007) argues that knowledge is a "mix of information, understanding, capability, experience, skills and values". Chedid (2019) also defines knowledge as "the information analyzed with some reflection, synthesis and context, acquires some meaning and allows decision making".

2.1.2. Types of Knowledge

According to Nonaka et al. (2000), there are two dimensions of knowledge in organizations: explicit knowledge and tacit knowledge. Explicit knowledge can be defined as knowledge that has been articulated, codified and can be expressed in symbolic form and/or natural language (Alavi & Leidner, 2001; Nonaka et al., 2000). It is formal, regulated and easy to communicate. Explicit knowledge can be stored in databases, in the form of books, training materials, manuals and other

gathered data (Hejduk, 2005). On the other hand, tacit knowledge, also referred as implicit knowledge, refers to knowledge embedded in an organisation's operating practices (Smuts et al., 2009) and in people's minds resulting from experience and specific skills (Hejduk, 2005). This type of knowledge cannot be articulated and is hard to detail, be recorded or to distribute, becoming the key intellectual capital of a company (Hejduk, 2005; Smuts et al., 2009). However, it should be noted that both types of knowledge are important for an organization. Indeed, explicit and tacit knowledge are complementary, since explicit knowledge loses its meaning without tacit knowledge (Nonaka et al., 2000).

Although the tacit-explicit knowledge classification is the most cited one, there are other classifications of knowledge in literature (Alavi & Leidner, 2001). Table 1 summarizes the main types of knowledge identified in the literature by Alavi & Leidner (2001).

Table 1 – Knowledge Taxonomies and Examples
Source: Adapted from Alavi & Leidner (2001)

Knowledge Type	Definition	Example
Tacit	Knowledge deeply rooted in individual actions and experiences in specific context	Knowing how to deal with a customer based on their needs
Explicit	Generalized knowledge that can be articulated	Knowledge stored in books
Individual	Created by and inherent in the individual	Insights gained from completed project
Social	Created by and inherent in collective actions of a group	Norms for inter-group communication
Declarative	Know-about	What are the appropriate ingredients for a food dish
Procedural	Know-how	How to cook the food dish
Causal	Know-why	Understanding why the ingredients work
Conditional	Know-when	Understanding when to add the ingredients
Relational	Know-with	Understanding how the ingredients interact
Pragmatic	Useful knowledge for an organization	Best practices, lessons learned, etc.

Alavi & Leidner (2001) argue that an understanding of the concept of knowledge and its types is important since it can influence the design of a knowledge management system, according to the need to support different types of knowledge and the flows between them.

2.1.3. Knowledge Management Definition

Although Knowledge Management has been extensively studied, defining it has always been a challenge. It is a multi-faced and controversially concept, with a mix of tools and techniques (Theriou et al., 2011). In the literature it is possible to find numerous different definitions of knowledge management, usually mutually supplementary or mutually exclusive (Hejduk, 2005).

According to Hejduk (2005), the lack of a universal definition is due to two main factors: there is an excess of unhelpful theories and the limited time of knowledge management utilization makes it difficult to apply all gathered data and information in a given subject.

For example, for Bitkowska (2015), knowledge management is a systematic approach to ensure the full utilization of the knowledge base of an organization. Raudeliūnienė, Davidavičienė, & Jakubavičius (2018) define it "as target and systematic management of processes, methods and tools, making full use of the organization's knowledge potential for strategic goals, making effective decisions, implementing and creating value". King (2009) adds that "knowledge management is the planning, organizing, motivating and controlling of people, processes and systems in the organization to ensure that its knowledge-related assets are improved and effectively employed".

According to Awad & Ghaziri (2004), in general, each knowledge management definition integrates the following parts:

- Use of accessible knowledge from external sources;
- Incorporation and storage of knowledge in business processes, products and services;
- Knowledge representation in databases and documents;
- Promotion of knowledge growth through culture and incentives;
- Knowledge transfer and sharing through the organization;
- Regular evaluation of the value of knowledge assets and their impact.

Hejduk (2005) warns that, although it is frequently a necessity and a very useful tool for improving processes, knowledge management is not a remedy that will solve all the problems of an organization.

2.2. Knowledge Management Processes

In literature, several authors consider knowledge management as a process involving various activities (Alavi & Leidner, 2001). Although there is a wide range of terms to describe knowledge management activities or processes, it is possible to find a consensus regarding their basic categories and concepts (Alavi & Leidner, 2001; Chedid, 2019).

For example, Yusr, Mokhtar, Othman, & Sulaiman (2017) distinguished three knowledge management processes: knowledge acquisition (gaining valuable knowledge), knowledge dissemination (disseminating the valuable knowledge in the organization) and knowledge application (timely delivery and commercial application). For King (2009), these processes involve knowledge acquisition, creation, refinement, storage, transfer, sharing and utilization. Based on a literature analysis, Raudeliūnienė et al. (2018) found that most researchers are investigating the following main knowledge management processes:

1. Knowledge creation, development, generation;
2. Knowledge acquisition;
3. Knowledge distribution, dissemination, sharing, transfer, user achievement;

4. Knowledge preservation, capture, archiving;
5. Knowledge use, utilization, integration, embedding, enable reuse.

In order to simplify and facilitate the explanation of KM processes, for this research the author adopted four KM processes commonly used in literature and defined in the *'European guide for good practice in knowledge management'*, also considered by Chedid (2019):

a) Knowledge Creation;
b) Knowledge Capture;
c) Knowledge Sharing;
d) Knowledge Application.

a) Knowledge Creation

Nonaka et al. (2000) define knowledge creation as a continuous process related to the acquisition of new contexts, new views and new knowledge, through the interactions amongst individuals or between individuals and their environment. Sun (2010) argues that knowledge creation is "the process of transforming the newly acquired knowledge to the context of the organization".

Knowledge creation is originated through the interactions of explicit and tacit knowledge, between individuals or groups of people, also known as 'knowledge conversion' (Nonaka et al., 2000). Figure 3 presents the four modes of knowledge conversion, according to Nonaka's SECI model (Nonaka et al., 2000). They are: (Nonaka et al., 2000)

- Socialization: process of converting tacit knowledge into new tacit knowledge, through social interactions and shared experiences, such as social meetings;
- Externalization: process of converting tacit knowledge to new explicit knowledge, allowing it to be shared by others;
- Combination: process of combine, edit or process explicit knowledge to form new and more complex explicit knowledge;
- Internalization: process of converting explicit knowledge into tacit knowledge by individuals. This process is related to 'learning by doing'.

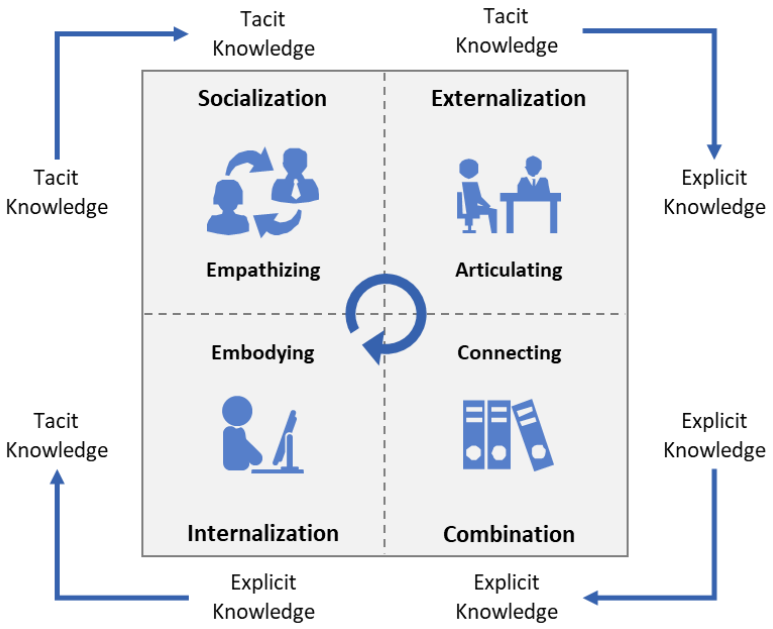

Figure 3 – The SECI Process
Source: Adapted from Nonaka et al. (2000)

b) Knowledge Capture

Knowledge capture is one of the main goals of knowledge management (Chedid, 2019). Nielsen (2006) defines the capture process as the inclusion of the knowledge into the existing knowledge base of an organization. This process has several methods that must be related to the knowledge type to be captured: for example, explicit knowledge can be captured in reports, manuals or books, while tacit knowledge can be captured during discussions, meetings or workshops (Chedid, 2019). Igbinovia & Ikenwe (2018) argue that knowledge capture also involves knowledge mapping, which is a method for identifying where knowledge resides within an organization and requires some techniques such as questionnaires, interviews and observations. This method should also identify knowledge experts within the organization (Igbinovia & Ikenwe, 2018).

c) Knowledge Sharing

Knowledge sharing is another fundamental component in knowledge management. Sun (2010) defines knowledge sharing as the process of applying the created knowledge and sharing it from individual to individual or groups. This process occurs when there is exchange and sharing of information, knowledge, ideas, skills and experiences among people and organizations (Igbinovia & Ikenwe, 2018).

An effective knowledge sharing contributes to the accumulation of knowledge of an organization and improves the performance of its employees in their jobs (Xiong & Deng, 2008). Moreover, it is crucial for organizations to develop mechanisms to encourage knowledge sharing among their

employees, in order to avoid many negative impacts, such as the loss of organizational knowledge and critical know-how (Slagter, 2007).

d) Knowledge Application

The performance of an organization depends on the ability to apply knowledge to deliver products or services using its own capabilities (Nielsen, 2006). Once knowledge is created, shared and captured, it should be used and disseminated to fill a gap or need. The use of knowledge is not a simple part of knowledge management (Paliszkiewicz, 2011). For an effective knowledge application, knowledge management process should be communicated within an organization (Igbinovia & Ikenwe, 2018). Paliszkiewicz (2011) adds that employees must be able to identify existing knowledge and knowledge managers must evaluate the usefulness of knowledge.

In an organization, those responsible for knowledge management should manage these processes, developing methodologies and initiatives to support them and achieve KM's goals, as well as motivate employees to participate in achieving them (King, 2009).

2.3. Knowledge Management Implementation in Organizations

Nowadays, knowledge is one of the main instruments of competition in current and future markets (Nazarizade & Azizi, 2018). The interest in organizational knowledge has led to the implementation of knowledge management in many organizations (Alavi & Leidner, 2001). The main objective is to capture existing tacit knowledge and encourage workers to share and communicate knowledge among themselves. In this way, an organization can better leverage its intellectual assets, as well as position itself to respond quickly to its customers, creating new markets, developing new products and mastering emerging technologies (Awad & Ghaziri, 2004).

Awad & Ghaziri (2004) summarize the main benefits and reasons to implement knowledge management in organizations:

- Creates numerous benefits from knowledge as employees learn from it;
- Helps to improve business processes;
- Allows the organization to position itself for responding quickly to customers;
- Builds mutual trust between employees and management and facilitates cooperation in time-sensitive tasks;
- Builds better sensitivity to "brain drain";
- Ensures successful partnership and competences with suppliers, vendors, customers and others;
- Shortens the learning curve, facilitates knowledge sharing and enables less trained employees to quickly reach higher performance levels;
- Increases the problem-solving capacity of employees by providing access to important files available to all offices.

Despite all the benefits, the decision to move to a knowledge management implementation is very important for any organization. It is crucial that all aspects of KM implementation are well considered, since the success or failure of an organization may depend on this decision (Nazarizade & Azizi, 2018).

To achieve a successful outcome, any knowledge management practice must be based on three fundamental elements: people, processes and systems (technologies) (Igbinovia & Ikenwe, 2018). As shown in Figure 4, these components are interdependent.

Knowledge management is about people, also known as human resources, and the way they interact and share knowledge (Awad & Ghaziri, 2004). People are the main conveyor of knowledge (Igbinovia & Ikenwe, 2018). Processes are another important component, corresponding to the methods by which knowledge management initiatives are achieved. Igbinovia & Ikenwe (2018) state that people firstly design and then operate processes, while processes define the roles and knowledge needed by people. Lastly, systems or technologies are devices that support the implementation of knowledge management, in particular people and processes involved (Igbinovia & Ikenwe, 2018).

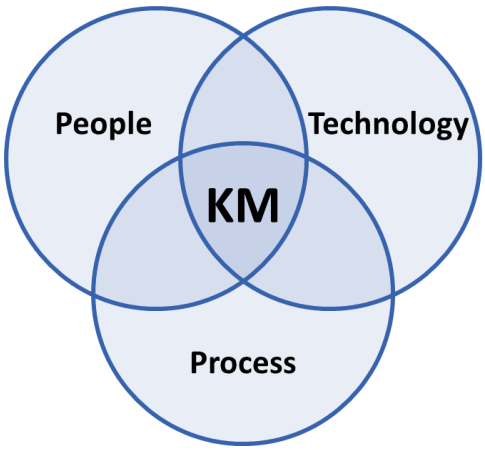

Figure 4 - Core elements of Knowledge Management

2.3.1. Strategies and Methodologies

According to Davenport and Prusak (1998), cited by Alavi & Leidner (2001), most knowledge management initiatives in organizations have one of the following objectives:

1. Make knowledge visible and show its role in an organization;
2. Develop a knowledge-intensive culture, encouraging knowledge sharing and proactively seeking and offering knowledge;
3. Build a knowledge infrastructure, composed of both a technical system and a web of connections between people.

Although currently there is no universal standard for implementing knowledge management, organizations have developed multiple approaches and frameworks to design, implement and measure knowledge management systems, in order to meet their objectives (Smuts et al., 2009).

In general, these frameworks prescribe different ways of getting involved in KM activities, for example, suggesting a KM methodology (Rubenstein-Montano et al., 2001). These methodologies must be aligned with the organization's strategy, and it is essential that they are clear and structured so that teams can implement it more easily and effectively (Almeida, 2019).

The process of implementing KM is an extensive procedure that requires a great commitment from the organization in order to achieve results (Smuts et al., 2009). Rubenstein-Montano et al. (2001) make the following recommendations for a KM framework:

- A KM framework should be developed within systems thinking context;
- A KM framework should be both prescriptive and descriptive;
- A KM framework should consider purpose, knowledge, technology, learning and people/culture of the organization;
- Planning should occur before KM activities are undertaken;
- KM is an iterative process: learning and feedback loops (both single and double) should be part of a KM framework.

For Awad & Ghaziri (2004), the implementation of knowledge management is seen as a life cycle that begins with a justification and a master plan, ending with a structured system to meet the KM needs of the organization. This system should be composed of a knowledge team, that represents the organization's thinking, and of an expert in knowledge capture, design and implementation, also known as knowledge developer. The authors proposed a KM system development life cycle, or framework, composed by 8 main stages and summarized in Figure 5.

Figure 5 - KM System Life Cycle
Source: Awad & Ghaziri (2004)

Levett & Guenov (2000) proposed a KM introduction program, with the steps that an organization must take in order to achieve a practical and feasible KM program. The methodology presented has 4 phases (Levett & Guenov, 2000):

1. Case Study Definition: it represents the activities of undertaking KM feasibility studies and the definition of a number of critical KM metrics to measure employees' effectiveness. The authors propose a case study focusing the KM pilot program on a particular department or process.
2. Capture Knowledge Management Practice: it represents the activities of preparing the employees that will be involved in the KM implementation and collecting raw data and information. Interviews and observations of the personal involved in the case study are examples of data gathering procedures.
3. Building a KM Strategy: the collected data on current KM practice is analyzed to calculate KM metric performance and identify improvements strategies. The design of any new KM strategy depends on the analysis of current KM practice.
4. Implement and Evaluate: it represents the comparison of before and after the KM pilot program implementation. If it has been successful, management may consider expanding the scope of the pilot into other areas.

Figure 6 summarizes the methodology proposed by Levett & Guenov (2000).

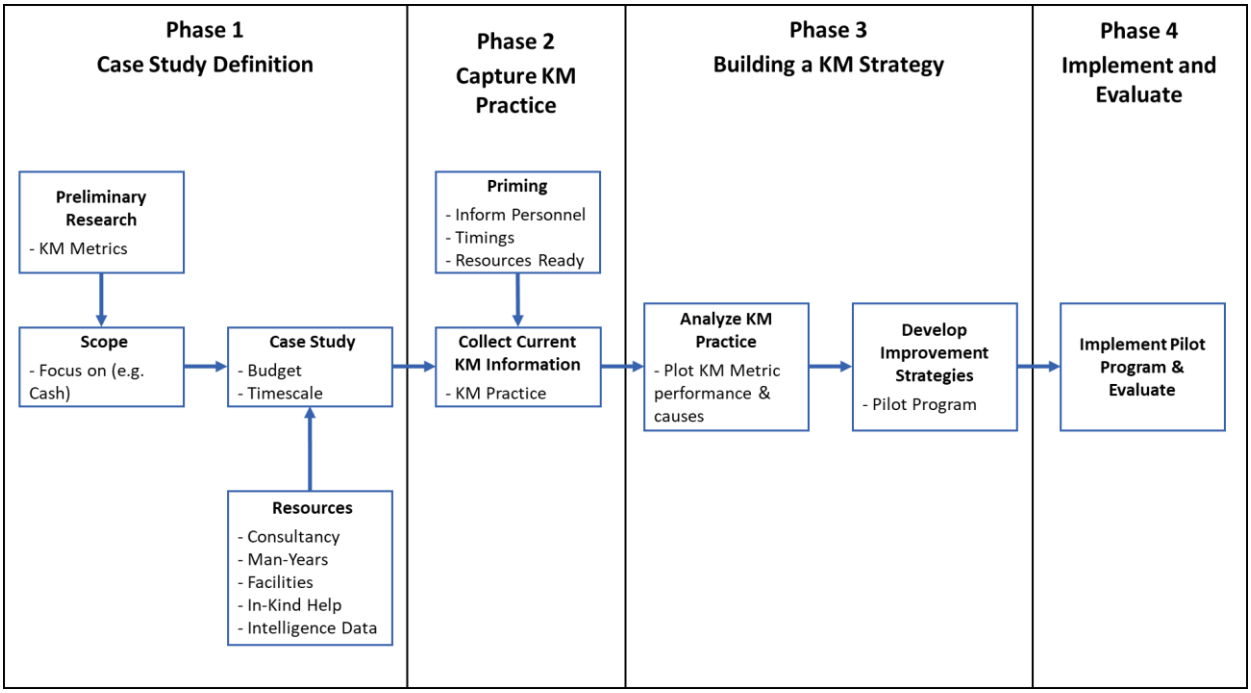

Figure 6 - KM Program (conceptual perspective)
Source: Levett & Guenov (2000)

In addition, it is also interesting to observe the methodology for implementing a KM system in organizations proposed by Calabrese & Orlando (2006). In their study, the authors analyzed 5 KM approaches to an effective system, two derived from academic sources and three from practitioner's corporations. Based on the analysis, which identified correlations among the 5 approaches, Calabrese & Orlando (2006) presented a 12-step hybrid KM approach that combined the best features of the approaches analyzed.

Table 2 presents the methodology proposed by Calabrese & Orlando (2006), which is supported by 4 pillars: leadership, organization, technology and learning.

Table 2 - 12-step methodology proposed by Calabrese & Orlando (2006)
Source: Calabrese & Orlando (2006)

Pillar	Step	Activity
Leadership		
	1	Identify knowledge critical to your business
	2	Conduct work-centered analysis
	3	Sell high-level plan of action to senior management
Organization		
	4	Engage key stakeholders
	5	Develop process model
	6	Identify critical knowledge gaps, opportunities and risks
	7	Establish and prioritize goals
	8	Develop requirements and measurement plan
Technology		
	9	Plan high-level strategy approach
	10	Implement strategy, build and deploy

	11	Monitor, measure and report metrics
Learning		
	12	Learn from results

In the three methodologies presented previously, the steps must be carried out by a KM team. According to Tiwana (2002), selecting a team with a lot of expertise is critical to the success of the project (Calabrese & Orlando, 2006). Besides, it is common for the KM function to be led by a Chief Knowledge Officer (CKO). Depending on the complexity of the KM strategies, there may be one or more KM departments (King, 2009).

