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AN INTEGRATIVE ANALYSIS OF KNOWLEDGE MANAGEMENT IMPLEMENTATION FRAMEWORKS: A PROPOSED RESEARCH AGENDA

UMA ANÁLISE INTEGRATIVA DE *FRAMEWORKS* DE IMPLEMENTAÇÃO DA GESTÃO DO CONHECIMENTO: PROPOSTA DE UMA AGENDA DE PESQUISA

UN ANÁLISIS INTEGRADOR DE LOS MARCOS DE IMPLEMENTACIÓN DE LA GESTIÓN DEL CONOCIMIENTO: AGENDA DE INVESTIGACIÓN PROPUESTA

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ABSTRACT

Objective: This article analyzes the characteristics of the Knowledge Management (KM) implementation frameworks published in high impact magazines, and seeks to answer the following research question: How are Knowledge Management implementation frameworks characterized?

Design/methodology/approach: Through a literature review, ten Knowledge Management implementation frameworks were identified. These were individually analyzed and structured as to their dimensions and variables, as well as the pillars and processes of KM.

Results: Individual analysis of each framework led to the generation of an integrative framework that guides the direction of research in the field. The frameworks are also classified as descriptive and prescriptive. Analysis of the frameworks also revealed gaps in measuring processes, measuring results, and solutions that envision IT as a fundamental structure for KM. In addition to the integrative framework, this article also proposes a research agenda for empirical studies and the application of Knowledge Management frameworks.

Limitations/implications of the research: This study was limited to KM implementation frameworks. Therefore, articles with other structures were not included in the analysis. Future studies will be able to carry out an overview with different perspectives, more generic or more specific, analyzing KM processes and their mechanisms individually.

Practical implications: For managers, this study promotes discussion on the applicability of implementation frameworks, invoking more pragmatic studies that assist in the measurement, application, and conducting of KM processes.

Theoretical implications: This article contributes to research in the area of KM by bringing together frameworks from different sectors, under the classification of KM processes and pillars, allowing the identification of gaps that have not yet been filled and reflections on why this topic of research has not been taken up by professionals in the field.

Originality/value: There is a lack of options adapted to certain sectors, such as the banking segment. There is also a need to incorporate into the frameworks the use of KM maturity models and indicators for process metrics, which will be qualitative and quantitative, as well as measurements of financial and non-financial results. The article manages gives an overview of these gaps.

Keywords: Knowledge Management; Implementation Models; Implementation Frameworks.

RESUMO

Objetivo: Este artigo analisa as características dos *frameworks* de implementação da Gestão do Conhecimento (GC) publicados em revistas de alto impacto e responde à seguinte questão de pesquisa: Como se caracterizam os *frameworks* de implementação da GC?

Design/metodologia/abordagem: Por meio de uma revisão de literatura, identificaram-se 10 *frameworks* de implementação da GC, que foram analisados individualmente e estruturados quanto às suas dimensões e variáveis, bem como os pilares e os processos da GC.

Resultados: A análise individual de cada *framework* permitiu a geração de um quadro integrativo que orienta os rumos da pesquisa no campo. Os *frameworks* também são classificados em descritivos e prescritivos. A análise dos *frameworks* ainda evidenciou lacunas em medição dos processos, medição dos resultados e soluções que vislumbram a TI como estrutura fundamental para a GC. Além do quadro integrativo, este artigo também propõe uma agenda de pesquisa para propiciar estudos empíricos e a aplicação dos *frameworks* de GC.

Limitações/implicações da pesquisa: Este estudo se limitou aos *frameworks* de implementação de GC, logo, artigos que porventura apresentassem outras estruturas não foram contemplados na análise. Assim, próximas pesquisas poderão realizar um apanhado com perspectivas diferentes, mais genéricas ou mais específicas, analisando de forma individualizada os processos de GC e seus mecanismos.

Implicações práticas: Aos gestores, o estudo fomenta a discussão sobre a aplicabilidade dos *frameworks* de implementação invocando pesquisas mais pragmáticas e que auxiliem na medição, na aplicação e na condução dos processos de GC.

Implicações teóricas: Este artigo contribui com as pesquisas na área da GC, ao reunir *frameworks* de diferentes setores sob a classificação dos processos e dos pilares da GC, permitindo a identificação de lacunas ainda não preenchidas e reflexões acerca do afastamento dos profissionais das pesquisas no campo .

Originalidade/valor: Faltam alternativas adaptadas a determinados setores, por exemplo, o segmento bancário. Falta também incorporar aos *frameworks* o uso de modelos de maturidade de GC e indicadores para métricas do processo, que serão qualitativas e quantitativas, assim como medidas de resultado financeiras e não financeiras. O artigo consegue reunir um panorama sobre essas lacunas.

Palavras-chave: Gestão do Conhecimento; Modelos de Implementação; *Frameworks* de implementação.

RESUMEN

Objetivo: Este artículo analiza las características de los marcos de implementación de Gestión del Conocimiento publicados en revistas de alto impacto y responde a la siguiente pregunta de investigación: ¿Cómo se caracterizan los marcos de implementación de Gestión del Conocimiento?

Diseño / metodología / enfoque: A través de la revisión de la literatura, se identificaron 10 marcos de implementación de la Gestión del Conocimiento, los cuales fueron analizados y estructurados individualmente en cuanto a sus dimensiones y variables, así como los pilares y procesos de la Gestión del Conocimiento.

Resultados: El análisis individual de cada marco permitió la generación de un marco integrador que orienta la dirección de la investigación en el campo. Los marcos también se clasifican en descriptivos y prescriptivos. El análisis de los marcos también reveló brechas en los procesos de medición, los resultados de medición y las soluciones que visualizan a la TI como una estructura fundamental para la GC. Además del marco integrador, este artículo también propone una agenda de investigación para proporcionar estudios empíricos y la aplicación de marcos de gestión del conocimiento.

Limitaciones / implicaciones de la investigación: Este estudio se limitó a los marcos para la implementación de GC, por lo tanto, no se incluyeron en el análisis artículos que pudieran tener otras estructuras. Así, las próximas investigaciones podrán realizar una panorámica con diferentes perspectivas, más genéricas o más específicas, analizando individualmente los procesos de GC y sus mecanismos.

Implicaciones prácticas: Para los gerentes, el estudio fomenta una discusión sobre la aplicabilidad de los marcos de implementación, invocando investigaciones más pragmáticas que ayudan en la medición, aplicación y conducción de los procesos de GC.

Implicaciones teóricas: Este artículo contribuye a la investigación en el campo de la GC al reunir marcos de diferentes sectores bajo la clasificación de procesos y pilares de la GC que permitan identificar vacíos aún no cubiertos y reflexiones sobre la remoción de profesionales de la investigación de campo.

Originalidad / valor: No existen alternativas adaptadas a determinados sectores, como el bancario. También falta incorporar en los marcos el uso de modelos de madurez de GC e indicadores para métricas de proceso, que serán tanto cualitativas como cuantitativas, así como medidas de resultados financieros y no financieros. El artículo logra recopilar una descripción general de estas lagunas.

Palabras clave: Gestión del conocimiento; Modelos de implementación; Marcos de implementación.

1. INTRODUCTION

Interest in controlling knowledge has been growing recently (Ali, Musawir & Ali, 2018). Recognized as the main input in the generation of value and sustainable competitive advantage, organizations are looking for ways to incorporate knowledge strategies into their business models (Oztemel & Arslankaya, 2012). Due to this importance, Knowledge Management (KM) begins to play a prominent role when it comes to creating value (Al-Debei & Avison, 2010).

The literature brings together frameworks and models that present different alternatives for the implementation of KM. However, as these structures tend to be focused on a specific sector, alternatives for certain sectors are lacking, for example, the banking segment (Cebi, Aydin & Gozlu, 2010; Abbas, Rasheed, Habiba & Shahzad, 2013; Liao, Chang, Hu & Yueh, 2012; Hung, Chou & Tzeng, 2011). Another relevant aspect is the lack of frameworks or models on KM maturity that capture sufficient quantifiable information about the budgetary scope linked to KM. This can pose a barrier in that management initiatives follow guidelines based on financial results, and require quantifiable financial indicators (Hsieh, Lin & Lin, 2009). This evidence was corroborated by a study on KM indicators conducted by Oliveira and Goldoni (2006), and some indicators are proposed for process metrics, both qualitative and quantitative, as well as financial and non-financial results indicators.

Pee and Kankanhalli (2009) integrated the existing maturity models to propose a general model of KM. Applying it to a specific sample. They identified that a unit found at a maturity level rarely implements practices that characterize higher levels of maturity. Thus, they suggest investigating the relative importance of practices at each stage. They also propose future research relating the model to other aspects, people, processes, and pillars of technology, such as situational factors in the development of KM that, in this article, are identified by the KM processes. The authors argue that it is necessary to consider aspects of the internal and external environment when applying the models.

Currently, a literature review is needed that can foster the construction of a KM implementation framework that: 1) considers the lessons already learned in several sectors; 2) applies existing maturity models; 3) meets the demands for results and process measurement indicators; 4) relates the KM practices suggested in the frameworks to the KM processes and their pillars and; 5) identifies whether the propose frameworks take environmental aspects into consideration. It is therefore hoped that this study will contribute to the development of the field of study, through discussion of theoretical elements, and that it will provide a tool for managers (Rubenstein-Montan et al., 2001). The framework is important for a KM structure precisely because it highlights the link between KM initiatives and the organization's goals, justifying the proposed actions and making value generation clearer (Sunassee & Sewry, 2002).