2.3.2. Tools and Techniques

Within an KM implementation initiative, there are several tools that can be used to facilitate the creating, sharing, capture and application of knowledge, which can be IT (Information Technology) or Non-IT methods (Young, 2010). Cerchione & Esposito (2017) distinguished KM practices and KM tools, both used in knowledge management systems. KM practices are defined as the set of methods and techniques to support the KM processes, while KM tools are the specific IT-based systems supporting KM practices.

Nowadays the utilization of technology in KM is very important, since it provides new opportunities and enabling environments for sharing and communicating knowledge (Igbinovia & Ikenwe, 2018). In fact, according to Awad & Ghaziri (2004), the most common tools include the internet and intranets, data warehousing, document and best-practices repositories, database mining tools, etc.

Through a systematic literature review, Cerchione & Esposito (2017) highlight the KM tools and practices most used in small and medium enterprises (SMEs). According to the authors, SMEs follow large companies in developing KM practices. In their study, the 5 KM tools most used by the companies are e-mails, databases, document management systems, audio/conference/video conference and cloud computing. Regarding KM practices, the most used are: problem solving, brainstorming, work groups, learn by doing and meeting/task force (Cerchione & Esposito, 2017).

Ghomi (2014), cited by Ghomi & Barzinpour (2018), presents a list of tools and techniques that the world's most successful organizations have used in KM initiatives. These tools are summarized in Table 3.

Table 3 - KM Tools and Techniques presented by Ghomi (2014)
Source: Ghomi & Barzinpour (2018)

Knowledge Management Tools and Techniques		
Based on Information Technology	**Based on Organizational approaches**	**Based on Individual approaches**
Social network analysis	Leader or senior management support	Direct concurrence
Document libraries	Culture	Assistance to coworker
Knowledge bases	Knowledge Center	Reviews of learning
Data bases	Identifying and sharing best activities	Reviews after measurement
Social networking services	Creating a knowledge strategy	Innovation
Advanced searching tools	Knowledge Audit	Knowledge house
Creating knowledge branches	Changing organizational structure (horizontal)	Work communities
Identifying specialists	Knowledge exhibition	Classification
Collaborative virtual workspaces	Motivational activities	Teacher-student method
Learning in individual spaces	Harvesting knowledge	Small articles
Websites	Structured interviews with experts	Telling story
Networks	Contribute qualified staff in education	Apprenticeship
Groupware	Collaborative physical workspace	Dialogue
	Knowledge Map	Trust
	After-project evaluation	

2.3.3. Barriers and Challenges

As already stated, the decision to implement knowledge management in companies should be well considered, since it requires a major shift in organizational culture and a commitment at all levels of an organization to be successful (Gupta et al., 2000). Indeed, according to Awad & Ghaziri (2004), the biggest challenge in KM is explaining what KM is and how it can benefit a corporate environment. It the culture does not encourage cooperation and trust, employees will not cooperate (Awad & Ghaziri, 2004). It is a change management problem that brings serious leadership challenges to a Chief Knowledge Officer (Gupta et al., 2000).

In the studied carried out by Dzunic, Boljanovic and Subotic (2012) about the major limitations to KM implementations, cited by Igbinovia & Ikenwe (2018), the authors identified insufficient training, unwillingness of employees to share knowledge, too complex system, failure to recognize personal benefits that employees would have and lack of trust among employees.

Frost (2014) indicates some of the main issues that hamper the implementation of KM in organizations:

- Lack of performance indicators and measurable benefits;

- Inadequate management support;
- Improper planning, design, coordination and evaluation;
- Inadequate skill of knowledge managers and workers;
- Organizational culture problems.

The previous barriers are also supported by Awad & Ghaziri (2004), that noted that most of them are nontechnical. These issues are lack of support from top management, knowledge developers' limited interpersonal skills, experts' poor communications skills and user's resistance (Awad & Ghaziri, 2004).

Besides the obstacles to KM implementations, there are also other barriers to knowledge sharing that organizations have to deal with, such as organizational hierarchy, geographical barriers, human nature and personality (Smuts et al., 2009). This is one of the reasons why motivating employees is so important to a successful KM implementation.

2.3.4. Critical Success Factors

Besides the understanding about the implementation of KM and the main challenges, it is also important to discuss KM critical success factors. According to Othman, Ismail, Yahya, & Ahmad (2018), many researchers defined critical success factors (CSFs) as "the keys in which acceptable outcomes would result in accomplished competitive performance". In this area, the success factors are activities and actions necessary to implement KM successfully (Ghomi & Barzinpour, 2018). Understanding the CSF can help organizations to execute KM with less risk of failure (Othman et al., 2018). It should be noted that external factors, such as environmental impacts, are usually not included because organizations do not control them in KM implementations (Ghomi & Barzinpour, 2018).

According to Othman et al. (2018), several researchers indicate leadership, resources, information technology (IT) and culture as vital factors for a successful implementation of KM.

In the study of Ghomi & Barzinpour (2018), which was taken in an university, the authors found the following critical success factors of using KM tools:

- Human-motivational factors: employees' motivation, resources, human resource management;
- Information technology;
- Education;
- Leadership and management support;
- Processes and activities;
- Structure;
- Culture;
- Measurement;
- Organizational infrastructure, strategy and goal;
- Communication.

In short, in order to facilitate KM practices in organizations, Igbinovia & Ikenwe (2018) make the following recommendations:

- Organizations should encourage knowledge creation by supporting research activities, collaborations and team work;
- Organizations should create reward systems to motivate employees to acquire and share knowledge for common good;
- Organizations should carry out knowledge mapping to identify best practices and inculcate such practice in their organizational activities;
- Organizations should create accessible knowledge repositories;
- Organizations should ensure that knowledge is applied to solve problems and ensure innovations;
- Organizations should attempt to acquire tools and technologies to support people and processes involved in KM.

Chapter 3 of the present document presents a systematic literature review related to knowledge management critical success factors.

3. Critical factors for a Successful KM Implementation: a Systematic Literature Review

This section proposes a systematic literature review (SLR) to analyze the state of the art on the critical factors for a successful implementation of knowledge management in organizations. In this chapter, after a brief introduction, the SLR methodology is presented, followed by the results section, which identifies the main critical success factors of KM and describes the main findings.

3.1. Introduction

As previously stated, the implementation of KM in organizations is not a simple process and understanding the critical success factors (CSFs) can be very advantageous, reducing the risk of failure (Othman et al., 2018). The CSFs approach helps managers to identify what are the most important issues for adopting KM and to ensure the organization's success and survival (Altaher, 2010). In fact, there are many benefits with this practice, since CSFs are very important to retain people's focus and should be used together with a development process, such as a KM implementation.

In the literature, there are many studies related to the CSFs of KM implementation in organizations. However, these studies are very dispersed and few bring together the CSFs in a systematic and extensive manner (Sensuse et al., 2018; Yang et al., 2010).

Yang et al. (2010) conducted a systematic literature review on the CSFs for the adoption of KM. Nevertheless, that research was done in 2010 and may be outdated. Since KM is a dynamic and increasingly sought-after field, CSFs need continuous attention to ensure its sustainability. More recently, Sensuse et al. (2018) also conducted a systematic review on the same topic. However, it is a conference article with some restrictions, basing the research on only 15 papers.

For the above reasons, the main motivation of this study is to have a comprehensive and up-to-date view of the critical factors that lead to the success of KM implementations in organizations. Today, organisations are increasingly dynamic and what works for one may not work for others. The fact that there is a comprehensive study, without restrictions to any sector or size of the organisation, can help any organisation to implement KM practices, although there is always a need for adaptation.

On the other hand, since KM is considered by many authors as a process involving several activities (e.g. knowledge creation, capture, sharing and application) (Alavi & Leidner, 2001), it would also be interesting to study which KM processes are most important for organizations implementing KM, relating them to CSFs, if possible.

3.2. Methodology

As mentioned before, the methodology used for this research is a systematic literature review (SLR). Denyer & Tranfield (2009) defined a systematic review as "a specific methodology that locates

existing studies, selects and evaluated contributions, analysis and synthesizes data, and reports the evidence in such a way that allows reasonably clear conclusions to be reached about what is and is not known". The main goal of a systematic review is to identify all empirical evidence that fits the inclusion criteria, in order to answer a question or hypothesis of an investigation (Snyder, 2019).

This study follows the typical five established SLR steps, presented by Denyer & Tranfield (2009) and summarized in figure 7. This methodology provides the potential to bring together the best academic evidence with the judgment and experience of professionals in the evidence-based practice (Denyer & Tranfield, 2009).

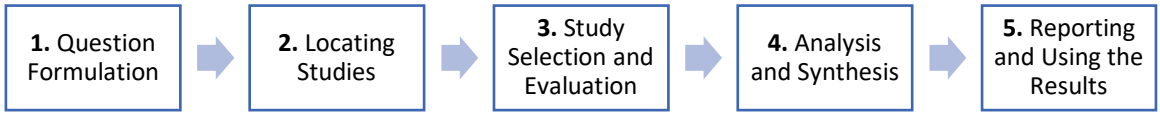

Figure 7 - Five SLR steps
Source: Denyer & Tranfield (2009)

Each of the phases is described in detail below.

Step 1: Questions Formulation

This step aims to establish the focus and purpose of the research, asking clearly framed questions. The purpose of this specific research is to analyze the state of knowledge that exists in the literature related to the critical success factors in knowledge management practices. Since the area of knowledge management is very oriented to KM processes, this research is directed towards these processes, with the additional objective of understanding which are the most outstanding processes in the literature. Although there are several studies on CSFs, the author did not find studies that related them to KM processes.

This general research question is broken into the following specific questions:

- What are the main critical success factors (CSFs) for implementing knowledge management strategies in organizations?
- At the level of the CSFs identified, what are the most implemented KM processes? Which are the most relevant for companies implementing KM initiatives?

It should be noted that this study focuses on specific knowledge management processes, as presented in the literature review:

1. Knowledge creation
2. Knowledge capture
3. Knowledge sharing
4. Knowledge application.

Step 2: Locating Studies

This step involves identifying relevant studies related to the research questions. This includes search terms, based on words and concepts directly related to the research questions, and

appropriate databases (Snyder, 2019). These search terms, also known as keywords, are very important since they determine which papers the database will retrieve.

Snyder (2019) argues that it is important to test the search terms initially on a smaller sample, in order to adjust the search before the final review is made and ensure higher quality. Therefore, the author of the present study made several attempts before establishing the final search string. In order to avoid losing important results, besides the knowledge management processes identified before, the author also considered in the keywords other processes that are also widely cited in the literature and could be related to the previous ones: knowledge transfer, knowledge storage and acquisition, as well as knowledge management processes in general.

The search string has been constructed using logical and Boolean operators. With the final search string, the author performed a search on October 28, 2020, in Scopus database, since it is multidisciplinary and offers the widest coverage of papers throughout the available databases (Mongeon & Paul-Hus, 2016). Initially, a total of 224 hits were found, as shown in table 4.

Table 4 - Material Search

Keywords used	TITLE-ABS-KEY (("knowledge process*" OR "knowledge management process*" OR "creation" OR "sharing" OR "transfer" OR "storage" OR "application" OR "acquisition" OR "capture") AND "knowledge management" AND "organization*" AND ("critical factors" OR "critical success factors"))
Data Range	The literature review spans the years 2000-2020 (no filtering)
Number of hits retrieved in Scopus	224

Step 3: Study Selection and Evaluation

The purpose of this phase is to use a set of selection criteria to assess the relevance of each research for answering the review questions (Denyer & Tranfield, 2009). Snyder (2019) exemplifies some criteria that can be considered and are commonly used, such as year of publication, language of the article, type of article and journal.

If the studies do not meet the inclusion criteria, they should be discarded (Denyer & Tranfield, 2009). In this way, it is possible to eliminate articles that clearly do not belong in the research (Denyer & Tranfield, 2009).

In this research, the search was limited to articles published in English and Portuguese, since they are the only languages the author can understand. In addition, all the articles without author identification were also excluded. With the application of these criteria, a total of 211 publications were selected out of the 224 initially identified.

After this first screening process, the next step was to examine the title, abstract and keywords of the articles, which made it possible to determine the articles that were clearly related or not to the research question. In this process, the author found many articles related to knowledge management, but without reference to critical success factors, so they were excluded. On the other

hand, articles that mentioned CSFs but were not related to knowledge management initiatives were also excluded. There were still some articles that the author could not conclude by reading only the title and abstract, so these were not excluded and moved to the next phase. At the end of step 3, a total of 80 publications were selected for further analysis.

Step 4: Analysis and Synthesis

The purpose of this step is to review and analyze each of the selected articles in the previous step, reading them in their entirety. With this, it is possible to break down individual studies into different topics and describe how each relates to the other, which allows to reformulate the information and develop knowledge that is not apparent from the isolated reading of studies (Denyer & Tranfield, 2009).

Of the 80 articles selected previously, there were 14 studies that the author could not obtain in full text, thus remaining 66 full-text articles to be assessed for eligibility. Finally, after reading these articles, 19 papers were also excluded because they did not meet the selection criteria, with a final total of 47 articles obtained and included in this research.

During this synthesis process, a database was created in a spreadsheet containing the main contributions, critical success factors identified and knowledge management processes for each paper. Other complementary information was also identified, such as the author, title, year of publication, journal and methodology.

Step 5: Reporting and Using the Results

This step aims at reporting the main results of the analysis and synthesis of the selected papers of the literature (Denyer & Tranfield, 2009). The information extracted from the studies has been combined and categorized so that the results can be discussed and any research gaps and future research can also be identified. The results of this step are presented in Section 3.2.

In order to summarize the various phases of the SLR followed in this study, the author used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) flow diagram, shown in figure 8, since it is widely accepted for both meta-analysis and systematic reviews (Liberati et al., 2009). According to Liberati et al. (2009), a flow diagram can be very useful and should represent all studies included based on compliance with the selection criteria.

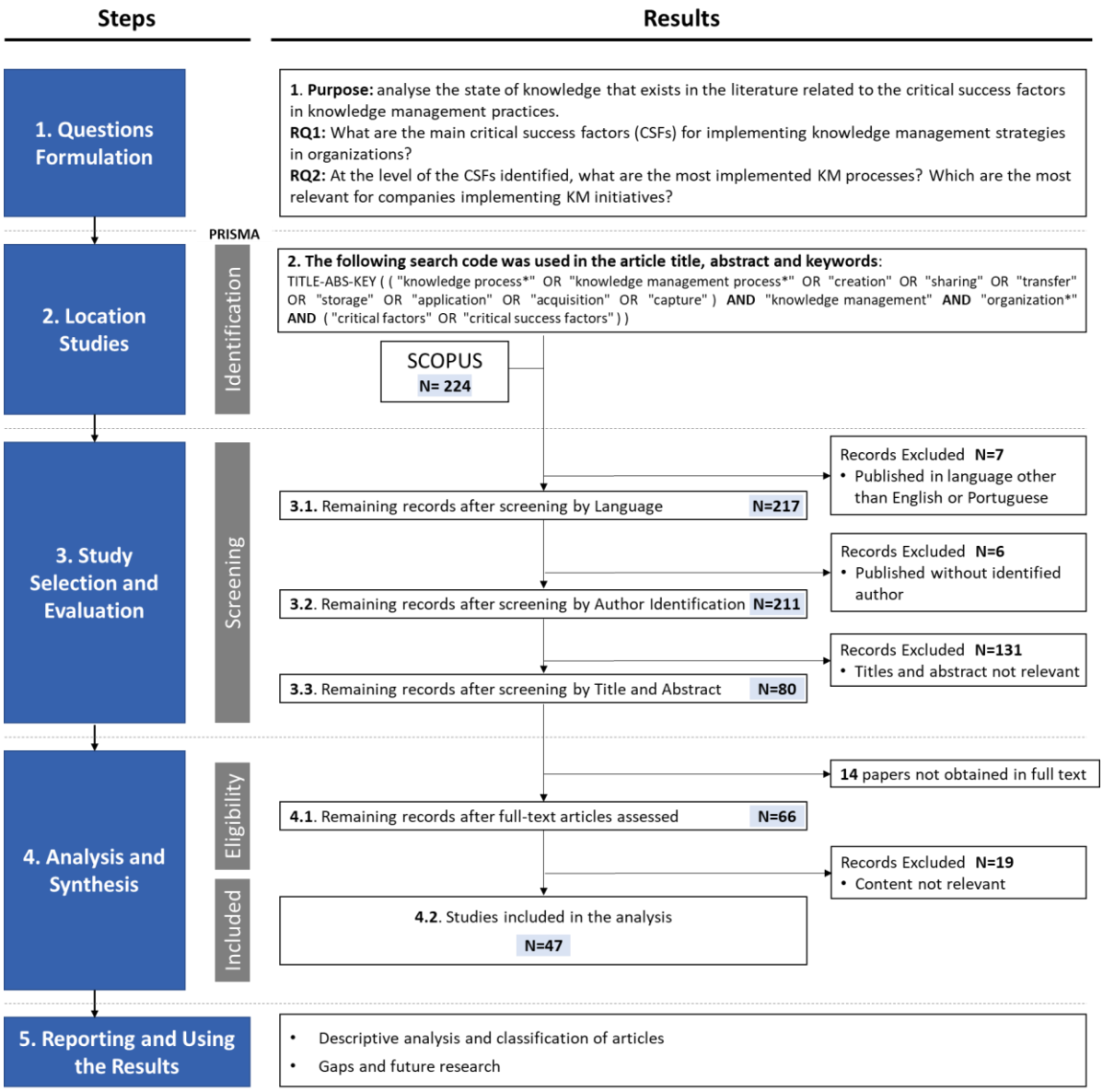

Figure 8 - Summary of the Systematic Literature Review, including PRISMA flowchart.
Source: Developed by the author

3.3. Results

3.3.1. Overview of the included articles

As shown in figure 9 the articles obtained in this research were published between 2000 and 2020. According to distribution over time, there is only one article published before 2006, precisely in the year 2000. Most of the articles are published between 2006 and 2012 (29 papers). In 2018, the number of publications increased considerably again, which did not continue the following year. From 2020, the current year of the research, there are 5 articles published until October 2020.

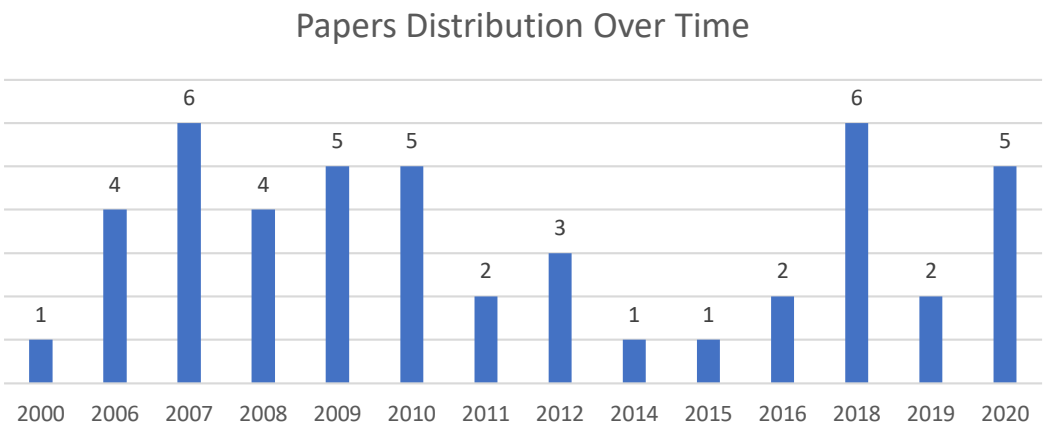

Figure 9 - Papers Distribution Over Time

Of the 47 articles in total, 33 were published in journals and 14 in conferences. Tables 5 and 6 present the journals and conferences where the articles were published, as well as the number of papers. In fact, both in terms of journals and conferences, it can be observed that there is great diversity, since most of them have only one article published. However, it is important to highlight the "Journal of Knowledge Management", being the journal with the most published articles (5 articles), followed by "Management Science Letters" and "Aircraft Engineering and Aerospace Technology", with 2 articles each.