As a contribution to management, the results of research on KM implementation have been far from applicable, reflecting a reduction in the engagement of professionals in building models (Ragab & Arisha, 2013). This has led to a disconnect between professionals and the study of KM, resulting in a low rate of use of academic findings in organizations, making much of the work produced irrelevant (Booker, Bontis & Serenko, 2008).

To achieve these objectives, this article answers the following research question: How are the implementation frameworks for KM characterized?

Based on the characteristics of different publications related to the implementation of KM frameworks, a framework was created that allows an integrated view of these artifacts and that can: 1. better guide the development of empirical research and; 2. facilitate its application in organizations. It was also possible to compare the findings and highlight the dimensions and variables that still require investigation. For this purpose, an agenda is proposed for further research.

2. THEORETICAL REFERENCE

In the view of Stevens, Millage, and Clark (2010), all knowledge is based on information, but not all information can become knowledge. At this point, KM delivers value because it helps transform information into trends, products, and greater profitability, through robust knowledge management processes, enabling the knowledge to be linked to a specific purpose or idea. The flow of information creates and organizes knowledge, which is anchored in the commitment and beliefs of the person who holds it. Therefore, knowledge is related to human action (Nonaka, 1994). The SECI conversion model proposed by Nonaka (1994), based on this dichotomy, assumes that the most valuable knowledge is contained in the minds of individuals in tacit form and can only add some value to the organization once it is converted into explicit form.

2.1 KNOWLEDGE MANAGEMENT PROCESSES

The change in thinking caused by the increased importance of knowledge implies a new approach to innovation in the organizational environment, as there is no longer room for the organization's paradigm as an information processing or problem-solving system (Al Ahbabi et al., 2019). The new challenges demand acceptance of the creative role that companies need to assume in the knowledge society. This role comprises four processes (Nonaka, 1994): 1) creation, 2) storage, 3) sharing and 4) application of knowledge.

The dimensions related to knowledge creation require the actions of an individual and, more precisely, the individual's commitment to the knowledge creation process. Therefore, knowledge creation can be understood as a continuous dialogue between tacit and explicit knowledge (Nonaka, 1994). Explicit knowledge is that which can be encoded and stored in various formats, such as manuals, such that it can be transferred without loss (Stevens, Millage & Clark, 2010). Tacit knowledge, on the other hand, is more related to an individual's experiences and opinions, making it impossible to store (Grant, 2007).

Storing knowledge is a process that can form organizational memory. Knowledge is registered via physical systems, retained formally or informally, in the form of values, norms, and beliefs, which are associated with the organizational culture and structure (Alavi & Leidner, 2001). Gonzalez and Martins (2017) list five ways of storing knowledge: 1) the individuals that make up the organization, 2) the culture that defines the way of thinking and feeling, 3) the process of transforming working methods, 4) the set of rules, hierarchies and attributions and 5) the ecology that promotes the sharing process. Information technology (IT) appears as a key tool, offering support and conditions for coding, creating directories, and creating knowledge networks (Alavi & Leidner, 2001).

Knowledge sharing encompasses the activities of transferring or disseminating knowledge between one person, group, or organization and another. This process includes both the tacit and explicit dimensions (Al Ahbabi et al., 2019). Sometimes, knowledge sharing is identified in KM models as a knowledge distribution process. In this work, we chose to use the term sharing because it is more commonly used, and because it enables the series of actions that comprise it to be better identified.

Finally, the process of applying knowledge has the role of generating value for an organization. It is a process that directs the knowledge captured and stored, towards a specific purpose. The application of knowledge becomes more evident when associated with decision-making processes, whether at the operational, tactical, or strategic levels (Al Ahbabi et al., 2019). This process is sometimes identified in the models as the use of knowledge. However, we chose to use the term application, as we believe this term is more comprehensive and more commonly used.

2.2 KM PERFORMANCE MEASURES

Linking KM initiatives to financial investment can help justify KM to senior management, with a view to improving the company's ability to manage its knowledge assets more effectively. However, as most of the benefits of KM are intangible, few alternatives can fulfill this role. Bearing in mind that most management initiatives are not guided by financial results alone, the constant concern is to identify quantifiable financial measures. However, few KM maturity models are able to capture sufficient quantifiable information in the budgetary scope linked to KM (Hsieh, Lin & Lin 2009). One of the alternatives found in the literature is the Balanced Scorecard (BSC) method, which considers financial aspects, marketing, internal processes, and learning perspectives to enable KM initiatives to be linked to performance (Lee, Lee & Kang, 2005). Another alternative offered by the literature is the Knowledge Management Performance Index (KMPI), which can be used to assess performance in KM based on an underlying basic assumption that knowledge can be seen from a unified perspective (Alavi & Leidner, 2001).

The factors of success and failure of KM have also been the subject of studies by Davenport, Jarvenpaa and Beers (1996), who identified successful KM projects in order to determine which success factors should be encouraged to enable a company to create, share and use knowledge more efficiently. Among the factors found were financial remuneration for the knowledge provider, incentive systems, and organizational culture.

In a broad study on indicators for measuring KM, Oliveira and Goldoni (2006) found that KM indicators are generally based on a comparison between planning and execution. They also suggest that KM indicators can present process metrics, both qualitative and quantitative, as well as financial and non-financial indicators of results. It is important to gather a balanced set of indicators that, when analyzed together, can accurately and comprehensively reflect the KM process. The authors also emphasize that the use of indicators must meet the requirements of validity and relevance.

2.3 IMPLEMENTATION OF KNOWLEDGE MANAGEMENT

Several KM frameworks have been developed over time, by individuals and organizations. Frameworks can be classified as prescriptive, descriptive, or hybrid (Rubenstein-Montano et al., 2001). Prescriptive frameworks provide an insight into the types of KM procedures, without dwelling on specific details about the procedures to be put into practice. In contrast, structures classified as descriptive identify relevant KM attributes in terms of their influence on the success or failure of the KM initiatives. Most of the studies found in the literature are based on prescriptive structures. As the structures are task-oriented, initial KM efforts follow a natural progression, as the processes involved in the implementation of knowledge management are tasks or activities that involve manipulating knowledge (Rubenstein-Montano et al., 2001).

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Oliveira, Caldeira, and Romão (2012) investigated the challenges associated with the implementation of KM in eleven companies operating in Portugal. Data were collected through qualitative research with the companies' management committees. The findings listed four dimensions that can guide the mapping of challenges: knowledge content, internal context, external context, and company processes. Rubenstein-Montano et al. (2001) address the need to consider the systemic view in the elaboration of KM initiatives, in order to reduce failure in the existing structure and converge towards a more generic one. The systemic view, in the author's understanding, involves the ability to understand the whole from its parts, and how each part functions within the wider set that encompasses both the final function of the macro process and the expected results. The adoption of a hybrid structure, which includes prescriptive and descriptive elements, facilitates a holistic approach that considers the activities required for KM and the additional parts of the system that impact KM activities, such as business, culture, people, and learning objectives.

3. METHODS

In our investigation of research on frameworks for KM implementation, we analyzed scientific production on the subject published in indexed journals, through a systematic literature review. As proposed by Wolfswinkel (2013), this was carried out in three stages: (1) a systematic search; (2) a systematic analysis of the literature, and (3) a content analysis. The first step was to search for articles in the Web of Science, Scopus, and ProQuest scientific repositories. These databases were used due to their wide scope, and the search filters they offer. The search terms were in English, using Boolean operators, including quotes and parentheses to control the priority given to particular expressions - ("knowledge management model" or "knowledge management framework") AND (deployment or implementation). The searches were restricted to papers published between January 2009 and November 2019, and only papers in article format were considered. In the Scopus, ProQuest, and Web of Science databases, documents were searched by article title, abstract, and keywords. Where possible, articles were searched by area of knowledge: Computer Science; Business, Management, and Accounting; Social Sciences; Engineering and Decision Sciences. Totaling the results for the three databases, 249 articles were retrieved; 197 from ProQuest, 16 from Web of Science, and 36 from Scopus.

The second step was to remove duplicate articles. In such cases, the repository record that had most citations was retained and the other removed. This procedure resulted in a larger number of articles from ProQuest than from the other repositories. Articles were then selected by title and abstract, removing any that did not meet the research objective. This left a total of 61 articles remaining. Articles that were eliminated because they had a different focus from the proposal of this research included topics such as collaborative intelligence techniques, quality management systems, decision architecture, traceability management, implementation of a management system, Six Sigma practices, the impact of KM in civil construction, e-governance, KM program curricula, maturity assessment criteria, knowledge capture for manufacturing, disaster analysis, and knowledge sharing in cross-functional teams. Also, articles published in high-impact magazines were selected according to the SJR Best Quartile indicator, leaving only those within Q1. The remaining sample consisted of 10 articles with an average H index of 88.4 and citations in Google Scholar with an average of 38.6. Using a qualitative and exploratory approach, according to Malhotra (2001), we sought to analyze whether the articles brought new frameworks, adapted frameworks already in use, or applied frameworks proposed in the literature. The list of articles from which the models were extracted is shown in Table 1.