Table 5 - Classification by journals

Journals	Number of papers
Journal of Knowledge Management	5
Management Science Letters	2
Aircraft Engineering and Aerospace Technology	2
Kybernetes	1
Journal of Business Economics and Management	1
Total Quality Management & Business Excellence	1
Expert Systems with Applications	1
Behaviour and Information Technology	1
Information & Management	1
Education, Business and Society: Contemporary Middle Eastern Issues	1
Information Sciences	1
European Research Studies	1
International Journal of Technology Management	1
Journal of Engineering Design and Technology	1
International Journal of Web Engineering and Technology	1
Knowledge Management & E-Learning	1
International Journal Learning and Intellectual Capital	1
Life Science Journal	1
International Journal of Advanced Computer Science and Applications	1

The Journal of Academic Librarianship	1
Knowledge & Process Management	1
European Business Review	1
International Journal of Management Practice	1
International Journal of Quality & Reliability Management	1
International Journal of Knowledge Management	1
International Journal of Advanced Science and Technology	1
International Journal of Scientific & Technology Research	1
TOTAL	**33**

Table 6 - Classification by conferences

Conferences	Number of papers
European Conference on Information Systems Proceedings	2
International Symposium on Knowledge Acquisition and Modeling	1
International MultiConference of Engineers and Computer Scientists	1
Portland International Conference on Management of Engineering & Technology	1
Australasian Conference on Information Systems Proceedings	1
Hawaii International Conference on System Sciences Proceedings	1
International Symposium on Automation and Robotics in Construction	1
International Conference on Computer & Information Science	1
Pacific Asia Conference on Information Systems	1
International Conference on Information Management, Innovation Management and Industrial Engineering	1
International Conference on Information Society	1
International Conference on Intelligent Human Systems Integration	1
IOP Conference Series: Materials Science and Engineering	1
TOTAL	**14**

Regarding the methodology used, studies that are quantitative are most common and represent 45% of the total, followed by studies that are qualitative (28%). In addition, 13% of the studies have applied both quantitative and qualitative methods. Lastly, 9% of the studies are conceptual and 6% are literature reviews. Generally, the studies applying quantitative methodology use questionnaires to collect data, processing it with statistical techniques such as factor analysis, multiple regressions, structural equations, among others. On the other side, in terms of qualitative methodology the most used techniques are interviews with experts and case studies. At last, conceptual studies focus on the development of conceptual frameworks and have no empirical content. Figure 10 gives a classification of the papers by methodology used.

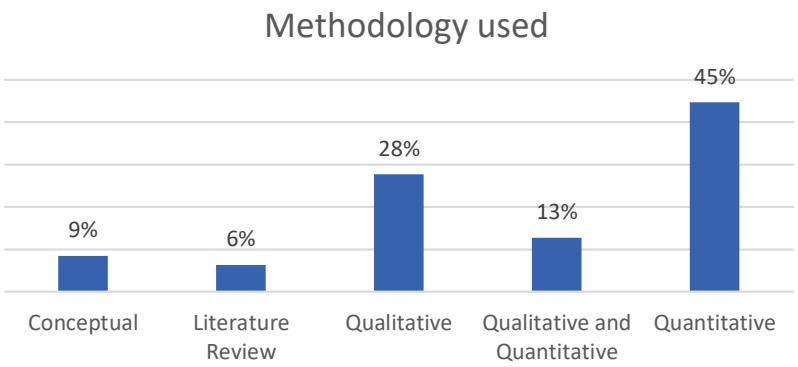

Figure 10 - Papers Distribution by Methodology used

3.3.2. Main Critical Success Factors Identified

Through the analysis of the 47 articles, it was possible to extract 461 critical factors. In order to facilitate the presentation and analysis of these factors, 4 iteration stages were performed. The procedure with these iterations is shown in figure 11 and detailed below.

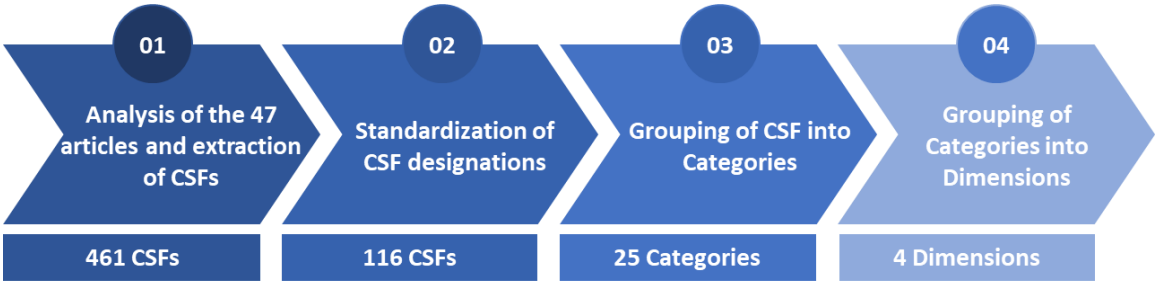

Figure 11 - Steps for CSF Compilation

After the extraction of 461 CSFs, the author removed duplicated factors and standardized the designations, using generic terms that represent synonyms. There are factors that are present in several articles, with the same meaning but using different terms. For example, to refer the "alignment between KM strategy and business needs" critical factor, Mathew & Rodrigues (2019) presented "KM strategy aligned with organizational strategy" and du Plessis (2007) referred as "linking KM strategy to the business strategy". In addition, some authors presented the factors in more detail than others - for example, Ghomi & Barzinpour (2018) presented "Culture" as a CSF in general way, unlike Alsadhan et al. (2008) which referred "Trust", "Openness", "Collaboration" and "Acceptance of Knowledge Sharing & Reuse" as CSF related to Culture. Other authors presented 2 factors in only 1 item – for example, Damodaran & Olphert (2000) presented "appropriate communication, training and support" as a unique factor, but for Xiong & Deng (2008), "effective communication" and "training" are two separate factors. With this first iteration, it was possible to standardize the initial critical factors in 116 different factors.

The next step was to group similar factors, creating categories. In providing names for each category, the author took care to ensure that these names were representative of the factors in

question as much as possible. Thus, a total of 25 categories were obtained. It is important to note that there were certain factors that did not have any similar factors and therefore some categories refer to only one factor (e.g. Benchmarking).

Finally, due to the considerable number of categories, the author still felt the need to group them in dimensions, creating 4 dimensions. Figure 12 shows the dimensions and respective categories created after the 3 interactions. This process of compiling the critical success factors was reviewed by another expert in this field and an inter-rater reliability of 93% was obtained (Armstrong et al., 1997). Appendix A presents a table detailing the 116 critical factors identified within each category and dimension.

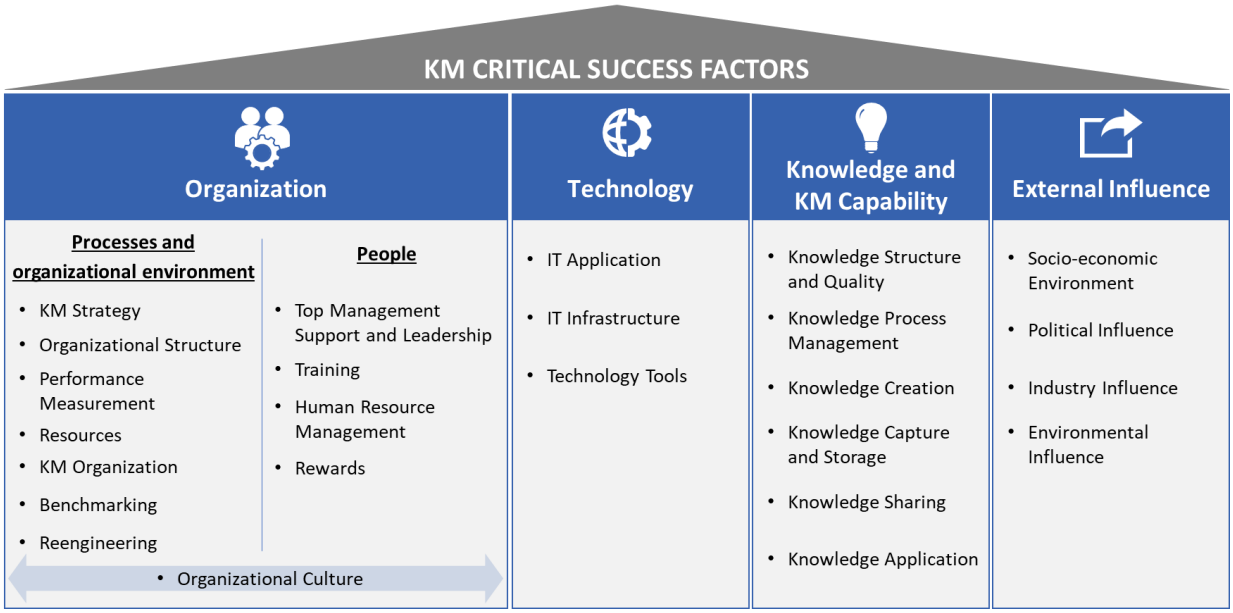

Figure 12 – Framework CSFs@KM: Critical Success Factors of KM - Dimensions and Categories
Source: Developed by the author

The 4 dimensions of the CSFs and the categories included are represented in table 7, where it is also possible to observe the percentage of papers that cited each category. The frequency of citations provides valuable information about the popularity of these factors. More popular factors are ranked higher for easy reading. Additionally, Appendixes B-E include a table for each dimension, where it is possible to observe all the papers that referred each CSFs category in a more organized way that the table in Appendix A.

Table 7 - Critical Success Factors of KM

Dimension	Category	% of Papers
Organization	Organizational Culture	87%
	KM Strategy	70%
	Top Management Support and Leadership	68%
	Training	57%
	Human Resource Management	51%
	Organizational Structure	34%
	Rewards	32%
	Performance measurement	30%
	Resources	28%
	KM Organization	21%
	Benchmarking	11%
	Reengineering	6%
Technology	IT Application	55%
	IT infrastructure	26%
	Technology tools	13%
Knowledge and KM Capability	Knowledge Structure and Quality	34%
	Knowledge Sharing	28%
	Knowledge Process Management	21%
	Knowledge Capture and Storage	11%
	Knowledge Creation	9%
	Knowledge Application	2%
External Influence	Socio-economic environment	6%
	Political influence	2%
	Industry influence	2%
	Environmental influence	2%

According to table 7, it is possible to observe that there are more important factors than others, or at least, cited more frequently in the literature. In fact, the factors related to the organization are the most relevant, especially the organizational culture, which is the most cited category. Next, categories such as KM Strategy, Top Management Support and Leadership and Training should also be highlighted. In addition, regarding the technology dimension, IT Application was also one of the most cited categories in the literature.

An overview of each of these CSF categories is provided below, grouped by dimensions.

3.3.2.1. Critical Success Factors: Organization Dimension

This dimension presents all categories of critical success factors directly related to the organization and is divided into two segments/sub-dimensions: i) processes and organizational environment and ii) people.

Processes and organizational environment contain factors related to the structure of the organization, strategy, resources and processes carried out in the implementation of the KM program. People sub-dimension includes people-related factors, such as motivational or personal development factors.

Finally, the organizational culture category, despite being related to the organization, belongs in part to the two previous segments. On one hand, culture is related to people, as they think and act. On the other hand, culture belongs to the environment of the organization as a whole.

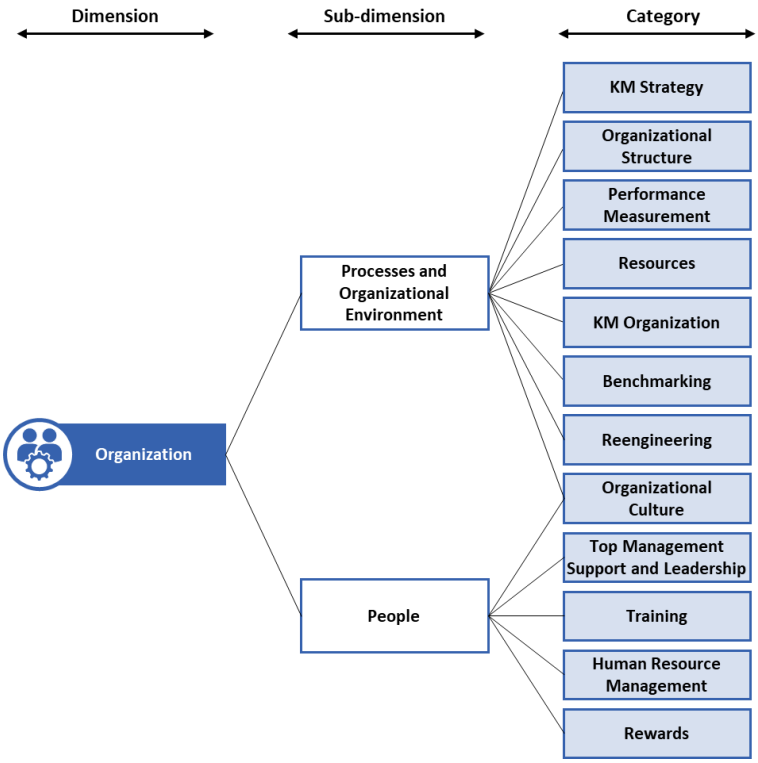

Figure 13 - Critical Success Factors: Organization Dimension
Source: Developed by the author

i) Processes and organizational environment

- KM Strategy

There seems to be common agreement in the literature that one of the critical factors for KM implementation is to have a clear and well-planned strategy (Akhavan et al., 2006), with main objectives and specially knowledge objectives (Jafari et al., 2007). It determines the needs, activities and the means for the accomplishment of the goals (Jafari et al., 2007).

The KM strategy should be aligned with business goals and include a vision of short term and long-term initiatives and benefits (du Plessis, 2007). Damodaran & Olphert (2000) also argue that knowledge management practices must be integrated with other company initiatives and institutionalized into normal working practices. In fact, KM needs to be intuitive and embedded,

since its integration with only policies and procedures is not necessarily effective (Bishop et al., 2008).

In addition, it is very important that knowledge management program has a value proposition, with a vision that inspires others to participate in the initiatives (Alsadhan et al., 2008; du Plessis, 2007). KM has to add value to employees' working environment and they have to understand that KM will improve their own knowledge too (du Plessis, 2007). For this reason, communication channels must also be established in the organization to communicate the importance, processes and achievements of KM (Alsadhan et al., 2008).

Furthermore, Akhavan et al. (2006) and Jafari et al. (2007) also advise to execute the KM program in a pilot in a first phase, instead of implementing the project immediately throughout the organization. Thus, the results of the pilot can be studied and it is possible to learn from the process and make improvements through feedbacks (Akhavan et al., 2006; Jafari et al., 2007).

- Organizational Structure

Organizational structure is another critical factor of KM mentioned in the literature. Companies must have a structure that facilitates the capture and sharing of knowledge within the organization (Jafari et al., 2007). According to Akhavan et al. (2009) and Mathew & Rodrigues (2019), the organizational structure must be flexible and dynamic. In addition, having a flat structure is another important condition for knowledge sharing, as opposed to the hierarchical or bureaucratic structure (Alsadhan et al., 2008; Xu et al., 2009).

- Performance Measurement

Performance measurement is another factor considered essential for the success of KM implementations and includes two different types: tracking and performance measurement of the KM program and performance measurement of the employees in the organization.

According to du Plessis (2007), measuring KM impact is necessary in order to enable tracking of successes and failures. Furthermore, measurement of KM enables to track the progress of KM and determine its benefits and effectiveness (Alsadhan et al., 2008). For Hassanali (2002), cited by Ghomi & Barzinpour (2018), measurement is the basis for evaluating, comparing, controlling and improving the performance of KM in organizations.

Although financial measures have been used to measure and evaluate project progress and ensure effective budget control, KM requires that non-financial and intangible measures are also considered to measure organizations' performance (Gunasekera & Chong, 2018). For example, milestones in the form of key performance indicators can be used to measure each stage of the KM project (Gunasekera & Chong, 2018). In addition, according to du Plessis (2007), some organizations measure their KM success on the number of repository entries, the number of times a knowledge repository or document was accessed, and also through surveys and questionnaires.

Besides, in order to encourage staff sharing knowledge, the evaluation of their performance is also important (Xu et al., 2009). This topic is related to the rewards category, since performance

measurement can include giving visible rewards to those who show commitment to the KM initiative (du Plessis, 2007).

- Resources

Providing necessary resources is an important factor for the success of knowledge management initiatives (Alsadhan et al., 2008; Ghomi & Barzinpour, 2018).

According to Holsapple & Joshi (2000), cited by Ghomi & Barzinpour (2018), increasing financial resources for KM activities may affect their effectiveness or the quality of their results. However, Ghomi & Barzinpour (2018) warn that the domain of the KM project should not exceed the available resources and investment decisions should be based on a detailed review of these resources. In any case, it is important that organizations view the budget for KM activities as strategic investments rather than costs (Gunasekera & Chong, 2018).

In addition, organizations also need to invest in adequate KM resources and human resources (Gunasekera & Chong, 2018). M. Y. Chang et al. (2009) suggest the use of consultants as an important factor in implementing KM programs. R. S. Chen & Hsiang (2007) refer also the importance of providing learning time and space within the company.

In conclusion, it is crucial to understand the best way of acquisition, allocation and management of resources for the successful implementation of KM in organizations (Ghomi & Barzinpour, 2018).

- KM organization

The purpose of the KM organization category is to create an infrastructure that favors KM practices.

Some authors are of the opinion that an independent team for carrying out KM activities is essential for KM implementation (Bishop et al., 2008; du Plessis, 2007; Ghomi & Barzinpour, 2018; Nazarizade & Azizi, 2018). If there are no people focused, KM related tasks will always take a back seat compared to other “more important” business matters (du Plessis, 2007). These specific KM roles can be assigned to existing posts or created new posts for it in the organization (Ghomi & Barzinpour, 2018). Additionally, Xu et al. (2009) also advocate the creation of a KM department within the organization.

Another important point that is also frequently mentioned in the literature is the appointment of a KM Champion (Alsadhan et al., 2008; Bishop et al., 2008) or a Chief Knowledge Officer (CKO) (Akhavan et al., 2009; du Plessis, 2007) and a steering committee (or another suitable title) (Alsadhan et al., 2008; Nazarizade & Azizi, 2018) to take proper decisions on development of policies and overall plans of the KM program (Nazarizade & Azizi, 2018). These champions should also take responsibility for convincing other members of staff of the benefits of the KM program (Alsadhan et al., 2008; Bishop et al., 2008). Ideally, they should be people at a strategic level within the organization, people who are respected and with influence (Bishop et al., 2008), to act as role models of information sharing (Alsadhan et al., 2008).

Finally, Jafari et al. (2007) argue that networks of experts are another enabler of KM systems, since they lead knowledge activities through communities of practice, knowledge teams and centers and scientific committees, as well as driving knowledge efforts in the organization.

- Benchmarking

Benchmarking has also been identified as a CSF for KM implementation in many studies (Akhavan et al., 2009; Alsadhan et al., 2008; Gunasekera & Chong, 2018; Kant & Singh, 2010; Othman et al., 2018). This process involves the continuous comparison with successful rivals and the improvement of internal processes (Akhavan et al., 2009). There should be a constant benchmarking for best practices within and outside the organization (Alsadhan et al., 2008), and ideally organizations should start from the inside before looking at outside (Gunasekera & Chong, 2018). Benchmarking leads to a continuous improvement of the organization's processes, generating more productivity and higher performance (Akhavan et al., 2009).

- Reengineering

Other extracted concept is reengineering, which is a process that involves replacing old and traditional ways of doing business with new and innovative ways (Akhavan et al., 2006; Jafari et al., 2007). This way, new rules emerge from the redesigned processes, determining how the new processes will operate (Akhavan et al., 2006; Jafari et al., 2007).

Since usually processes in organizations have not been well designed, considering reengineering concept, if we want to establish a KM program on a weak basis, knowledge efforts will fail (Jafari et al., 2007). Thus, the available processes in the organization must be reviewed and, if necessary, changed in order to adopt KM successfully (Akhavan et al., 2006). Reengineering helps the organization to define a value-oriented structure, in that KM can be implemented correctly (Akhavan et al., 2006; Jafari et al., 2007).

- Organizational Culture (This category also belongs to People sub-dimension)

Organizational culture plays a critical role on knowledge management implementation, since it is very important for facilitating learning, knowledge sharing and creation (Theriou et al., 2011). Culture is a pattern of shared basic assumptions and organizations learn what works and what doesn't over time (Altaher, 2010). Slagter (2007) states that it might take several years to adapt an organizational culture, but when the right culture is achieved, knowledge management programs can be very effective.