Table 1
List of references used in the study of frameworks

Article title	References	H Index[a]	Citations[b]	Action[c]
	Prescriptive frameworks			
Toward A Unified Knowledge Management Model For SMEs	Lee & Lan (2011)	162	115	Applied
An Ecological Model For Organizational Knowledge Management	Chen, Liang & Lin (2010)	55	71	New
Enterprise Knowledge Management Model: A Knowledge Tower	Oztemel Arslankaya (2012)	56	43	New
Knowledge Management In Teams: Empirical Integration And Development Of A Scale	Singh & Gupta (2014)	95	42	Adapted
Environmental Knowledge Management: A Long-Term Enabler Of Tourism Development	Martínez-Martínez, Cegarra-Navarro & García-Pérez (2015)	159	31	Applied
A Knowledge Management *Framework* For Effective Integration Of National Archives Resources In China	An, Bai, Deng, Sun, Zhong & Yu (2017)	58	13	New
	Descriptive Frameworks			
Harmonizing Firms' Knowledge And Strategies With Organizational Capabilities	Tsai, Tsai, Li & Lin (2012)	55	28	New
An Integrated Proactive Knowledge Management Model For Enhancing Engineering Services	Wu, Tseng, Yu, Yang, Lee & Tsai (2012)	95	19	New
Knowledge-Collector Agents: Applying Intelligent Agents In Marketing Decisions With Knowledge Management Approach	Moradi, Aghaie & Hosseini (2013)	94	18	New
Using Serious Games To Manage Knowledge And Competencies: The Seven-Step Development Process	Allal-chérif, Bidan & Makhlouf (2016)	55	6	Applied

Notes:
[a] the H index was retrieved from the website www.scimagojr.com searching from the journal title in Nov. 2019.
[b] the citations were obtained from a search for articles on the website www.scholar.google.com.br in Nov. 2019.
[c] the action column denotes whether the framework suggested in the article is an application or adaptation of an existing proposal, or a new framework.
Source: the authors.

In the third stage, content analysis was performed to highlight the proposed frameworks of each article, for an integrative analysis.

4. ANALYSIS OF THE RESULTS

The change in thinking brought by the increased importance of knowledge has led to a new approach to innovation in the organizational environment. There is no longer room for the paradigm of the organization as an information processing or problem-solving system (Al Ahbabi et al., 2019). Thus, after presenting the frameworks studied in this research, the dimensions, variables, processes, and pillars are presented in Figure 11, analyzing their overlaps and gaps.

4.1 KNOWLEDGE MANAGEMENT IMPLEMENTATION FRAMEWORKS

Several KM frameworks have been developed over time, by individuals and organizations. Frameworks can be classified as prescriptive, descriptive, or hybrid (Rubenstein-Montano et al., 2001). Prescriptive frameworks provide an insight into the types of KM procedures, without dwelling on specific details about the procedures to be put into practice. In contrast, structures classified as descriptive identify relevant KM attributes in terms of their influence on the success or failure of the KM initiatives. Most of the studies found in the literature are based on prescriptive structures. As the structures are task-oriented, initial KM efforts follow a natural progression, as the processes involved in the implementation of knowledge management are tasks or activities that involve manipulating knowledge (Rubenstein-Montano et al., 2001).

To classify the sample frameworks as prescriptive or descriptive, the authors used the analysis of the factors present as criteria. When there is support for practical actions, it was considered descriptive, when support is limited to the theoretical elements of KM, it was considered prescriptive.

4.1.1 Prescriptive Knowledge Management Frameworks

To compare the problems faced by SMEs in the process of incorporating KM in Taiwan and Hong Kong, Lee & Lan (2011) developed a quantitative survey. The problems are grouped into infrastructure and process capabilities, and are listed in Figure 1.

Components	**Description**
Infrastructure capacity	
Technology	Incorporate internet access as part of the technology infrastructure.
Structure	Align the company's infrastructure and policy to encourage sharing.
Culture	Culture of support, training, and trust.
Process capability	
Acquisition	Standardized guidelines for knowledge acquisition.
Conversion	Processes to convert competitive intelligence into an operational plan.
Application	Support mechanism that allows the necessary knowledge to be delivered.
Protection	Access policies to protect organizational knowledge.

Figure 1. Growth structure of Knowledge Management (KMG-SME)
Source: Lee & Lan (2011).

Among the findings, the authors proposed that the ability to understand the problems faced by organizations when adopting and incorporating KM is part of the key business competence, so it may reflect on the willingness and speed of SMEs in implementing KM. The authors adopted the model of Chan & Chao (2008) as a starting point for creating the implementation framework. The framework proposed by the authors presents an indication of growth in GC for SMEs, starting from a point of complete lack of knowledge. They highlight seven capabilities that are necessary for the implementation process: technology, structure, culture, acquisition, conversion, enrollment, and protection.

The authors warn that detailed and systematic procedures that focus on the protection of organizational knowledge must be aligned with practices and operational knowledge. In future research, the authors suggest the development of a practical mechanism to deal with the validation and precision of organizational knowledge.

In the absence of a more ecological approach to KM, Chen, Liang & Lin (2010) sought to investigate what types of knowledge configuration should be maintained in the organization, and what the organization must do to manage the evolution of knowledge in a context of dynamic change in today's business environment. To this end, they propose the development of a new structure for the study of organizational KM from an ecological perspective, offering the model of the ecology of knowledge (DICE - distribution, interaction, competition, and evolution). This model was tested through a study of a unique case of a Taiwanese packaging industry company. The model contemplates the dimensions of distribution, interaction, competition, and evolution of knowledge. Its variables are listed in Figure 2.

Components	Description
Knowledge distribution	
Intensity	The strength of knowledge improves performance against the competition.
Diversity	The combination of different elements and structures favors the quality of knowledge.
Knowledge Interaction	
Internal	Sharing between internal communities to promote knowledge.
External	It allows knowledge to be introduced into the organization from external sources.
Knowledge Competition	
Collaborative	Ability to move towards a win-win solution by sharing certain resources or common values while competing.
Conflicting	It affects mutual understanding between members of the organization, reducing levels of knowledge sharing.
Knowledge Evolution	
Mutation	It is defined as changes or improvement of knowledge.
Crossover	It is identified as changes or improvements in knowledge initiated by external forces.

Figure 2. Knowledge ecology model (DICE)
Source: Chen, Liang & Lin (2010).

Oztemel and Arslankaya (2012) explore some KM assumptions to support the Enterprise Knowledge Management Model (EKMM) developed by the authors, which was tested in a unique case study of the office furniture industry in Turkey. The EKMM model, associated with the "Tower of Knowledge" proposal, resulted in a clearly defined procedure to assess knowledge management resources. EKMM provides 22 main criteria (Arslankaya, 2007). Figure 3 lists the components of the EKMM model with the evaluation criteria. For future studies, Oztemel & Arslankaya (2012) recommend applying the model in other industries and contexts, as well as developing models for decision making that can be linked to EKMM.

Components	Description	Main criteria
Knowledge infrastructure	5, 9, 11, 12, 15, 16, 17, 18, 19	1: Define sources and monitor progress; 2: Provide knowledge sharing and access facilities; 3: Improve knowledge and provide adaptation in use; 4: Provide positive value to the organization; 5: Protect intellectual capital and intellectual property rights; 6: Define workers' organizational roles and measure change; 7: Generates a culture of knowledge; 8: Determine Knowledge Management strategies and implement t; 9: Apply a systematic management approach; 10: Generate Knowledge Management processes and improve; 11: Make use of information technology and KM devices;
Knowledge Management Process	1, 2, 3, 4, 9, 10, 13, 14, 15, 16, 17, 18, 19, 21	
Knowledge representation	1, 2, 15, 16, 17, 18, 19, 21	
Knowledge planning	3, 4, 9, 10, 15, 16, 17, 18, 19, 22	

(Continua)

(Conclusão)

Knowledge Management Strategies	8, 9, 13, 14, 15, 16, 17, 18, 19, 20, 22	12: Use knowledge-based management methodologies; 13: Define Enterprise Intelligence and measure; 14: Develop a learning organization; 15: Experience leadership in KM; 16: Have an open mind and follow the change; 17: Offer competitive advantage; 18: Manage risks; 19: Establish an evaluation system; 20: Establish a system to increase knowledge and experience; 21: Use systematic methods of knowledge representation; 22: Determine the company's business objectives and form plans.
Knowledge organization	6, 9, 12, 15, 16, 17, 18, 19	
Culture of knowledge	3, 7, 9, 13, 14, 15, 16, 17, 18, 19, 22	
Leverage of knowledge	4, 13, 14, 15, 16, 17, 18, 19, 20	
Assessment of KM capabilities	15, 16, 17, 18, 19	

Figure 3. Relationship between criteria and components (EKMM - KT)
Source: Oztemel & Arslankaya (2012).

Singh and Gupta (2014) used mixed methods to analyze the IT sector in India. The proposal developed by the authors is interesting as it measures KM at team level, helping to promote theory and practice about KM and helping the teams understand their own practices. The proposed four-dimensional KM model uses Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) as a basis. By integrating several KM concepts, the scale presented contributes by providing actionable support, as demonstrated in Figure 4.

Components	Description
Knowledge creation	
Generation	Activities and actions that seek to increase the stock of corporate knowledge.
Application	Activities that transform knowledge into effective action related to the business.
Adoption	Activities to adapt the knowledge acquired in an external environment.
Knowledge sharing	
Transfer	Explicit and formal processes through which one unit is affected by another.
Diffusion	Process by which knowledge and innovation are communicated to other internal teams.
Actionable support	Ways in which employees cultivate the knowledge of their co-workers in the process of executing projects and solving problems at work.
Knowledge retention	
Transactive memory system	Refers to a specialized division of labor with respect to coding, storing and retrieving information in a team in order to compose a collective memory system to communicate knowledge in the group.

Figure 4. Four-factor model (3FAC)
Source: Singh & Gupta (2014).

As a way of questioning the relevance and importance of the SECI model as a facilitator of the processes of reusing and updating an organization's environmental knowledge, Martínez-Martínez, Cegarra-Navarro & García-Pérez (2015) used a quantitative approach supported by the SECI model, which was originally designed for the hospital environment in Spain. The findings suggest that the creation of environmental knowledge is a relevant factor for creating competitiveness. However, the authors argue that it is not enough to maintain competitive advantage over time. This is because the creation of environmental knowledge depends heavily on the environmental knowledge previously created and on the implementation of a KM program that facilitates KM processes. Thus, individuals will be able to focus their efforts on the problems that are most important to the organization. Figure 5 explains the perspective adopted by the authors for each of the variables. The research contributed to a questioning of existing frameworks, and the assumption of the relationship between KM processes and environmental issues over time.