Since most knowledge processes are voluntary and much of the knowledge resides in people's minds, there should be a strong culture of trust, mutual respect, openness and transparency in all over the organization before people actually start in developing, sharing and using knowledge (Akhavan et al., 2006; Jafari et al., 2007).

Collaboration and teamwork are other two aspects considered important for knowledge management. Collaboration influences the creation of knowledge through open communication and further increases knowledge exchange (Lee et al., 2012). In addition, teams have better performance in a collaborative environment to achieve common team goals (Gunasekera & Chong, 2018).

Finally, another factor commonly referred in the literature was a learning culture. Hurley and Hult (1998), cited by Lee et al. (2012), define learning culture as the extent to which organizations encourage learning, which can be through such means as education, training and mentoring. Individual learning leads to a higher expectation of knowledge creation and, therefore, organizations should focus on both individual and group learning to increase knowledge creation and sharing and, consequently, organizational performance (Lee et al., 2012).

ii) People

- Top Management Support and Leadership

Many researches have empathized the necessity for top-level support, suggesting that without top management support a KM program will never work (Bishop et al., 2008).

It is very important that leaders share a vision of KM (du Plessis, 2007), since they are seen as the pattern of others (Ghomi & Barzinpour, 2018). Top management and leaders must believe in the value of knowledge management and support the implementation strategy, providing an example for all the employees of the organization (Akhavan et al., 2006; Mathew & Rodrigues, 2019).

In fact, when management is committed and creates an environment built on trust, it can motivate its employees to share knowledge (Bishop et al., 2008; Mathew & Rodrigues, 2019; Slagter, 2007), and it strongly affects organizational culture, norms and strategic actions (Lee et al., 2012).

Davenport et al. (1998), cited by Alsadhan et al. (2008), exemplify types of support that top management can provide, such as sending messages to the organization that KM and organizational learning are critical to the organization's success, and clarifying the most important types of knowledge for the organization. Bishop et al. (2008) add that the top-level staff must ensure that the right processes are put in place to support the initiative and that there is an understanding of what is needed for the initiative.

- Training

Training programs are very important for organizations conducting KM, since employees can get deeply familiar with knowledge concepts (Akhavan et al., 2006; Jafari et al., 2007). To have a successful participation, employees must understand how the program works, as well as in-dept training on the technology based system (du Plessis, 2007), if applicable.

On the other hand, training is an important mean for improving professional skills of the staff and facilitating knowledge sharing (Xiong & Deng, 2008). Xiong & Deng (2008) present a case study where training was an important strategy to leverage different knowledge to the collective level.

According to Yap & Toh (2020), organizations should align their training goals with business needs for continuous improvement.

- Human Resource Management

The success of KM is also dependent on human resource management (HRM), since people are the only creators of knowledge in an organization and therefore the main drivers of KM (Alsadhan et al., 2008; Ghomi & Barzinpour, 2018). In fact, any investment and technology will be useless if people are unwilling to implement KM (Lee et al., 2012). The main goal of HRM is to hire, train and retain human resources (Ghomi & Barzinpour, 2018). According to W.-C. Chang & Li (2007), it is important for organizations to adopt fit-oriented employment and to emphasize employees' career development, in order to promote knowledge sharing among employees. In addition, Ghomi & Barzinpour (2018) warn about the prevention of the exit of knowledge through the withdrawal of experience personnel from the organization, which is another crucial issue that HRM must manage.

- Rewards

Rewards and incentives for employees are also considered essential to the success of knowledge management in organizations (Bishop et al., 2008; du Plessis, 2007). Du Plessis (2007) argues that recognition for participation in knowledge management initiatives is indispensable. Some authors recommend financial rewards while others suggest using non-financial rewards (Bishop et al., 2008).

However, it should be noted that extremely individual incentives for 'knowledge production' may encourage workers to see their innovative ideas as resources and refuse to share them with others (R. S. Chen & Hsiang, 2007). Hence, organizations should provide incentives for knowledge creation and sharing and support staff with innovative knowledge work (R. S. Chen & Hsiang, 2007). According to du Plessis (2007), an effective incentive system should consist of push and pull rewards: rewarding employees according to their participation in the KM program (push) and incentivizing them to use the knowledge base to provide a platform for sharing ideas (pull).

On the other hand, Xu et al. (2009) defend that employees should be criticized or punished if they do not participate in the KM program.

Table 8 presents the main ideas and keywords of each category belonging to the Organization dimension.

Table 8 - Summary of Organization Dimension

CSFs Category	Key-terms
KM Strategy	Clearly articulated KM strategy; Alignment between KM strategy and business needs; Integration with other initiatives and work practices; KM value proposition; Strategic planning; Pilot
Organizational Structure	Flexible organization structure; Decentralization; Formalization; Flat structure
Performance Measurement	Performance measurement; Financial performance; Non-financial performance; KM progress tracking and measurement
Resources	Availability of resources; Financial resources; Free time and space; Use of consultants
KM Organization	KM roles and responsibilities; KM department; Specialized KM team; KM champions and leaders; Chief Knowledge Officer; Knowledge communities; Network of experts
Benchmarking	Benchmarking
Reengineering	Reengineering
Organizational Culture	Trust; Collaboration; Openness; Teamwork; Transparency; Knowledge creating and sharing culture; Learning culture; Common vision and goals
Top Management Support and Leadership	Top management support; Leadership
Training	Training
Human Resource Management	Human resources and human capital; Employees motivation, commitment, involvement and retention; Job security
Rewards	Incentives and rewards

3.3.2.2. Critical Success Factors: Technology Dimension

Technology is considered as one of the critical enablers of KM in an organization (Mathew & Rodrigues, 2019; Theriou et al., 2011). This dimension includes the application of information technology in general, technology tools to be used in the KM system, as well as some important factors related to the system infrastructure.

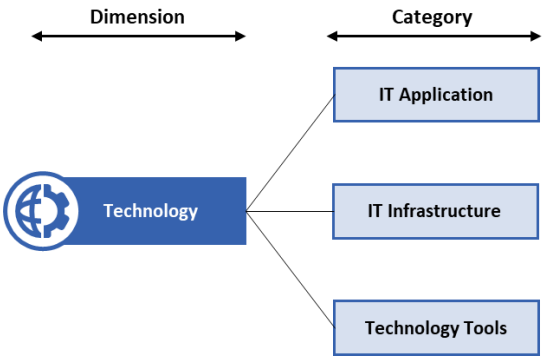

Figure 14 - Critical Success Factors: Technology Dimension
Source: Developed by the author

- IT Application

The information technology (IT) factor was suggested by many researchers as a critical factor for KM implementation. According to Koloniari et al. (2018), IT support is the degree to which IT tools is sufficient to support the daily work as well as collaboration and communication among employees.

IT can support KM processes where knowledge acquired by employees can be captured and transferred to others through different channels such as e-mail, databases and through other means, such as the Intranet (Gunasekera & Chong, 2018). Several types of knowledge can be stored and accessed, thus supporting the knowledge sharing process (Lee et al., 2012). According to Gunasekera & Chong (2018), improving accessibility to knowledge helps the creation of a knowledge sharing environment.

There are many information technologies that can be integrated into an organization's technological platform, working together as a knowledge management system (KMS) (Theriou et al., 2011). The design of the KMS should be friendly and easy to use and navigate (Alsadhan et al., 2008; Lin & Lin, 2006; Mathew & Rodrigues, 2019; Xu et al., 2009). In fact, it must attract and maintain users' attention (Butler & Murphy, 2007).

In addition, it is worth referring that IT is just an enabler of KM (Gunasekera & Chong, 2018) and should not be seen as a sole driver, since it is only a tool (Theriou et al., 2011). Furthermore, different views of people and IT factors should not be separated; on the contrary, it is important to suggest how IT adequately support systems based on content or collaboration (Lee et al., 2012). Bishop et al. (2008) also suggest that to achieve the right balance, an organization should strive to keep its people-oriented KM activities, while ensuring that the right technology is in place.

Finally, Bishop et al. (2008) state that there should be an alignment between business and technology. It is crucial for KM teams to align closely with IT department to ensure that IT business requirements are understood and translated correctly in a technology environment that can support KM (Bishop et al., 2008).

- IT Infrastructure

Besides the use of IT, it is crucial for any KM initiative to include infrastructure management, which includes the technology itself, training and support (du Plessis, 2007). Alsadhan et al. (2008) conclude in their research that building an effective IT infrastructure is an important factor in KM implementation. In fact, the use of IT entails an inherent risk of losing control over the flow of knowledge, and it is important that appropriate support measures are in place (du Plessis, 2007).

In addition, in order for the knowledge to be continuously captured in the organization, the identified work processes and IT systems must allow the entry of data from different sources, which includes the integrated technical infrastructure (Aggestam & Persson, 2010).

However, since the knowledge management system can deal with highly sensitive issues, organizations also identify a need for security and protection of knowledge (Butler & Murphy, 2007; du Plessis, 2007). Nyame & Qin (2020) advocate a knowledge access control policy, which is a

security-based mechanism to regulate the ability of people to access valuable organizational objects (Nyame & Qin, 2020). According to the authors, access control capability is the most secure way to improve the integrity, confidentially and quality of knowledge (Nyame & Qin, 2020).

- Technology tools

The use of technological and collaborative tools is also an important factor for the implementation of KM. The presence of collaborative tools enables interdepartmental collaboration (Mathew & Rodrigues, 2019).

Several authors suggested to structure a knowledge base, creating a knowledge repository (Damodaran & Olphert, 2000; du Plessis, 2007; Jafari et al., 2010; Mathew & Rodrigues, 2019). Knowledge structures lead to easier navigation, organization and knowledge retrieval, and should be flexible and able to adapt as the business environment changes (du Plessis, 2007). Mathew & Rodrigues (2019) also argue that a well-organized KM repository is a requirement for faster recovery of relevant knowledge.

In fact, du Plessis (2007) identifies search and retrieval functionality as a critical success factor for the technology selected for a KMS, which can increase the target rate of retrieval and usage of knowledge. Search engines help employees to find the right knowledge at the right time (Mathew & Rodrigues, 2019). According to the authors, simple object access protocol based web applications also support knowledge sharing and collaboration, as well as content management systems that are well regarded, especially in software firms (Mathew & Rodrigues, 2019).

Table 9 summarizes the CSFs categories of the Technology dimension.

Table 9 - Summary of Technology Dimension

CSFs Category	Key-terms
IT Application	Technology; IT application; Friendly and easy to use KM system; Balance between people and IT; Alignment between business and technology
IT Infrastructure	Effective IT infrastructure; Security; Access to network infrastructure and hardware
Technology tools	Knowledge repository; Collaborative tools; Functions of KMS (search and retrieval functionality)

3.3.2.3. Critical Success Factors: Knowledge and KM Capability Dimension

This dimension includes factors related to the structure and quality of knowledge to be used, the knowledge processes in general and also the KM processes capability, which in turn is related to the efficiency of each KM process in the organization.

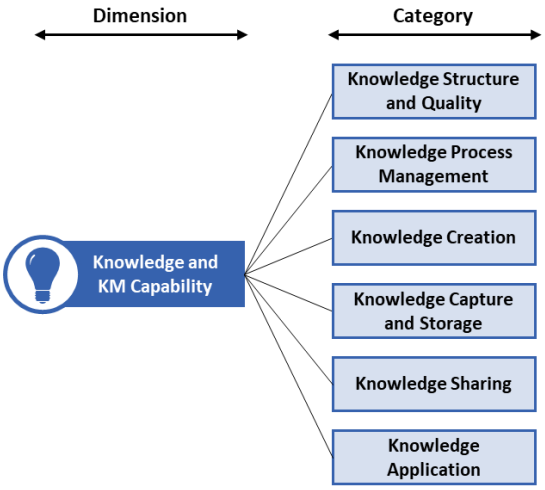

Figure 15 - Critical Success Factors: Knowledge and KM Capability Dimension
Source: Developed by the author

- Knowledge Structure and Quality

Knowledge structure and architecture also affect the success of KM. According to Akhavan et al. (2006) and Jafari et al. (2007), knowledge architecture can be defined as a set of principles and standards which guides the engineering (high level design, detailed design, selection, construction, implementation, support, and management) of an organization's KM system infrastructure. It focuses on KM through a systematic approach, integrating all factors related to KM to prepare a suitable architecture for knowledge in the organization (Jafari et al., 2007). Organizations need to institutionalize a comprehensive and robust knowledge architecture that leverages knowledge in a more effective way (Nyame & Qin, 2020).

Furthermore, several authors revealed that having an appropriate knowledge structure and map is another critical success factor for KM implementation (Aggestam & Persson, 2010; Alsadhan et al., 2008; Arif & Shalhoub, 2014; M. Y. Chang et al., 2009; Xu et al., 2009; Yang et al., 2010). It is crucial for an organization to understand the content needed, where and how it can be made available, and to ensure its capture (du Plessis, 2007). Knowledge elements must be identified at the beginning of a KM implementation and should be linked to the contents in which they are used as well as the individuals who use them (du Plessis, 2007). According to Greco (1999), Martiny (1998) and Mullin (1996), cited by du Plessis (2007), the focus should be on knowledge critical to the business. Moreover, this factor is also related to the quality of information, since having current and relevant content was also identified as critical to the success of KM (Alsadhan et al., 2008; du Plessis, 2007; Mathew & Rodrigues, 2019; Mohammadi et al., 2009; Othman et al., 2018). Mohammadi et al. (2009) define quality of information as "the extent to which one felt that he or she had useful and meaningful information throughout the change process".

Lastly, in order to assess the effect of KM, Mohammadi et al. (2009) suggest the construction of an adequate knowledge management maturity model, from which organizations can find and solve the problems of KM in time.

- Knowledge Process Management

As previously mentioned, knowledge management processes are crucial for any KM program. Ghomi & Barzinpour (2018) define KM processes as the processes that are conducted with knowledge within an organization.

It is crucial to understand how knowledge is created, captured, shared and used, as well as how organizations can improve these (du Plessis, 2007). Ruggles (1998), cited by Ghomi & Barzinpour (2018), states that when implementing KM, 25% of time and budget is allocated to the processes. Thus, organizations should establish processes to all phases of the knowledge management lifecycle, e.g. processes to create, capture, share and apply knowledge (du Plessis, 2007). These processes should be precise and easy to follow (Othman et al., 2018).

According to Lo & Chin (2009), organizations should identify the requirements and design knowledge processes to provide values and achieve KM success, and at a later stage evaluate the performance of these processes to establish priorities and improvement goals. In order to improve processes and eliminate waste and barriers, Lin & Lin (2006) also advise to establish mechanisms for examination and approval of knowledge material.

In summary, processes provide structure and standards to the KM initiative and ensure that roles and responsibilities are clearly defined, which is crucial for the success of KM implementation (du Plessis, 2007).

- Knowledge Creation

Despite being indirectly involved in the implementation of KM, some authors have identified the knowledge creation process as a critical factor (Kant & Singh, 2010; Yang et al., 2010). Yang et al. (2010) define knowledge creation as the development of new content or the replacement of existing content within the tacit and explicit knowledge of the organization.

Still related to the creation of knowledge, Kant & Singh (2010) and Nyame & Qin (2020) also identified innovation as an enabler of the success of KM implementation. The effect of innovation in a KM environment is to increase the rate at which new knowledge is recognized and accepted for use for further increased innovation (Nyame & Qin, 2020). The presence of knowledge innovation capability, besides increasing the intention and behavior of knowledge innovation, also impacts adaptive system strategies and reinforces entrepreneurship of knowledge in the organization (Nyame & Qin, 2020).

- Knowledge Capture and Storage

Knowledge capture and storage is another necessary factor for a successful KM adoption. After correct capture and identification of knowledge in the organization, this knowledge should be stored in knowledge bases and repositories (Akhavan et al., 2006). Knowledge capture gathers internal and external sources of knowledge and imports them into the repository, establishing the

classification structure for future use of knowledge (M. Y. Chang et al., 2009). In fact, if an organization cannot truly capture and store its knowledge, the most important property of the organization (knowledge) can easily be lost, or else incur in undesirable outcomes (Akhavan et al., 2006, 2009).

- Knowledge Sharing

As previously stated, knowledge sharing is crucial on implementing and executing a KM system (Akhavan et al., 2006; Jafari et al., 2007). According to Yang et al. (2010), sharing of knowledge can be formal or informal, personal or impersonal with multiple channel. In fact, the selection of the most effective channels for knowledge sharing is essential for the success of KM (Abdel Moneim M.Baheeg Ahmed & Hegazy, 2006; du Plessis, 2007; Gunasekera & Chong, 2018; Kant & Singh, 2010). Examples of channels for knowledge sharing include face-to-face interactions, regular meetings, sharing of best practices and lessons learned, mentoring and coaching, intranets, e-mails, conferences, etc (du Plessis, 2007; Gunasekera & Chong, 2018; Jafari et al., 2007, 2010; Kant & Singh, 2010). These channels support knowledge dissemination for the better performance of the organization (Kant & Singh, 2010). However, the use of channels depend on the culture of each organization (du Plessis, 2007).

- Knowledge Application

Yang et al. (2010) also identified the process of knowledge application as a critical success factor for KM adoption. The performance of an organization depends on the ability to apply knowledge to deliver products or services using its own capabilities (Nielsen, 2006).

The main keywords of each category from this dimension are presented in Table 10.

Table 10 - Summary of Knowledge and KM Capability Dimension

CSFs Category	Key-terms
Knowledge Structure and Quality	Knowledge structure and map; Knowledge architecture; Variety of knowledge sources; Quality of information
Knowledge Process Management	Managing knowledge throughout its lifecycle; KM processes and procedures; KM processes easy to follow; Managing explicit and tacit knowledge
Knowledge Creation	Knowledge Creation; Innovation
Knowledge Capture and Storage	Knowledge Capture; Knowledge Storage
Knowledge Sharing	Knowledge sharing; Multiple channels for knowledge sharing; Specialized meetings, conferences and seminars
Knowledge Application	Knowledge Application

3.3.2.4. Critical Success Factors: External Influence Dimension

This dimension focuses on factors that are beyond the organization's control. According to Gunasekera & Chong (2018), the identification of external factors allow organizations to identify threats and opportunities and map them to their strengths and weaknesses in projects execution.

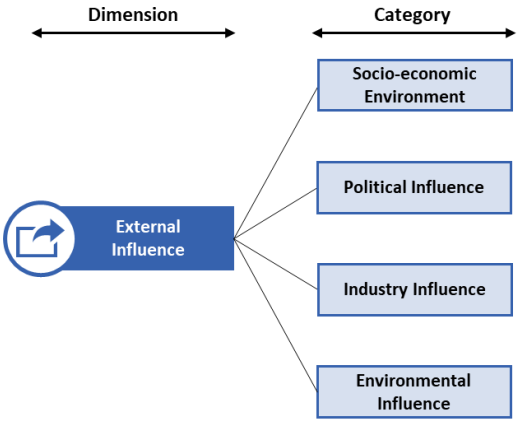

Figure 16 - Critical Success Factors: External Influence Dimension
Source: Developed by the author

- Socio-economic environment

Sadovykh & Sundaram (2015), Othman et al. (2018) and Gunasekera & Chong (2018) identified the socio-economic environment, the economic-financial situation and the level of social capital inside and outside the organization as important factors for KM. According to Gunasekera & Chong (2018), the success of the projects may depend on the social influence, which may come from various stakeholders who have an interest in the projects. In addition, economic policies can influence the performance of projects and the sustainability of organizations, so it is important to be aware of both economic stability and economic policy to expand the internal capabilities of organizations, especially in the construction sector (Gunasekera & Chong, 2018).

- Political influence

Regarding construction industry in particular, Gunasekera & Chong (2018) state that politicians are increasingly becoming an important project stakeholder, particularly in large infrastructure projects. Therefore, they have an influence on project activities and on the definition of project success, especially when projects are defined by government regulations (Gunasekera & Chong, 2018).

- Industry influence

According to Gunasekera & Chong (2018), industry-related factors also have an influence on the success of KM, especially in construction organizations. Firstly, organizations will need to look for resources from outside the industry or even country, which can be subcontractors, suppliers and human or other physical resources (Gunasekera & Chong, 2018). In addition, market prices of materials and labor can influence KM processes.

- Environmental influence

The natural environment depends on many factors beyond the control of human beings (Gunasekera & Chong, 2018). Although adverse weather conditions are largely inevitable, Gunasekera & Chong (2018) state that using KM processes to obtain and share information on environmental influence is critical for organizations, in particular construction organizations, since the information gathered and stored can be used to make predictions on the effect of environment on the duration, cost and quality of projects.

Table 11 - Summary of External Influence Dimension

CSFs Category	Keywords
Socio-economic Environment	Economic stability; People affected because of the project activities; People benefiting from the project
Political Influence	Sources of finance; Regulations; Confidence of politicians; Adaptability to amendment of project plans
Industry Influence	Availability of external resources; Subcontractors and suppliers; Market prices of materials and labor
Environmental Influence	Weather conditions; Ground conditions of projects

3.3.3. Knowledge Management Processes

Regarding KM processes, the processes used and/or highlighted throughout the articles under study were also identified.

As previously mentioned, this research focuses on these four main processes: (i) Knowledge Creation, (ii) Knowledge Sharing, (iii) Knowledge Capture and (iv) Knowledge Application. It should be noted that, through the reading of the articles, some authors identified other very similar processes that fit into these four (e.g. knowledge transfer was considered as knowledge sharing, due to the similarities of these processes in the literature). In addition, the process of knowledge storage was also widely cited and, for this reason, was grouped into “Knowledge Capture and Storage”, since the capture process can be defined as the inclusion of knowledge into the existing knowledge base of an organization (Nielsen, 2006). Figure 17 summarizes the frequency of citations of the KM processes identified in the 47 articles.

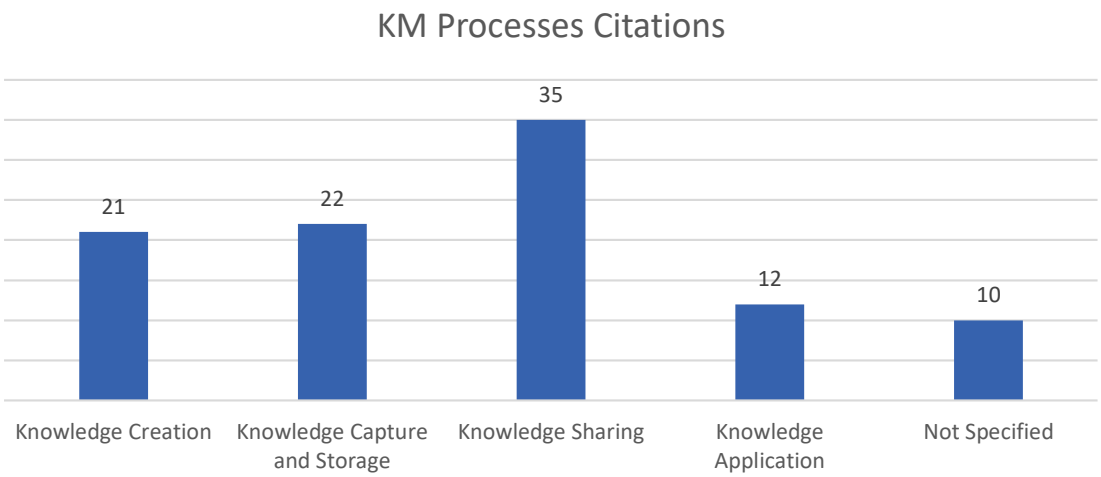

Figure 17 - KM Processes Citations

As can be seen in the graph above, Knowledge Sharing is the most cited KM process in the articles, where there is more focus when implementing KM practices. Of the 47 articles, 35 identified Knowledge Sharing.

Secondly, Knowledge Capture and Storage is highlighted with 22 citations, followed by Knowledge Creation with 21 citations. In fact, organizations also look for methods and techniques for knowledge creation and capture, with the subsequent objective of being sharing among the organization.

Regarding Knowledge Application, this process has been explicitly mentioned only 12 times, which does not mean that it is less relevant and is not implicit in KM strategies. In fact, although KM processes are almost always mentioned in the literature review section of the articles, not all papers focus on the processes most used in the KM strategies. 10 articles did not highlight any specific KM process when they presented the critical success factors, however, since they mentioned the implementation of KM initiatives in general, they were always based on KM processes.

It is important to note that, in a general manner, when presenting the CSFs, the authors of the articles did not relate them to just one particular KM process, but to the KM initiative or strategy in general.

3.4. Discussion and Final Remarks

This study proposes a comprehensive investigation of the critical success factors of KM implementations in organizations. Through the synthesis of 47 articles, 25 categories of CSFs were extracted, forming a support base for organizations that are implementing KM initiatives. In addition, this research had the second objective of understanding which KM processes are most relevant to organizations.

Of the 4 dimensions of CSFS presented in this study, the results show that the factors related to the organization are the most important in KM implementations. Firstly, because this is the dimension

with the largest number of CSF categories identified, and secondly, because these categories are the most cited in the literature.

Furthermore, the results reveal organizational culture as the most important factor for the success of knowledge management, a fact that was also concluded by other authors (Mathew & Rodrigues, 2019; Theriou et al., 2011). In fact, promoting a culture of sharing and creating knowledge, trust, mutual respect and collaboration is crucial when implementing KM, since if employees are not willing to share knowledge, the initiative will fail. Therefore, organizations that want to succeed in KM implementation should focus on creating a culture of collaboration as a prerequisite.

The second most cited CSF, which also belongs to the organizational dimension, is the KM strategy. According to Akhavan et al. (2006), strategies show the way to reach objectives. The implementation of KM in an organization is not an easy or fast process, so it is fundamental to have a well-defined and concise strategy, with concrete objectives and goals to achieve success. In turn, this strategy must be aligned with the organizational strategy and be communicated to the organization, with a vision that inspires others to participate in KM initiatives.

In general, the results suggest that the factors related to People are the ones that have the greatest impact in the implementation of KM. Besides the organizational culture, mentioned above, factors such as top management support and leadership, training, human resources management and rewards have been frequently mentioned in the literature. In fact, since most of the organizational knowledge resides in people and they are the main conveyor of knowledge (Igbinovia & Ikenwe, 2018), the significance of these factors becomes evident, as concluded by other authors (Akhavan et al., 2009). It is crucial to adopt mechanisms and procedures that support and motivate people to participate in KM initiatives.

In addition to People, as mentioned before, any KM practice should also be based on Technology and Processes (Igbinovia & Ikenwe, 2018). In fact, there is no doubt that IT facilitates knowledge management, which can also be observed through the results of this study - for example, 26 papers presented factors related to the IT application as critical to the success of KM. However, technology cannot be seen as a single facilitator to KM, as it will never work by itself. Therefore, it serves as a support to people and processes involved, as perceived by Igbinovia & Ikenwe (2018).

In terms of knowledge processes (knowledge creation, capture and storage, sharing and application), there are some authors who identify the capability of these processes as critical factors to the implementation of KM, however, this aspect is not consensual. Most researchers identify CSFs to the implementation of KM indirectly contemplating knowledge processes in general, and not the processes in particular. Nevertheless, knowledge process management was identified as a critical success factor in 10 papers.

In any case, within the CSFs, the ability to share knowledge stands out from other processes, which is supported by the second part of the results. As previously mentioned, knowledge sharing is the most cited KM process in the papers analyzed, followed by knowledge capture and storage and knowledge creation. This fact answers the second question of the present study, what are the most relevant KM processes. Most companies begin to implement KM practices with the main objective of knowledge sharing within the organization, since one of the main problems is knowledge residing only in the mind of employees. However, almost no author has related CSFs to a particular

knowledge process, but to the KM initiative in general. This leads to the conclusion that for KM initiatives to be successful, it is important to integrate all processes, not just share knowledge, for example.

Finally, it is also important to refer that there were only 3 articles that mentioned external influence factors as critical to KM success (Gunasekera & Chong, 2018; Othman et al., 2018; Sadovykh & Sundaram, 2015). According to Sadovykh & Sundaram (2015), the unpopularity of these topics can be explained by the concept of context which, although it has been increasing weight in the literature, there are still many authors who consider the role of context irrelevant for organizations seeking to promote KM practices. On the other hand, the results obtained have shown that the CSFs of external influence are very much related to the sector of the organization, such as the construction sector demonstrated by Gunasekera & Chong (2018). Thus, the author concludes that the external factors are less referred to in the literature since knowledge management depends a lot on factors inherent to the organization, such as people, processes and technology. Except for certain situations, factors that are outside the control of organizations are not critical to the success of KM implementations, however, they should not be totally ruled out.

In conclusion, the results of this study will help organizations to understand how they can enhance the success of KM implementations. Unlike other studies that identify CSFs limited to particular sectors, this study is comprehensive enough for any organization that wants to implement KM practices. The identification of these CSFs facilitates organizations to understand which areas should be improved and which are the main measures to take in order to succeed in the KM implementation. In any case, it should be noted that each organization is different and therefore its current state of KM implementation should be well reflected, as well as which success factors will best fit its context.

This research also has limitations. The present study focuses on specific KM processes, and since there is still a lot of divergence in the literature regarding the main processes (or at least concepts), it may not have covered all KM processes and CSFs. Future research may focus on identifying CSFs covering all KM processes, or none at all, since KM implementation includes the entire cycle of KM processes.

4. Case Study: Implementation of Knowledge Management in an Organization and CSFs identified

This chapter introduces a case study embarking on a KM initiative implementation. The main purpose of the study was to investigate how the company had approached the implementation of KM.

Initially, it contains relevant information about the initial problem of the organization where the project took place, as well as the main goals of the project and methodology used. Then, the strategy used in the implementation of a KM initiative is presented, namely the identification of knowledge areas, organizational roles, methodology used and main results obtained. Finally, a reflection is made on the critical success factors for KM initiatives identified in the case study, based also on the work developed in chapter 3.

4.1. Problem Contextualization and Main Goals

The case study was conducted within a multinational wood-based panel organization, referred as Company A, for the purposes of confidentiality, with the integration of a consulting company. As already mentioned, currently Company A has 23 industrial and commercial units in 9 locations spread over 2 continents and around 3000 employees, where more than 1600 work in operational areas. In addition, Company A's products can be found in over 75 countries.

The organization was facing some challenges regarding the loss of organizational knowledge that could be critical for the company's future. In Company A, knowledge was mostly resident in key peoples' minds and spread along the organization. For this reason, there was a risk of losing critical knowledge with the planned exit of key knowledge holders in coming years due to retirement, especially in maintenance and production areas. For example, in 2020 there were 166 employees with average 29 years of experience in the company, planning for retirement in the next 5 years. In addition, the organization did not have adequate training programs to transfer knowledge between employees - 40% of performance assessment processes had comments regarding training needs, in 2020.

For the reasons above, Company A considered essential that senior employees who leave the company have the opportunity to teach and share their knowledge with younger generations. Therefore, the organization decided to implement a Knowledge Academy with the main purpose of identify, collect and standardize its core and critical knowledge, aiming to retain and transmit it. The key objectives of the purposed solution are:

- Minimize the loss of organizational knowledge;
- Design more effective training programs and development plans;
- Improve competitive advantage;
- Align talent management with the business.

The project started in 2018, developed under the support of a dedicated team. The author joined the implementation team in September 2019, as an external consultant.

4.2. Methodology

As a member of the implementation team, the researcher was able to interact directly with different types of people from Company A, being involved in the various stages of the project. The methodology used for the research was mainly participant observation, since the researcher has been immersed in a "setting" of research and could experience and observe at first hand a range of dimensions in and of that setting (Mason, 2002). Participant observation occurs when a researcher participates in the daily activities and interactions of a group of people, learning aspects about their routines and culture (DeWalt & DeWalt, 2011).

In fact, the researcher had the opportunity to observe, participate, interrogate, listen and communicate during her experience in the project. According to Mason (2002), this set of activities is often referred to as fieldwork. For several months, the researcher was in the organization on a daily basis, participating in meetings with different stakeholders, organizing initiatives and workshops, both related to knowledge processes and project management. Additionally, the researcher visited several plants of Company A, where she could also observe specific practices and procedures. As a participant observer, the author has taken notes throughout her experience, in order to fundament and develop her research on the KM critical success factors.

4.3. Knowledge Academy Implementation

As previously mentioned, the process of implementing KM is an extensive procedure that requires a great commitment from the organization in order to achieve results (Smuts et al., 2009). The resultant information solicited from the Knowledge Academy implementation is organized into four key topics: identification of knowledge areas, organizational roles and responsibilities, methodology for knowledge capture and sharing and main results.

4.3.1. Identification of Knowledge Areas

One of the first tasks that Company A conducted in its KM program was to identify the areas of critical knowledge that should be captured and organized. In this sense, six knowledge pillars were identified, aligned with the organization's Product Lifecycle (Almeida, 2019):

1. Onboarding;
2. Product & Applications;
3. Production, Technology & Equipment;
4. Market;
5. Sourcing;
6. Safety, Environment & Risk Management.

Table 12 explains each knowledge pillar to provide an overview of the contents.

Table 12 - Knowledge Pillars or Areas

Knowledge Pillar	Description
Onboarding	This pillar corresponds to the phase of receiving new employees and convers basic knowledge related to the other knowledge pillars, necessary for an initial training.
Product & Applications	This area captures knowledge related to Company A's products, describing the products, their history, properties and types, applications and also processing recommendations.
Production, Technology & Equipment	Knowledge contained in this pillar is that related to production processes, production stages in terms of tasks detail and specific knowledge, equipment used and available technologies.
Market	This pillar deals with main clients, sales and key market characteristics per region, capacity and main competitors per region, market trends and marketing and sales strategy.
Sourcing	Sourcing pillar is concerned with raw materials used for production in each geography, characteristics and the purchasing process.
Safety, Environment & Risk Management	This area includes knowledge related to environment requirements, safety rules/procedures and regulations in the sector.

On the other hand, besides the identification of knowledge areas and main contents to address, the type of information that is out of scope of the Knowledge Academy was also identified. Thus, knowledge that can be obtained outside Company A (e.g. soft skills training) as well as location-specific business knowledge (e.g. work instructions for each plant) was not included.

In addition, three levels of knowledge detail were created (Almeida, 2019). These detail levels determine the respective depth of information, as well as its applicability for each function, and are presented in table 13.

Table 13 - Knowledge Detail Levels
Source: Adapted from Almeida (2019)

Knowledge Detail Level	Description
Fundamentals	This level aims to share basic knowledge regarding each knowledge pillar. This information must be Company A's specific and transversal to every function/location. It is applicable to any employee that needs this kind of information to perform his/ her job.
Advanced	The advanced level aims to share detailed and deep knowledge regarding each knowledge pillar. This information must be Company A's specific and transversal to every function/location. It is applicable to employees that work directly with this kind of information to perform their job.
On-the-job (out of scope)	The on-the-job training level aims to ensure that specific knowledge by location or knowledge that cannot be shared through structured platforms is shared with the employee directly through the respective peers or supervisor/ manager.

It is important to note that the on-the-job training level is out of scope of the Knowledge Academy since, as mentioned above, location-specific business knowledge was not included in the initiative.

4.3.2. Organizational Roles and Responsibilities

Another step that was also conducted in the Knowledge Academy implementation was the creation of roles and respective responsibilities.

Firstly, a department was created at Company A with a team focused only on topics of the Knowledge Academy. The main responsibilities of this team are to plan, coordinate and implement the initiative according to the established plan. In the initial phase, where the author also participated, this team had the support of two external consultants.

Secondly, for each knowledge pillar a pillar owner has been identified. The pillar owners are the ultimate accountable for the respective knowledge pillar. They are influential people, with several years of experience at Company A, and have the responsibility to define the scope and structure of their pillar, choose contents and priorities, among others. In turn, pillar owners also must identify topic owners, who are experts in more specific topics to be addressed (Almeida, 2019).

Table 14 summarizes the main stakeholders of the KM initiative and their responsibilities.

Table 14 - Project Stakeholders and main responsibilities
Source: Adapted from Almeida (2019)

Stakeholders	Main Responsibilities
Steering Committee (Executive Committee Member)	• Global program coordination and strategic guidance; • Approve and make decisions regarding the final deliverables of the project; • Provide inputs to core team assuring the best link of the Company strategy and Knowledge Academy outputs.
Core Team	• Coordinate & monitor activities defined in Knowledge Academy Methodology Guidelines; • Propose and/or develop structure for training models in order to boost strategic goals; • Convert costumer, pillar owners and other internal costumer needs in structured knowledge and/or training models' requirements; • Stimulate identification of improvements and standardization opportunities; • Report Knowledge Academy activities, progress and performance; • Cooperate in training rollouts with HR departments; • Provide, in cooperation with Pillar owners, contents revision cycles and updates.
Consultant Partner	• Ensure compliance with project timings, interface with the Knowledge Academy interlocutors and conduct quick responses to overcome obstacles; • Develop and manage the delivery of the project and its outputs.
Pillar Owners	• Define and align the scope and structure of the pillar area (clarify the specific knowledge that is out of scope);

	• Identify the content and the priorities of knowledge pillar that will compose the different manuals/training modules; • Validate the final version of each training module and training path, according to the depth of detail and the respective target functions; • Point out the knowledge topic/operational owners and the stakeholders responsible for the validation process; • Ensure commitment and availability from everyone involved in the process; • Identify potential trainers for each area and/or plant, according to the training module goals and content; • Monitor and develop activities defined in Methodology Guidelines.
Topic Owners	• Provide know-how and relevant documentation; • Support the pillar owner on the development of the training module (e.g. data gathering, content validation, others) • Identify improvements and standardization opportunities • Follow-up and report to pillar owners the progress and status of the initiatives;
Validation Committee	• Validate final version of the training module in a trainee perspective, evaluating the content, feasibility and expected impact
Trainers	• Provide expertise during the trainings for specific modules/areas • Support trainees in e-learnings execution contributing to increase the training impact

4.3.3. Methodology for Knowledge Capture and Sharing

Having discussed the key components of Company A's KM initiative, this section will describe the methodology used to capture and share knowledge. The approach is divided into six main steps, as shown in figure 18, and it starts when a need to capture knowledge is identified.

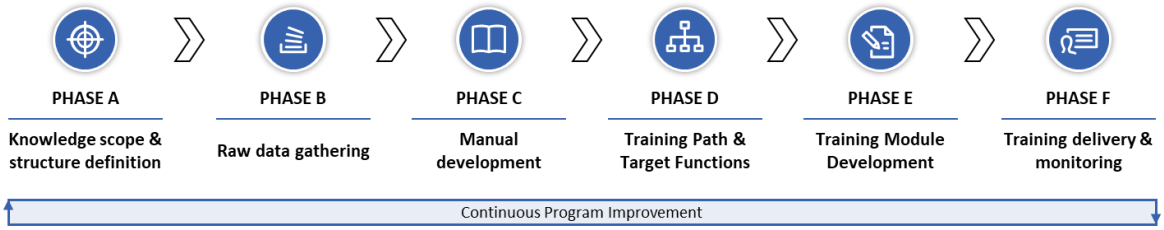

Figure 18 - Knowledge Capture and Sharing Methodology
Source: Developed by the author

Each of the phases of the methodology is explained below and modeled using Business Process Model and Notation 2.0 (BPMN) for a better visualization of the processes. BPMN is a graphical language, with simplicity, and provides standardization and support for processes (Arevalo et al., 2016). According to Dumas et al. (2018), modelling a process helps to better understand the process and to identify and prevent issues.

Phase A: Knowledge Scope & Structure Definition

In the first stage, the implementation team should arrange a meeting with the knowledge pillar owner to define the knowledge scope and the structure of the pillar area. It is important to define the topics/operational owners that will be responsible for providing information, as well as the validation process in terms of data validation and training material approvals. During the meeting, the implementation team and the knowledge pillar owner should also schedule the data gathering plan and define the target audience for each module. To support this stage, simplify and standardize future processes, it can be used template documents: Knowledge Pillar Structure, Content and Process Validation Matrix and Plant Visit Agenda.