Components	Description
Socialization	Sharing tacit knowledge among the actors in an organization.
Outsourcing	Process by which tacit knowledge becomes explicit
Combination	Maintain explicit knowledge in the organization associated with the existing stock.
Internalization	Process by which explicit knowledge becomes tacit.

Figure 5. Factors of the knowledge spiral (SECI-AMB)
Source: Adapted by Martínez-Martínez, Cegarra-Navarro & García-Pérez (2015).

The need to facilitate the optimized and integrated use of resources from China's national archives, led An et al. (2017) to explore the relationship between different integration mechanisms. They developed a GC-based framework to facilitate optimal use of resources. The study provides a KM structure for the effective integration of the resources of the national archives for their optimal use, as well as contributing to the examination of the role of the different integration mechanisms in the interactive processes of KM. Figure 6 shows the elements of the framework.

Components	Description
Legal control	Treating resources as valuable knowledge assets.
Collaboration	Taking steps to respect the diverse interests of various parties.
ICT adoption	Strategy to improve integration and sharing.
Standardization control	Strategy to improve integration performance
Managerial innovation	Ways to create mechanisms to adapt to changes.
Change of power	The provision of people-centered archiving services.
Accountability systems	System of responsibilities and functions linked to consequences due to non-compliance with laws and regulations.
Administrative control	Standardization of administrative control systems.
Information resource management	The management of knowledge resources, through processes such as collection, processing and storage for their optimal use.
People-centered services	Easy access to people.
Complaints handling	Repair mechanisms for actions to be taken in the event of problems.
(User feedback	Improving the quality of service provision and identifying gaps.
Risk control	Protecting national security and business privacy.

Figure 6. National Archives Model (ARQ)
Source: An *et al.* (2017).

The framework can be used to guide the development of a national strategy for the effective integration of resources from national archives, in order to promote better provision of public knowledge services in a specific society.

3.1.1 Descriptive Knowledge Management Frameworks

Tsai, Tsai, Li & Lin (2012) aimed to harmonize the Strategy Capability link (SC link) and Capability Knowledge link (CK link) as a broader construct called Strategy-Capability-Knowledge (SCK link), and to explore the gaps in this theme, as shown in Figure 7.

Components	Description
Company strategy	
Knowledge	
Built-in gap	Refers to inappropriate concepts, recognitions, ideas, institutions or understandings.
Embedded gap	Represents two conditions: lack of action-oriented actions appropriate skills in a specific environment and problems of proficiency.
Cultured gap	Refers to the weak processes of socialization and acculturation.
Embedded gap	Identifies the lack of knowledge requirements in the organization's systemic routines or processes.
Coded gap	Refers to the lack of a defined system of documents to guide employees to perform their tasks.
Organizational capabilities	
Capacity gap	Lack of necessary capabilities that can be applied and combined with other resources to provide new products or services to the market.
Dynamic resource gap	Refers to the company that lacks resources to adapt to the new environment.
Complementary capabilities gap	Insufficiency in related capacities to assist in the exercise of its main or dynamic resources.

Figure 7. Capacity and knowledge strategy model (SCK)
Source: Tsai, Tsai, Li & Lin (2012).

The authors' contribution to the SCK link, which is the result of the organizational harmonization of capacities with companies' knowledge and strategies, can explain how knowledge can help a company achieve its goals and, in addition, align its KM with the company guidelines. Based on the proposed model, the authors provided a descriptive framework for the company that participated in the case study.

For Wu et al. (2012) most of the traditional methods of KM respond reactively to the problems presented. To mitigate this problem, the authors conducted a study focused on an engineering consultancy in Taiwan, and proposed the Integrated Proactive Knowledge Management Model (IPKMM) to analyze the feasibility of a proactive solution. This study demonstrates that IPKMM can collaborate with studies to improve emerging problem solutions for engineering consultants. Study limitations included the need for user involvement, and the problem of incorrect classification, more details are shown in Figure 8.

Components	Description
EPPS (Enhanced Proactive Problem Solver)	Focused on knowledge and the experts who hold it, for proactive solutions.
Knowledge / Expert Map (K / EMap)	In EPPS, domain knowledge is represented by the Knowledge Map (KMap), while domain experts are characterized by the Expert Map (EMap).
Automatic Problem Answering Module (APA)	An automatic problem-solving system that automatically searches for the most relevant solutions.
Automatic Problem Dispatch Module (APD)	The unresolved problem is automatically dispatched to specialists.
Intellectual Asset Repository (IAR)	Consists of three main sources of knowledge: experiences, known cases and automatic feeding.
Knowledge value aggregation system (KVAS)	Compiles and records knowledge.
Intellectualization System (IS)	Generation of a corpus based on text mining that produces corpus of knowledge automatically from existing documents.
Integrated IPKMM operations	Shows the problem solving processes and the processes of generating intellectual assets.
Structure Analysis Module (SAM)	The titles of the chapters and sections are extracted and organized as a structured list of content with several levels.