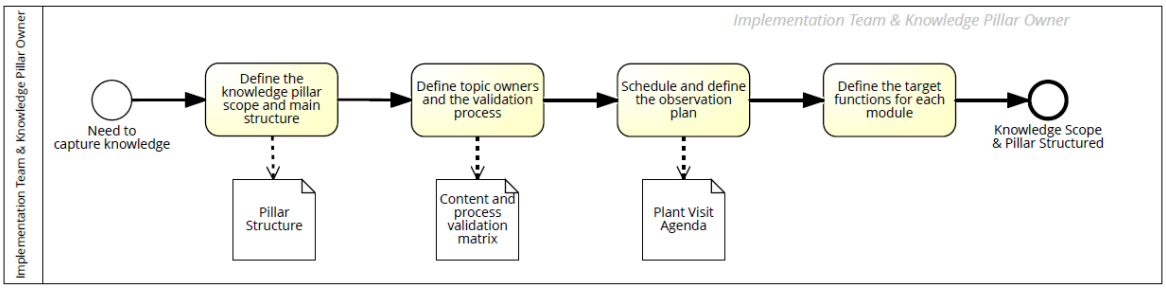

Figure 19 - Phase A: Knowledge Scope & Structure Definition

Phase B: Raw Data Gathering

This phase aims to capture knowledge. First, the implementation team must define which knowledge capture method should be used (e.g. request for information, interviews, observation, etc).

Depending on the knowledge capture method chosen, the implementation team must proceed and gathering the information needed. Additionally, based on the data gathered, it is important to define the index of data to be included in the training modules and validate it with the knowledge pillar owner.

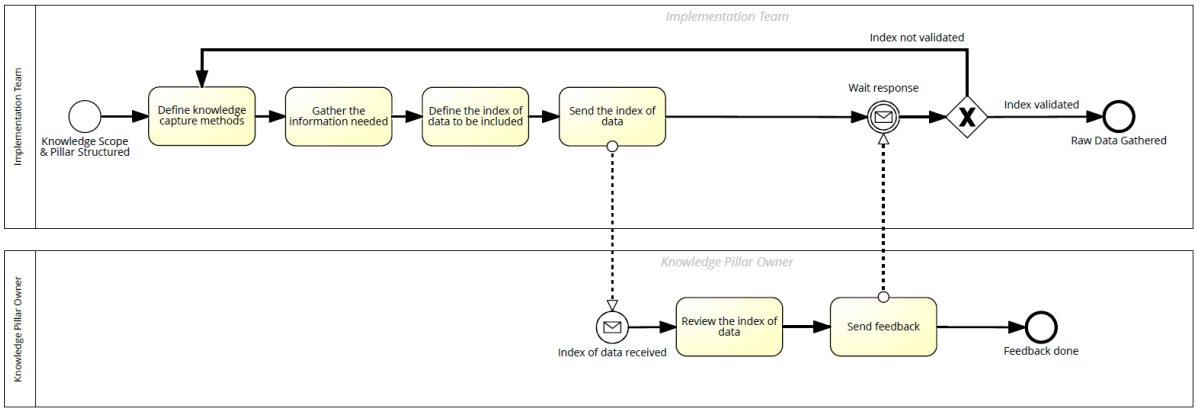

Figure 20 - Phase B: Raw Data Gathering

Phase C: Manual Development

After the Data Gathering phase, it is important to document the critical knowledge. This phase aims to develop a global manual that serves both for validation of key training contents and to support the training sessions themselves (before, during and after execution).

The first step is to create a draft version of the manual. Then, this version should be validated with the key knowledge stakeholders, that can be the pillar owner, topic owner and other people that participated in the data gathering phase. Based on their feedback, the implementation team must improve the draft version and/or create a final version of the document.

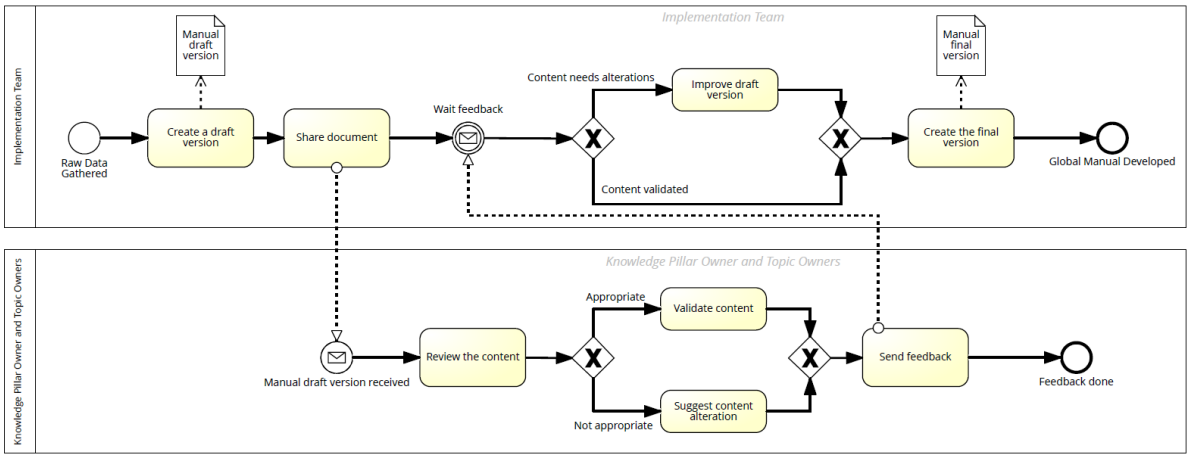

Figure 21 - Phase C: Manual Development

Phase D: Training Path & Target Functions

The main goals of this phase are to define the target functions for each training module and the logical precedence of training for each function. Each training module can have different detail levels and that must be taken into account when defining the training path for each function. This should be documented in a matrix. After systematize the training goals, audience and path, the knowledge pillar owner and the human resources must validate the content.

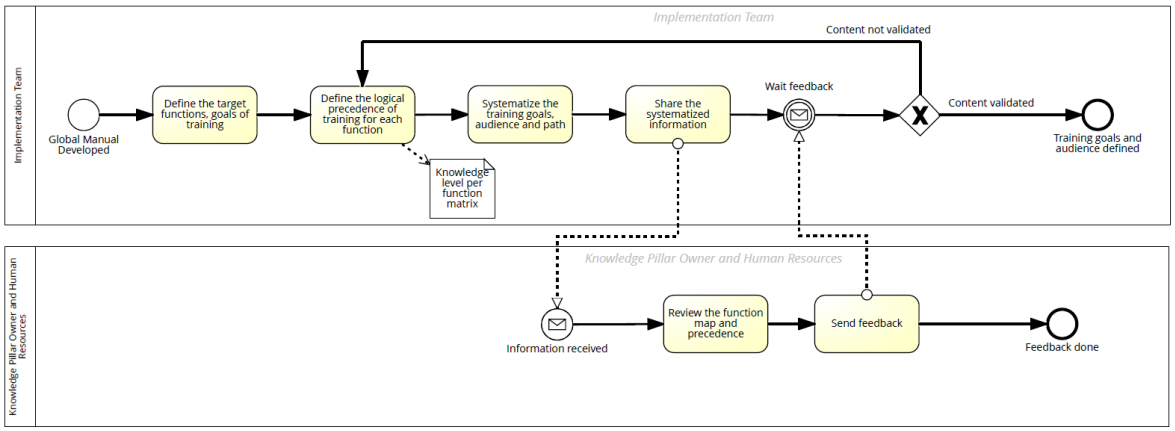

Figure 22 - Phase D: Training Path & Target Functions

Phase E: Training Module Development

Based on the goals and audience for each training module, the training method and sessions dynamics must be chosen, as well as the content to be included. There are many possibilities, for example, e-learnings, face-to-face learnings, videos, workshops and case studies. After the validation of the contents with the pillar owner, it is essential to develop the training module previously defined and, after that, validate it.

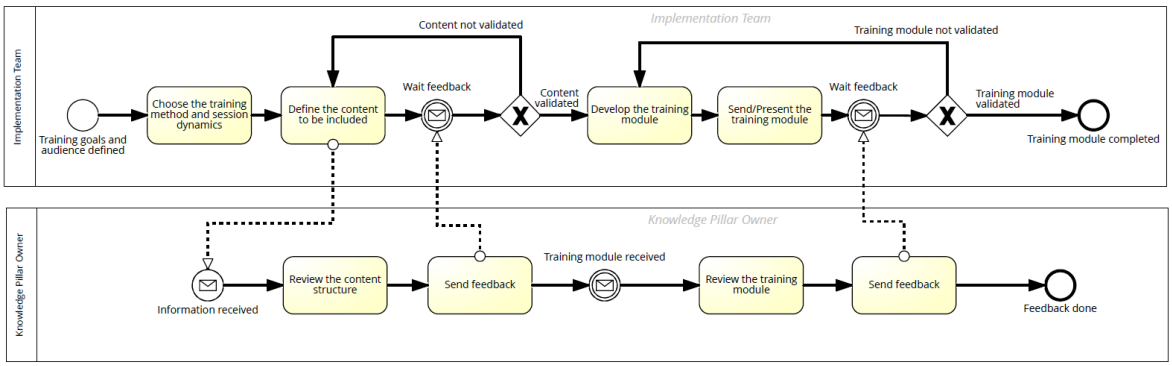

Figure 23 - Phase E: Training Module Development

Phase F: Training delivery & monitoring

The last phase of the methodology starts with the development of a training session evaluation survey, in order to collect feedback and evaluate the training adequacy. It is also important to develop the efficiency measurement module, defining the adequate KPIs and the monitoring method.

If applicable, in this phase trainers should also be identified, and the implementation team must prepare training modules and conduct a workshop to train the trainers. Finally, the team must validate trainer's ability and process with human resources. After this phase, there will be skilled trainers to effectively train employees (trainees) according to the defined audience, in order to share knowledge in the organization.

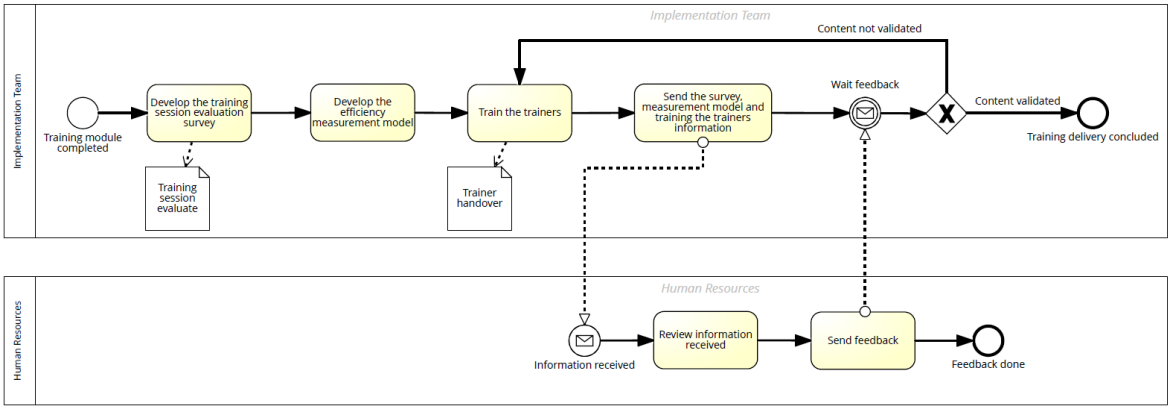

Figure 24 - Phase F: Training delivery & monitoring

4.3.4. Main Results

The implementation of the Knowledge Academy in the organization was based on a plan with the precedence of the activities to be performed, which was updated over time. In this way, the macro plan contained which training modules were to be implemented and when. This planning and prioritization of tasks was done with the support of the various stakeholders involved and was managed through frequent follow-up meetings during the project.

In fact, for each previously defined knowledge pillar, the implementation team met with the pillar owner to define the scope of the knowledge to be captured and the structure of the pillar (Phase A). Thus, it was possible to plan the important training modules to be developed for each knowledge pillar, according to the various themes and knowledge levels. In addition, each pillar owner identified topic owners to help the implementation team with the knowledge capture process, as well as with the knowledge validation process and approval of training materials.

For example, for the Sourcing pillar it was defined the creation of different training modules for three types of raw material (RM1, RM2 and RM3, the names are omitted for confidentiality reasons), for both fundamental and advanced levels. Accordingly, the following training modules have been defined for this pillar: RM1 Fundamentals, RM1 Advanced, RM2 Fundamentals, RM2 Advanced, RM3 Fundamentals and RM3 Advanced. For each module, the target audience, topic owners and the validation committee were also identified.

In order to support Phase A of the methodology presented, a content systematization matrix was created for all knowledge pillars, which allows to register the training modules to be developed, the type of documents and the people involved. Figure 25 shows an example of the matrix structure used by Company A, with the names and functions hidden for reasons of confidentiality.

PILLAR	Training Module	Document	Phase	Name	Function
ONBOARDING	Onboarding fundamentals	Manual	Data gathering		
			Data gathering		
			Data gathering		
			First approval		
			Data gathering		
			First approval		
			Data gathering		
			Data gathering		
			Translation validation - PT		
			Translation validation - SP		
			Translation validation - SP		
			Translation validation - SP		
			Translation validation - DE		
			Translation validation - DE		
			Translation validation - DE		
		Video sketch A	First approval		
		Video sketch B	First approval		
			First approval		
		E-learning	Validation Commitee		
			Validation Commitee		
			Validation Commitee		
			Validation Commitee		
			Validation Commitee		
			Validation Commitee		
			Validation Commitee		
			Validation Commitee		
			Validation Commitee		

Figure 25 - Content Matrix (illustrative)

After defining the structure of the knowledge to capture, the implementation team organized data gathering sessions. For the data gathering phase (Phase B), the most used method was workshops with topic owners, sometimes accompanied by plant visits, especially in the case of training modules belonging to the "Production, Technology and Equipment" pillar, where it was crucial to observe the production processes. However, since Company A has factories in several geographies

worldwide, many data gathering meetings were performed online, even though face-to-face method was more effective.

With data collected, for a given training module, the implementation team proceeds to its systematization in a global manual, which must ensure transversal contents across all geographies, and its validation (Phase C). Due to differences in information between geographies, the validation process of some training modules was extensive, with several iterations. If any topic (product, process, etc.) has differences between regions, the content of the global manual must be adapted to become universal.

After validating the manual with the knowledge to be used in the training module, the implementation team must analyze with the pillar owner what are the target functions for each level of content, systematizing the training goals, the target audience and the precedence of training for each function (Phase D). In this sense, an excel table was created to summarize the level of knowledge required per function, for all the trainings to be developed. In that document, it is possible to observe the number of employees per function in the organization that should perform each training module of the Knowledge Academy. Figure 26 shows an example of the structure used for this matrix, where it is possible to observe the training modules of the Onboarding and Product & Application pillars, and the number of people per function who should perform them, in area "A".

	Fundamentals
	Advanced

			TRAININGS PER PILLAR											
				Product & Applications										
				Product A			Product B			Prod. C		Product D		
Functional Area	Function	Head-count	Onboarding	Training 1	Training 2	Training 3	Training 1	Training 2	Training 3	Training 1	Training 2	Training 1	Training 2	Training 3
	Expected training duration (min)		135	30	240	120	20	240	240	20	60	20	240	120
		AREA A												
Functional Area 1	Function A	2	1	1	0	1	1	1	1	1	0	1	0	0
	Function B	58	1	1	0	1	1	1	1	1	0	1	0	0
Functional Area 2	Function C	1	1	1	0	1	1	1	1	1	0	1	0	0
	Function D	18	1	1	0	0	1	1	1	1	0	1	0	0
Functional Area 3	Function E	1	1	1	0	1	1	1	1	1	0	1	0	0
	Function F	45	1	1	0	1	1	1	1	1	0	1	0	0
Functional Area 4	Function G	1	1	1	0	1	1	1	1	1	0	1	0	0
	Function H	11	1	1	0	1	1	0	0	1	0	1	0	0
Functional Area 5	Function I	1	1	1	0	1	1	1	1	1	0	1	0	0
	Function J	19	1	1	0	1	1	1	1	1	0	1	0	0
Area A	Headcount	157	157	157	0	139	157	146	146	157	0	157	0	0

Figure 26 - Knowledge Level per Function matrix (illustrative)

After systematize the training goals, audience and path, the training module can be developed (Phase E). During the author's experience in the project, the most used format for the training modules was e-learning, especially for fundamental training level. E-learning is an appropriate method for teaching fundamental theoretical knowledge to a large number of people. In order to

gather feedback from the training sessions (Phase F), a reaction survey was created for the employees to fill out, evaluating its usefulness, ease of use and impact of the instruction methodology. In addition, some advanced training modules containing face-to-face learning and live observation were also developed. However, although trainers had been identified, it was not possible to carry out the delivery and monitoring of these trainings, due to COVID-19 situation.

It should be noted that the implementation team used Microsoft Teams platform as a form of collaboration, including all documents used in the various phases of the knowledge capture methodology. Regarding the delivery of training modules, it has been done through the online platform SAP SuccessFactors, which is a cloud-based human resource information system, where each training is assigned to employees according to their function. In the case of e-learnings, a deadline is given to users to perform the training. In addition, employees can also download the manuals developed in Phase C on this platform.

In the first two years after the launch of the Knowledge Academy (until the end of the author's experience in the project), Company A developed and validated 20 training modules and impacted 220 trainees from younger generations, according to the target functions covered by the trainings. A total of 8830 hours of training received by eligible employees is estimated. During this time, the knowledge data gathering and training development processes involved 159 senior employees, who together with the core team developed 13 manuals and identified 57 potential improvement opportunities in Company A's processes.

In terms of feedback from the training sessions, the most significant results to date are from the Onboarding training module, since it was the first to be launched. By December 2019, the training satisfaction survey had received 74 responses, and the main results are systematized in table 15.

Table 15 - Onboarding training module feedback - main results

Topic	Main Results
Simplicity and user friendliness	95% of respondents agreed that by going through the training they felt a smooth / effortless experience and that it contributed to a positive learning experience.
	80% of respondents agreed that during the training, it was very simple to solve any problem that happened.
Usefulness	73% of respondents agreed that this training clarified practical issues they face in work.
	88% of respondents agreed that the training allowed them to understand new perspectives/concepts that they can relate and use to improve their jobs.
	80% of respondents agreed that, after the training, they are likely to recommend it to someone of their own job function.
Methodology impact	85% of respondents agreed that the instruction methodology and its duration supported an effective learning of the content addressed.
	89% of respondents agreed all practical activities and resources provided worked as facilitators to their learning experience.

The table above shows that most of the employees valued the experience and benefits of the Onboarding training module, considering it simple to use, user friendly and useful for their work, in general.

4.4. Critical Success Factors in Knowledge Academy Implementation

In this project, the author observed a number of factors that contributed to the successful development of the Knowledge Academy. When comparing the observations to the factors found in the systematic literature review, in chapter 3, a number of consistencies can be identified, as shown in figure 27 and explained below, with no specific order.

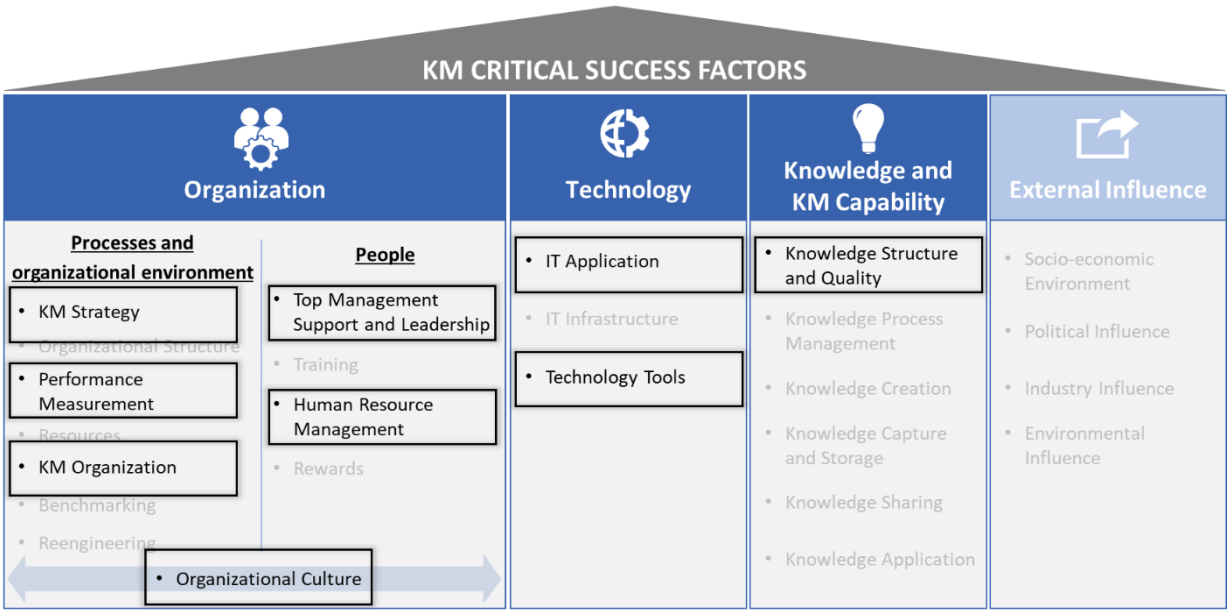

Figure 27 - Framework CSFs@KM in Knowledge Academy*:* Critical Success Factors observed in the practical KM project
Source: Developed by the author

1. Organizational Culture

The methodology used to capture and share knowledge in the Knowledge Academy is based on interaction with knowledge specialists from various areas. Therefore, it is essential to have a culture of trust and openness in order to share knowledge more efficiently.

Throughout the various meetings with experts, the author never felt there was any opposition or apprehension of knowledge sharing, even though she was an external consultant.

In fact, employees had always been very interested in the project, knowing its main goals and benefits, and they were always receptive and motivated to share the knowledge they knew and give suggestions, leaving the implementation team at ease to ask questions, which contributed positively to the success of the Knowledge Academy.

It is also important to reinforce that the involvement and inclusion of the senior and younger generations, only possible due to the inclusive culture of Company A, was of paramount importance for the success of the Academy, allowing the organization to ensure a sustainable approach to its knowledge management, while reinforcing the sense of purpose of the employees.

2. KM Strategy

During the project, the author concluded that it was essential to have a clear KM strategy. In fact, the strategy was planned right at the beginning of the project, where the main objectives and the activities to be carried out in order to achieve these objectives were defined, both in a short- and long-term vision. In this phase of strategy planning, it was crucial to understand the initial status of Company A in terms of KM processes and initiatives, in order to analyze the requirements and understand where the organization would like to be after the implementation of the Knowledge Academy, aligning the KM strategy with the vision of the organization.

In addition, it was also important to communicate the strategy of the Knowledge Academy and its benefits to the organization, so that employees realize its importance and are motivated to participate in the initiatives. For this, several approaches were used.

Firstly, during the different phases of the knowledge capture methodology, the implementation team always made an introduction of the project to participants during meetings (in case they were not yet aware of the project), explaining the objectives of the Knowledge Academy and thus why the organization was pursuing a KM strategy.

Secondly, there were also some presentations within the organization to explain the KM strategy, as well as interviews with core team members which were shared across the various geographies of Company A. Finally, it should also be noted that the organization holds quarterly global results presentation meetings for all members of the organization, where the main insights of the Knowledge Academy were also included.

3. Performance Measurement

The performance measurement of the program was an essential factor for the successful implementation of Knowledge Academy. The tracking of the project, done either through weekly follow up meetings or meetings with the Steering Committee, with less frequency, allowed to perceive the status of the training modules in development and to make a better management of the project, controlling the defined milestones and prioritizing activities, in order to meet the objectives of the project and the organization.

In addition, several KPIs (e.g. number of training modules, training hours, impacted employees) were created to evaluate and identify the main outputs and impacts that the initiative is creating in the organization.

4. KM Organization

Regarding KM organization, the creation of a specialized department and an implementation team was fundamental for the implementation of the Knowledge Academy. This way, it was possible to have people focused only on activities related to the KM project, without other distractions nor the concern of having to prioritize independent activities.

On the other hand, the appointment of knowledge pillar owners was also very beneficial for the project. Besides being responsible for defining the scope of their knowledge pillar and monitoring activities, they also acted as a bridge between the implementation team and experts, who are spread across various geographies. In addition, because they are respected people with influence in the organization, pillar owners also helped to ensure the commitment and availability of everyone involved in the process, being facilitators of the KM system.

Lastly, the steering committee was also crucial in providing strategic guidance for the entire project and in making important decisions. During the project, meetings with the steering committee and the core team took place on a quarterly basis.

5. Top Management Support and Leadership

As mentioned before, a steering committee was assigned to coordinate the global project and provide strategic guidance, composed of senior stakeholders, one of whom is a member of Company A's Executive Committee. The support of top management was crucial to make several strategic decisions, such as the creation of an exclusive department for Knowledge Academy.

In addition, top management showed their support for the project in several presentations, such as in meetings for presenting results and presenting strategic plans, which contributed positively to the motivation and participation of employees in the initiative.

6. Human Resource Management (HRM)

One of the major goals of the Knowledge Academy is to design more effective training programs and develop employees to be fully equipped with the appropriate technical and behavioral skills.

As mentioned before, HRM's main objective is to hire, train and retain human resources (Ghomi & Barzinpour, 2018). Thus, HRM plays an important role in the development of employees' careers, since the training modules developed must be aligned with the employees' functions.

7. IT Application

Most of the developed training modules were launched on SAP SuccessFactors platform, as previously mentioned. Considering the size of Company A, with several plants spread over several continents, the use of IT has greatly accelerated the sharing of knowledge, since it has been stored and available on a single platform with fast access for most employees. Without the use of IT, the organizational knowledge would not be so accessible.

However, the use of IT has also brought challenges, since not all employees have access to the Internet (e.g. functions as factory worker). In these cases, it was necessary to rethink how to make knowledge accessible, namely by providing computers in the plants where employees could access and perform the training modules.

8. Technology Tools

The use of the technological and collaborative tool Microsoft Teams was a crucial factor for the implementation of the Knowledge Academy. First of all, this tool was chosen to store all the files used during the knowledge capture, allowing the simultaneous collaboration of several people in the documents.

In addition, all online meetings were held through Microsoft Teams, facilitating knowledge sharing among the various stakeholders involved.

9. Knowledge Structure and Quality

The creation of a structure and map for organizational knowledge has contributed to a greater understanding of the existing content in the organization and the experts in various subjects. Indeed, one of the major problems experienced by employees was the fact that knowledge was "spread" throughout the organization and employees often did not know who to turn to for certain information. In this way, the creation of knowledge pillars and the respective pillar owners and topic owners made it possible to identify the areas of critical knowledge that should be captured and who were responsible for the areas. This factor also contributed to the capture of current and relevant content, which is fundamental to the success of the KM project.

In short, the nine factors identified above are the ones the author considered most critical to the success of the Knowledge Academy during her experience in the project. In general, these results are in line with the CSFs found in the SLR. However, although relevant factors such as training and rewards, for example, have not been identified by the author as CSFs, it does not mean that in the future they won't be crucial for the initiative. In fact, this project is in progress and still at an early stage, where there is uncertainty regarding the future and maintenance of the Knowledge Academy. Indeed, the author believes that incentives may be needed to motivate employees to participate in KM initiatives in the future, since rewards and incentives are considered essential and indispensable to the success of KM by many authors (Bishop et al., 2008; du Plessis, 2007). For the moment, no incentive system related to KM has yet been implemented in Company A, since the Knowledge Academy is a recent project and many initiatives for employees have not yet been launched. The same can be said for trainings, also widely cited in the literature and important for employees to understand how the KM program works and also the technology-based system. This aspect has not yet been fully considered necessary, but in time it may become essential to the success of the academy.

Moreover, it should be noted that the capture and sharing of knowledge is repeated on most topics. This is due to the importance of these processes in the field of knowledge management, being the main focus of the Knowledge Academy in Company A. In fact, by capturing knowledge and sharing it throughout the organization, knowledge does not remain the minds of employees and can even lead to the creation of new knowledge.

5. Conclusions, Limitations and Future Work

This last chapter presents the main conclusions of this research, where some final considerations and the contributions are exposed. In addition, some limitations are identified and, consequently, some opportunities for future work are also suggested.

5.1. Conclusions

As has been mentioned previously, knowledge management is a complex and important activity, increasingly sought by organizations that want to improve processes and ensure the use of useful knowledge in order to gain long-term competitive advantage. Although there are several methodologies to implement KM in organizations, there is no single comprehensive or integrated approach to implementing KM projects, therefore it is crucial to look at what other organizations have done, their main results and lessons learned.

This research aimed to identify critical factors for a successful implementation of KM, with a comprehensive theoretical study and based on a practical project. For that purpose, the author first conducted a systematic literature review and found hundreds of critical factors, compiling them into 25 categories within 4 dimensions. In the literature it was possible to find both internal and external factors to organizations, although internal factors play a much more prominent role in KM implementation, such as an organizational culture favorable to knowledge sharing, a well-defined KM strategy, top management support and IT application.

This research is also based on a practical KM implementation in an industrial context, within an organization that was facing some challenges mainly related to the loss of critical knowledge and lack of transfer programs or succession plans. Through the author's participation and experience in the project, the critical success factors found in the literature were studied and observed in practice during the implementation of a knowledge academy. Thus, of the 25 categories of critical success factors studied previously, the author highlighted 9. During the implementation of the knowledge academy, it was crucial to have a positive organizational culture and the involvement of top management, a clear strategy for the project and performance measures to monitor it, as well as a specialized team and knowledge owners. Besides, the use of technology contributed positively to the success of the project.

The summary of this research is presented in figure 28, where a comparison of the results of the systematic review and the case study can be observed.

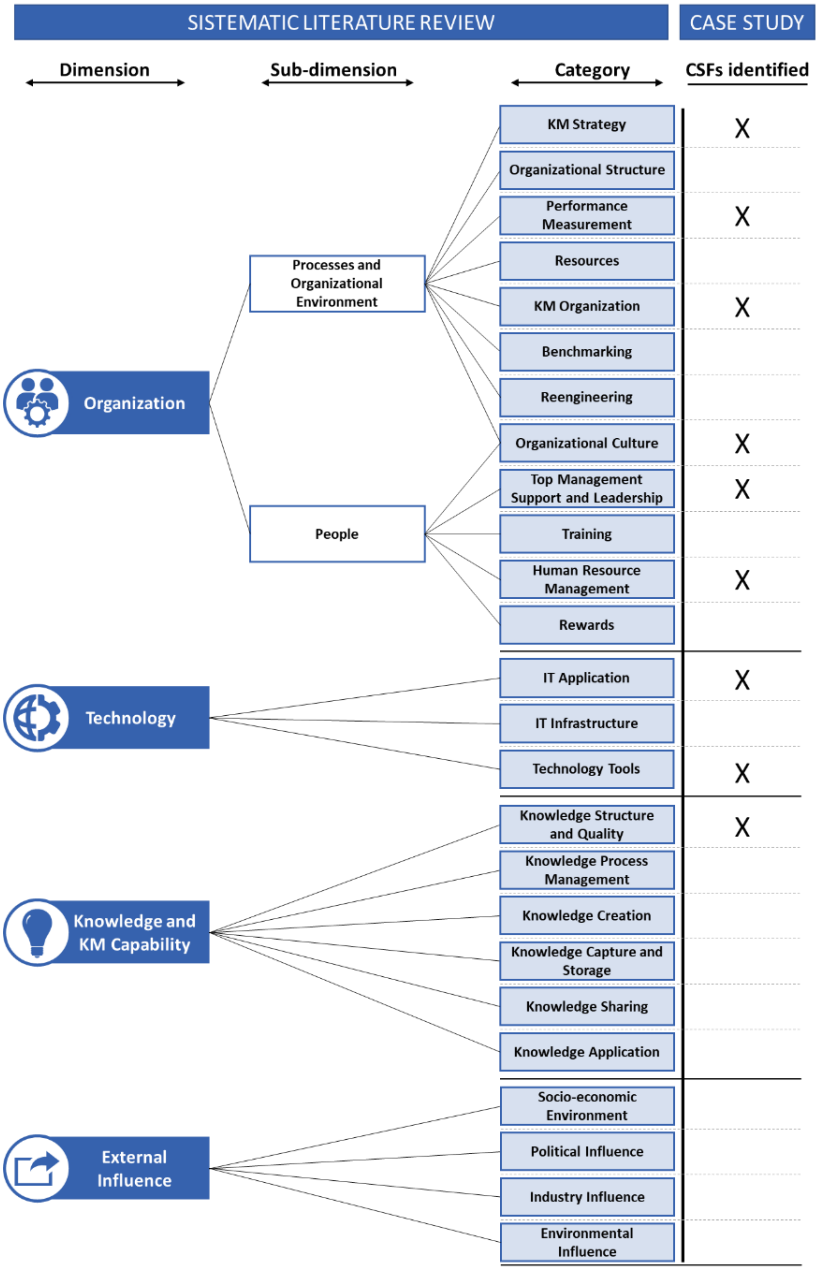

Figure 28 – CSFs in the KM: results from SLR and from practical case

In general, the results in both cases indicate the importance of the people-processes-technology trio in the implementation of KM initiatives in organizations, with greater focus on the organization and people. In fact, this sub-dimension is the greatest driver of knowledge and it is essential to adopt mechanisms and procedures that support and motivate human resources to participate in these initiatives. If people are not motivated and do not believe in the benefits of these practices, the project will surely fail.

On the other hand, processes are fundamental in any project and, therefore, it is crucial to know how to manage them and have a well-defined approach, concrete and aligned with the organizational strategy. Finally, considering the amount of information, the geographical distribution of sources and the dynamic evolution of information, such as observed in Company A,

it becomes quite complicated to implement a KM strategy without the use of technology, since it strongly contributes to improving access to knowledge and collaboration among employees. Therefore, it is very unlikely that the implementation of KM will achieve significant benefits without considering the CSFs studied in this research. Organizations should reflect on their current state, the objectives they intend to achieve with KM and thus adapt a KM strategy that fits their reality.

In addition, the results show that internal factors within the organization are far more important to KM's success than external factors. As already discussed before, external influence factors depend greatly on the context and are often impossible to control or predict, and the author did not consider them critical to the success of the Knowledge Academy in Company A. Although it is important to reflect on possible external factors, organizations should focus on what they can control to achieve success on KM implementations.

This study also made it possible to understand which knowledge processes stand out most clearly in literature, with knowledge sharing being the most cited process and what leads organizations to implement knowledge management. The lack of knowledge sharing is therefore one of the biggest issues in organizations, as it was observed in Company A. Thus, there must be an increased effort to ensure that knowledge is shared among employees and is not only retained in their minds. Nevertheless, for KM initiatives to be successful, it is important to integrate all processes, such as the creation, capture, sharing and application of knowledge.

Finally, the practical project to implement the Knowledge Academy contributed to build a knowledge transmission path according to the necessary skills of each function in Company A, ensure uniformity of knowledge and leverage knowledge to a variety of areas within the organization. The main steps that Company A has taken in its journey to implement KM were presented and can help other organizations to prepare and implement a similar strategy.

In conclusion, the findings of this study are relevant for all organizations pretending to implement KM initiatives, regardless of size and sector. It is expected from a theoretical perspective to contribute to the KM area through the compilation, categorization and classification of a set of critical success factors reported in the literature and subsequently validated in a practical context. From a practical perspective, these results can contribute as a consultative tool to support the preparation of strategies in this area by organizations wishing to implement KM initiatives.

5.2. Limitations and Future Work

Throughout this work, some limitations were also identified. Although two years have passed since the beginning of the project, the implementation of the Knowledge Academy is still at an early stage, where only a small part of the knowledge has been captured. In fact, considering the macro plan, there are still many training modules to develop. In addition, due to the pandemic situation of Covid-19, it has not yet been possible to implement any face-to-face training, and therefore the last phase of the knowledge capture and sharing methodology – Training delivery & monitoring – has not yet been fully explored.

For the reasons mentioned above, it becomes pertinent to continue studying the implementation of the Knowledge Academy, as well as its maintenance. Undeniably, over time the contents may become outdated, so it is crucial to adopt mechanisms to update them, which has not yet been studied. Moreover, in the future there will certainly be more feedback from employees regarding the training modules performed, which may lead to changes in the methodology used. Although the author has felt a culture of knowledge sharing in Company A, it is unknown how employees will react to the number of training modules in the future and how these trainings will impact their work. In this regard, the author recognizes the importance of studying the impact of the quantity and periodicity of trainings by functional groups, in order to ensure the retention of knowledge and motivation of employees in a continuous and sustainable learning.

Finally, although relevant and in agreement with the literature, the CSFs for the implementation of KM identified in the case study refer to an earlier phase of the project and therefore can be completed in a more mature phase. As mentioned before, the project is in progress and there is still uncertainty regarding the maintenance of the Knowledge Academy. Additionally, these CSFs have only been assessed by one person and it may have influenced the results, as it only covers one perspective. Therefore, the author also suggests to evaluate again the CSFs in a more mature phase of the Knowledge Academy, with the participation of more people to include different perspectives.

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Appendixes

Appendix A – KM Critical Success Factors in detail

Dimension	Category	Critical Success Factors	Citations
Organization	KM Strategy	**1.** Alignment between KM strategy and business needs; **2.** Clearly articulated KM Strategy; **3.** Communication and Marketing; **4.** Holistic approach; **5.** KM Strategy; **6.** KM Value Proposition; **7.** Integration with other initiatives and work practices; **8.** Strategic Planning; **9.** Pilot; **10.** User Orientation; **11.** Enterprise-wide and business unit specific needs	Damodaran & Olphert (2000); Akhavan, Jafari, & Fathian (2006); du Plessis (2007); Bishop, Bouchlaghem, Glass, & Matsumoto (2008); Chen & Hsiang (2007); Artail (2006); M. Y. Chang, Hung, Yen, & Tseng (2009); Akhavan, Hosnavi, & Sanjaghi (2009); Theriou et al. (2011); Mohammadi, Khanlari, & Sohrabi (2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Al-Hakim & Hassan (2016); Lo & Chin (2009); Xiong & Deng (2008); Yang et al. (2010); Alsadhan et al. (2008); Butler & Murphy (2007); Arif & Shalhoub (2014); Aggestam & Persson (2010); Tessier & Dalkir (2016); Altaher (2010); Koloniari, Vraimaki, & Fassoulis (2018); Ghomi & Barzinpour (2018); Ahmed & Hegazy (2006); Gunasekera & Chong (2018); Othman et al. (2018); Kant & Singh (2010); Yap & Toh (2020); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018); Peszynski, Cooper, & Molla (2008); Zain & Latief (2020); Heryanto, Aulawi, & Munthe (2020)
	Organizational Structure	**12.** Organizational structure; **13.** Flat structure; **14.** Flexible structure; **15.** Formalization; **16.** Centralization; **17.** Decentralization	Akhavan, Jafari, & Fathian (2006); Akhavan, Hosnavi, & Sanjaghi (2009); Mohammadi, Khanlari, & Sohrabi (2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Al-Hakim & Hassan (2016); Yang et al. (2010); Alsadhan et al. (2008); Koloniari, Vraimaki, & Fassoulis (2018); Ghomi & Barzinpour (2018); Xu, Zhao, & Wang (2009); Gunasekera & Chong (2018); Sadovykh & Sundaram (2015); Biloslavo, Kljajić-Dervić, & Dervić (2019); Yap & Toh (2020); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018)
	Performance Measurement	**18.** Performance Measurement; **19.** Financial performance; **20.** Non-financial performance; **21.** KM progress tracking and measurement; **22.** Business performance	du Plessis (2007); M. Y. Chang, Hung, Yen, & Tseng (2009); Akhavan, Hosnavi, & Sanjaghi (2009); Yang et al. (2010); Alsadhan et al. (2008) ; Arif & Shalhoub (2014); Ghomi & Barzinpour (2018); Xu, Zhao, & Wang (2009); Ahmed & Hegazy (2006); Gunasekera & Chong (2018); Othman et al. (2018); Kant & Singh (2010); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018)
	Resources	**23.** Availability of resources; **24.** Financial resources; **25.** Free time and space; **26.** Use of consultants; **27.** Customer and knowledge supplier relationships	Chen & Hsiang (2007); Artail (2006); M. Y. Chang, Hung, Yen, & Tseng (2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Lo & Chin (2009); Alsadhan et al. (2008); Ghomi & Barzinpour (2018); Gunasekera & Chong (2018); Othman et al. (2018); Kant & Singh (2010); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018); Heryanto, Aulawi, & Munthe (2020)
	KM Organization	**28.** Chief Knowledge Officer; **29.** KM Champions and Leaders; **30.** KM Department; **31.** Specialized KM team; **32.** KM roles and responsibilities; **33.** Clearly defined knowledge ownership; **34.** Knowledge communities; **35.** Network of experts	du Plessis (2007); Bishop, Bouchlaghem, Glass, & Matsumoto (2008); Slagter (2007); Akhavan, Hosnavi, & Sanjaghi (2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Alsadhan et al. (2008); Butler & Murphy (2007); Ghomi & Barzinpour (2018); Xu, Zhao, & Wang (2009); Mathew & Rodrigues (2019)
	Benchmarking	**36.** Benchmarking	Akhavan, Hosnavi, & Sanjaghi (2009); Alsadhan et al. (2008); Gunasekera & Chong (2018); Kant & Singh (2010); Othman et al. (2018)
	Reengineering	**37.** Reengineering	Akhavan, Jafari, & Fathian (2006); Jafari, Akhavan, Fesharaki, & Fathian (2007); Butler & Murphy (2007)
	Organizational Culture	**38.** Organizational Culture; **39.** Collaboration; **40.** Trust; **41.** Common vision and goals; **42.** Knowledge creating	Damodaran & Olphert (2000); Akhavan, Jafari, & Fathian (2006); du Plessis (2007); Chen & Hsiang (2007); Artail (2006); M. Y. Chang et al. (2009); Akhavan, Hosnavi, & Sanjaghi (2009); Theriou et al. (2011); Mohammadi, Khanlari, & Sohrabi

		and sharing culture; **43.** Knowledge-centered culture; **44.** Learning culture; **45.** Learning from failure; **46.** Teamwork; **47.** Transparency; **48.** Openness; **49.** Readiness to accept the new system; **50.** Risk-taking climate	(2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Al-Hakim & Hassan (2016); Lo & Chin (2009); Xiong & Deng (2008); Yang et al. (2010); Alsadhan et al. (2008); Butler & Murphy (2007); Arif & Shalhoub (2014); Aggestam & Persson (2010); Altaher (2010); Koloniari, Vraimaki, & Fassoulis (2018); Ghomi & Barzinpour (2018); Ahmed & Hegazy (2006); Gunasekera & Chong (2018); Othman et al. (2018); Kant & Singh (2010); Yap & Toh (2020); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018); Peszynski, Cooper, & Molla (2008); Zain & Latief (2020); Heryanto, Aulawi, & Munthe (2020); Lee, Gon Kim, & Kim (2012); Slagter (2007); Cardoso, Meireles, & Peralta (2012); Lin & Lin (2006); Xu, Zhao, & Wang (2009); Sadovykh & Sundaram (2015); Biloslavo, Kljajić-Dervić, & Dervić (2019); Nyame & Qin (2020); Ganapathy, Mansor, & Ahmad (2019); Atanda, Dominic, & Mahmood (2012); Vyas, Bhalla, & Najneen (2020)
	Top Management Support and Leadership	**51.** Top management support; **52.** Leadership	Damodaran & Olphert (2000); Akhavan, Jafari, & Fathian (2006); du Plessis (2007); Bishop, Bouchlaghem, Glass, & Matsumoto (2008); (R. S. Chen & Hsiang, 2007); Artail (2006); Theriou et al. (2011); Mohammadi, Khanlari, & Sohrabi (2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Al-Hakim & Hassan (2016); Lo & Chin (2009); Xiong & Deng (2008); Yang et al. (2010); Alsadhan et al. (2008); Butler & Murphy (2007); Arif & Shalhoub (2014); Altaher (2010); Koloniari, Vraimaki, & Fassoulis (2018); Ghomi & Barzinpour (2018); Ahmed & Hegazy (2006); Gunasekera & Chong (2018); Othman et al. (2018); Kant & Singh (2010); Yap & Toh (2020); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018); Peszynski, Cooper, & Molla (2008); Zain & Latief (2020); Heryanto, Aulawi, & Munthe (2020); Lee, Gon Kim, & Kim (2012); Slagter (2007); Lin & Lin (2006); Biloslavo, Kljajić-Dervić, & Dervić (2019); Nyame & Qin (2020); Ganapathy, Mansor, & Ahmad (2019)
	Training	**53.** Training	Damodaran & Olphert (2000); Akhavan, Jafari, & Fathian (2006); du Plessis (2007); Slagter (2007); Artail (2006); M. Y. Chang, Hung, Yen, & Tseng (2009); Cardoso, Meireles, & Peralta (2012); Mohammadi, Khanlari, & Sohrabi (2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Jafari, Rezaeenour, Akhavan, & Fesharaki (2010); Lo & Chin (2009); Xiong & Deng (2008); Yang et al. (2010); Alsadhan et al. (2008); Butler & Murphy (2007); Arif & Shalhoub (2014); Koloniari, Vraimaki, & Fassoulis (2018); Ghomi & Barzinpour (2018); Ahmed & Hegazy (2006); Gunasekera & Chong (2018); Othman et al. (2018); Kant & Singh (2010); Yap & Toh (2020); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018); Zain & Latief (2020); Heryanto, Aulawi, & Munthe (2020)
	Human Resource Management	**54.** Human Resource Management; **55.** Human Resources; **56.** Employee commitment; **57.** Employee empowerment; **58.** Employee involvement; **59.** Employee motivation; **60.** Employee retention; **61.** Human capital; **62.** Job security	Chen & Hsiang (2007); Akhavan, Hosnavi, & Sanjaghi (2009); Cardoso, Meireles, & Peralta (2012); Theriou et al. (2011); Mohammadi, Khanlari, & Sohrabi (2009); Jafari, Rezaeenour, Akhavan, & Fesharaki (2010); W. Y. Chen, Hsu, Wang & Lin (2011); Al-Hakim & Hassan (2016); Alsadhan et al. (2008); Butler & Murphy (2007); Arif & Shalhoub (2014); Hsu, Chen, Wang, & Yu (2007); Ghomi & Barzinpour (2018); Ahmed & Hegazy (2006); Gunasekera & Chong (2018); Othman et al. (2018); Biloslavo, Kljajić-Dervić, & Dervić (2019); Kant & Singh (2010); Yap & Toh (2020); Ganapathy, Mansor, & Ahmad (2019); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018); Atanda, Dominic, & Mahmood (2012); Zain & Latief (2020)
	Rewards	**63.** Incentives and rewards	du Plessis (2007); Bishop, Bouchlaghem, Glass, & Matsumoto (2008); Chen & Hsiang (2007); Slagter (2007); Mohammadi, Khanlari, & Sohrabi (2009); Lin & Lin (2006); Yang et al. (2010); Alsadhan et al. (2008); Butler & Murphy (2007); Xu, Zhao, & Wang (2009); Ahmed & Hegazy (2006); Biloslavo, Kljajić-Dervić, & Dervić (2019); Yap & Toh (2020); Ganapathy, Mansor, & Ahmad (2019); Mathew & Rodrigues (2019)
Technology	IT Application	**64.** IT Application; **65.** Balance between people and IT; **66.** Technology; **67.** Learner-focused technology; **68.** Alignment between business and technology; **69.**	Damodaran & Olphert (2000); Lee, Gon Kim, & Kim (2012); du Plessis (2007); Bishop, Bouchlaghem, Glass, & Matsumoto (2008); Chen & Hsiang (2007); Artail (2006); M. Y. Chang, Hung, Yen, & Tseng (2009); Theriou et al. (2011); Jafari, Akhavan, Fesharaki, & Fathian (2007); Al-Hakim & Hassan (2016); Lin & Lin (2006); Yang et al. (2010); Butler & Murphy

		Friendly and easy to use KM system; **70.** KM system design	(2007); Altaher (2010); Koloniari, Vraimaki, & Fassoulis (2018); Ghomi & Barzinpour (2018); Xu, Zhao, & Wang (2009); Gunasekera & Chong (2018); Othman et al. (2018); Sadovykh & Sundaram (2015); Biloslavo, Kljajić-Dervić, & Dervić (2019); Mathew & Rodrigues (2019); Nazarizade & Azizi (2018); Atanda, Dominic, & Mahmood (2012); Zain & Latief (2020); Heryanto, Aulawi, & Munthe (2020)
	IT Infrastructure	**71.** Effective IT infrastructure; **72;** Access to network infrastructure and hardware; **73.** Security	du Plessis (2007); Artail (2006); Mohammadi, Khanlari, & Sohrabi (2009); Lo & Chin (2009); Alsadhan et al. (2008); Arif & Shalhoub (2014); Aggestam & Persson (2010); Ahmed & Hegazy (2006); Othman et al. (2018); Yap & Toh (2020); Nyame & Qin (2020); Heryanto, Aulawi, & Munthe (2020)
	Technology tools	**74.** Collaborative tools; **75.** Effective KM tools; **76.** Functions of KMS; **77.** Knowledge repository	Damodaran & Olphert (2000); du Plessis (2007); Jafari, Rezaeenour, Akhavan, & Fesharaki (2010); Alsadhan et al. (2008); Mathew & Rodrigues (2019); Heryanto, Aulawi, & Munthe (2020)
Knowledge and KM Capability	Knowledge Structure and Quality	**78.** Flexible knowledge structure; **79.** Knowledge structure and map; **80.** Knowledge architecture; **81.** Nature of knowledge; **82.** Quality of information; **83.** Variety of knowledge sources	Akhavan, Jafari, & Fathian (2006); du Plessis (2007); M. Y. Chang, Hung, Yen, & Tseng (2009); Akhavan, Hosnavi, & Sanjaghi (2009); Mohammadi, Khanlari, & Sohrabi (2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Yang et al. (2010); Alsadhan et al. (2008); Arif & Shalhoub (2014); Aggestam & Persson (2010); Xu, Zhao, & Wang (2009); Gunasekera & Chong (2018); Othman et al. (2018); Nyame & Qin (2020); Mathew & Rodrigues (2019); Atanda, Dominic, & Mahmood (2012)
	Knowledge Process Management	**84.** KM processes and procedures; **85.** KM processes easy to follow; **86.** Knowledge process management; **87.** Managing explicit and tacit knowledge; **88.** Managing knowledge throughout its lifecycle; **89.** Mechanism to approve activities; **90.** Precise KM processes	du Plessis (2007); M. Y. Chang, Hung, Yen, & Tseng (2009); Jafari, Rezaeenour, Akhavan, & Fesharaki (2010); Lin & Lin (2006); Lo & Chin (2009); Ghomi & Barzinpour (2018); Gunasekera & Chong (2018); Othman et al. (2018); Nazarizade & Azizi (2018); Zain & Latief (2020)
	Knowledge Creation	**91.** Knowledge Creation; **92.** Innovation	Yang et al. (2010); Ahmed & Hegazy (2006); Kant & Singh (2010); Nyame & Qin (2020)
	Knowledge Capture and Storage	**93.** Knowledge capture; **94.** Knowledge storage; **95.** Knowledge identification	Akhavan, Jafari, & Fathian (2006); M. Y. Chang, Hung, Yen, & Tseng (2009); Akhavan, Hosnavi, & Sanjaghi (2009); Ahmed & Hegazy (2006); Zain & Latief (2020)
	Knowledge Sharing	**96.** Knowledge Sharing; **97.** Multiple channels for knowledge sharing; **98.** Specialized meetings, conferences and seminars; **99.** Procedural design needs to help to establish a loop of knowledge-sharing	Akhavan, Jafari, & Fathian (2006); du Plessis (2007); Chen & Hsiang (2007); Artail (2006); M. Y. Chang, Hung, Yen, & Tseng (2009); Jafari, Akhavan, Fesharaki, & Fathian (2007); Jafari, Rezaeenour, Akhavan, & Fesharaki (2010); Yang et al. (2010); Ahmed & Hegazy (2006)(A.M.M.B. Ahmed & Hegazy, 2006); Gunasekera & Chong (2018); Kant & Singh (2010); Yap & Toh (2020); Atanda, Dominic, & Mahmood (2012)
	Knowledge Application	**100.** Knowledge Application	Yang et al. (2010)
External Influence	Socio-economic Environment	**101.** Socio-economic environment; **102.** Economic climates; **103.** Economic stability; **104.** People affected because of the project activities; **105.** People benefiting from the project; **106.** Sound economic policy; **107.** Surrounding neighbours affected because of the project activities	Gunasekera & Chong (2018); Othman et al. (2018); Sadovykh & Sundaram (2015)

	Political Influence	**108.** Sources of finance; **109.** Confidence of politicians; **110.** Regulations; **111.** Adaptability to amendment of project plans	Gunasekera & Chong (2018)
	Industry Influence	**112.** Availability of external resources; **113.** Subcontractors and suppliers; **114.** Market prices of materials and labour	Gunasekera & Chong (2018)
	Environmental Influence	**115.** Ground conditions of projects; **116.** Weather conditions	Gunasekera & Chong (2018)

Appendix B – KM Critical Success Factors and number of papers: Organization Dimension

CSF - Organization		Processes and organizational environment							People			
	Organizational Culture	KM Strategy	Performance Measurement	Organizational Structure	KM Organization	Resources	Benchmarking	Reengineering	Top Management Support and Leadership	Human Resource Management	Training	Rewards
Damodaran & Olphert (2000)	X	X							X		X	
Akhavan, Jafari, & Fathian (2006)	X	X		X				X	X		X	
Lee, Gon Kim, & Kim (2012)	X								X			
du Plessis (2007)	X	X	X		X				X		X	X
Bishop, Bouchlaghem, Glass, & Matsumoto (2008)		X			X				X			X
Chen & Hsiang (2007)	X	X				X				X		X
Slagter (2007)	X				X				X		X	X
Artail (2006)	X	X				X			X		X	
M. Y. Chang, Hung, Yen, & Tseng (2009)		X	X			X					X	
Akhavan, Hosnavi, & Sanjaghi (2009)	X	X	X	X	X		X			X		
Cardoso, Meireles, & Peralta (2012)	X									X	X	
Theriou et al. (2011)	X	X							X	X		
Mohammadi, Khanlari, & Sohrabi (2009)	X	X		X					X	X	X	X
Jafari, Akhavan, Fesharaki, & Fathian (2007)	X	X		X	X	X		X	X		X	
Jafari, Rezaeenour, Akhavan, & Fesharaki (2010)										X	X	
W. Y. Chen, Hsu, Wang & Lin (2011)										X		
Al-Hakim & Hassan (2016)	X	X		X					X	X		
Lin & Lin (2006)	X								X			X
Lo & Chin (2009)	X	X				X			X		X	
Xiong & Deng (2008)	X	X							X		X	
Yang et al. (2010)	X	X	X	X					X		X	X
Alsadhan et al. (2008)	X	X	X	X	X	X	X		X	X	X	X
Butler & Murphy (2007)	X	X			X			X	X	X	X	X
Arif & Shalhoub (2014)	X	X	X						X	X	X	
Aggestam & Persson (2010)	X	X										
Tessier & Dalkir (2016)		X										
Hsu, Chen, Wang, & Yu (2007)										X		
Altaher (2010)	X	X										
Koloniari, Vraimaki, & Fassoulis (2018)	X	X		X					X		X	
Ghomi & Barzinpour (2018)	X	X	X	X	X	X			X	X	X	
Xu, Zhao, & Wang (2009)	X		X	X	X							X
Ahmed & Hegazy (2006)	X	X	X						X	X	X	X
Gunasekera & Chong (2018)	X	X	X	X		X	X		X	X	X	
Othman et al. (2018)	X	X	X			X	X		X	X	X	
Sadovykh & Sundaram (2015)	X			X								

Biloslavo, Kljajić-Dervić, & Dervić (2019)	X			X					X	X		X
Kant & Singh (2010)	X	X	X			X	X		X	X	X	
Yap & Toh (2020)	X	X		X					X	X	X	X
Nyame & Qin (2020)	X								X			
Ganapathy, Mansor, & Ahmad (2019)	X								X	X		X
Mathew & Rodrigues (2019)	X	X	X	X	X	X			X	X	X	X
Nazarizade & Azizi (2018)	X	X	X	X		X			X	X	X	
Atanda, Dominic, & Mahmood (2012)	X									X		
Peszynski, Cooper, & Molla (2008)	X	X							X			
Zain & Latief (2020)	X	X								X	X	
Vyas, Bhalla, & Najneen (2020)	X											
Heryanto, Aulawi, & Munthe (2020)	X	X				X			X		X	
Total of papers	**41**	**33**	**14**	**16**	**10**	**13**	**5**	**3**	**32**	**24**	**27**	**15**

Appendix C – KM Critical Success Factors and number of papers: Technology Dimension

CSFs – Technology	IT Application	IT Infrastructure	Technology Tools
Damodaran & Olphert (2000)	X		X
Lee, Gon Kim, & Kim (2012)	X		
du Plessis (2007)	X	X	X
Bishop, Bouchlaghem, Glass, & Matsumoto (2008	X		
Chen & Hsiang (2007)	X		
Artail (2006)	X	X	
M. Y. Chang, Hung, Yen, & Tseng (2009)	X		
Theriou et al. (2011)	X		
Mohammadi, Khanlari, & Sohrabi (2009)		X	
Jafari, Akhavan, Fesharaki, & Fathian (2007)	X		
Jafari, Rezaeenour, Akhavan, & Fesharaki (2010)			X
Al-Hakim & Hassan (2016)	X		
Lin & Lin (2006)	X		
Lo & Chin (2009)		X	
Yang et al. (2010)	X		
Alsadhan et al. (2008)		X	X
Butler & Murphy (2007)	X		
Arif & Shalhoub (2014)		X	
Aggestam & Persson (2010)		X	
Altaher (2010)	X		
Koloniari, Vraimaki, & Fassoulis (2018)	X		
Ghomi & Barzinpour (2018)	X		
Xu, Zhao, & Wang (2009)	X		
Ahmed & Hegazy (2006)		X	
Gunasekera & Chong (2018)	X		
Othman et al. (2018)	X	X	
Sadovykh & Sundaram (2015)	X		
Biloslavo, Kljajić-Dervić, & Dervić (2019)	X		
Yap & Toh (2020)		X	
Nyame & Qin (2020)		X	
Mathew & Rodrigues (2019)	X		X
Nazarizade & Azizi (2018)	X		
Atanda, Dominic, & Mahmood (2012)	X		
Zain & Latief (2020)	X		
Heryanto, Aulawi, & Munthe (2020)	X	X	X
Total of papers	**26**	**12**	**6**

Appendix D – KM Critical Success Factors and number of papers: Knowledge and KM Capability Dimension

CSFs – Knowledge and KM Capability	Knowledge Structure and Quality	Knowledge Sharing	Knowledge Process Management	Knowledge Capture and Storage	Knowledge Creation	Knowledge Application
Akhavan, Jafari, & Fathian (2006)	X	X		X		
du Plessis (2007)	X	X	X			
Chen & Hsiang (2007)		X				
Artail (2006)		X				
M. Y. Chang, Hung, Yen, & Tseng (2009)	X	X	X	X		
Akhavan, Hosnavi, & Sanjaghi (2009)	X			X		
Mohammadi, Khanlari, & Sohrabi (2009)	X					
Jafari, Akhavan, Fesharaki, & Fathian (2007)	X	X				
Jafari, Rezaeenour, Akhavan, & Fesharaki (2010)		X	X			
Lin & Lin (2006)			X			
Lo & Chin (2009)			X			
Yang et al. (2010)	X	X			X	X
Alsadhan et al. (2008)	X					
Arif & Shalhoub (2014)	X					
Aggestam & Persson (2010)	X					
Ghomi & Barzinpour (2018)			X			
Xu, Zhao, & Wang (2009)	X					
Ahmed & Hegazy (2006)		X		X	X	
Gunasekera & Chong (2018)	X	X	X			
Othman et al. (2018)	X		X			
Kant & Singh (2010)		X			X	
Yap & Toh (2020)		X				
Nyame & Qin (2020)	X				X	
Mathew & Rodrigues (2019)	X					
Nazarizade & Azizi (2018)			X			
Atanda, Dominic, & Mahmood (2012)	X	X				
Zain & Latief (2020)			X	X		
Total of papers	**16**	**10**	**13**	**5**	**4**	**1**

Appendix E – KM Critical Success Factors and number of papers: External Influence Dimension

CSFs – External influence	Socio-Economic Environment	Political influence	Industry influence	Environmental influence
Gunasekera & Chong (2018)	X	X	X	X
Othman et al. (2018)	X			
Sadovykh & Sundaram (2015)	X			
Total of papers	**3**	**1**	**1**	**1**