(Continue)

(Conclusion)

Components	Description
Semantic Segmentation Module (SSM)	The purpose of semantic segmentation is to split a document into several shorter segments, with the phrases within a segment sharing a subtopic.
Extraction module of figures and tables (FTEM)	Figures and tables extracted are correlated with the most relevant semantic segments, to provide a corpus of knowledge.
Knowledge Categorization Module (KCM)	Used to classify semantic segments created by SSM. KCM applies case-based reasoning.
Figure and table categorization module (FTCM)	Used to classify figures and tables according to the categories of knowledge of the semantic segments relating to them.
Knowledge Integration Module (KIM)	Used to integrate KCB, KCs and LLFs into structured knowledge assets containing index semantics.

Figure 8. *Integrated Proactive Knowledge Management Model (IPKMM)*
Source: Wu *et al.* (2012).

The model proposed by Moradi, Aghaie and Hosseini (2013) comprises a knowledge management structure for making marketing decisions through agent technology, Analytical Hierarchy Process (AHP) and fuzzy logic. The goal is to develop a knowledge management structure, help marketers to make effective decisions based on useful knowledge and also encourage marketing guidelines geared towards intelligence. The proposed structure consists of four layers: knowledge management, retrieval and implementation, knowledge repository and acquisition and storage. The management layer and knowledge repository layer propositions are innovations of this model, see Figure 9.

Components	Description
Management layer	Monitors and controls agents and other layers.
Knowledge recovery and deployment layer	Responsible for locating and retrieving related knowledge, disseminating and sharing knowledge among the stakeholders.
Knowledge retrieval agent	*Responsible for recovering knowledge related to the consultation received.*
Weight determining agent	*Arises from the need to align strategic planning and managerial judgment skills, prioritizing human understanding and experience.*
Recommending agent	*Determines the appropriate decisions for marketing components based on the weights specified by the Determining Weight agent.*
Knowledge repository layer	Useful knowledge is stored in the database which is divided into different categories. The layer also updates and edits knowledge by removing outdated information.
Knowledge acquisition and storage layer	Responsible for identifying, collecting, filtering and saving new knowledge that is useful for decision making. Based on their processes, the parties can create or collect new knowledge.

Figure 9. Agent technology model and knowledge architecture (ARQK)
Source: Moradi, Aghaie & Hosseini (2013).

To investigate the effects of games on the creation of fundamental skills, Allal-Chérif, Bidan and Makhlouf (2016) analyzed the serious training games of three financial companies to determine how they contribute to the collection, formalization and dissemination of knowledge and the management of core competencies. The authors' contributions to the model can be seen in Figure 10.

Components	Description
Historization	Recording situations and relationships that occur within and through the organization.
Referencing	Referencing professional skills and key competences used by the company or its competitors to carry out its activities, according to landmark events.
Explanation	Formalizing the knowledge, skills, competencies, behaviors and vision associated with each of the key skills and competencies.
Design	Aims to recreate a playful and immersive world, where players can recognize situations of Historization and implement the knowledge and key skills of the Explication and Referencing phases.
Control	The phase of testing and verifying the overall consistency of the serious game by the main users who become referees or coaches.
Adoption	Consists of implementing serious play in a comprehensive and appropriate training protocol for each target. Adoption can be facilitated by an internal marketing campaign.
Sophistication	Deals with the evolution and continuous improvement of the game based on user feedback, new standards, new tools, new professional knowledge and skills and environmental changes, especially socioeconomic ones.

Figure 10. Spiral knowledge model for business games (SECI-GAM)
Source: Allal-Chérif, Bidan & Makhlouf (2016).

It was also identified that if the game is too far from the work environment, the players do not make the connection between virtual and real practices, and the game is not effective. As an academic contribution, the research shows the contribution of serious games to each of the phases proposed by Nonaka (1991) in the SECI model. Future research could test the model in other sectors, as well as developing a specific study on the performance of the games in each of the four phases of knowledge of the SECI model.

3.1.1 Consolidation of prescriptive and descriptive Knowledge Management frameworks

KM is a planning, organization, coordination, control and evaluation activity based on three pillars: technology, people and processes. Its main task is to provide organizational tools that, through the production and integration of knowledge, can add value to the organization (Firestone & McElroy, 2003). The three pillars were used as dimensions in the organization of the set of variables presented in the different frameworks. Because of their multidisciplinary basis, in which problems are approached from different perspectives (Dalkir, 2017), KM implementation frameworks are forged from complex analyzes that identify best practices and integrate them with theoretical assumptions (Castillo & Cazarini, 2014). In view of this observation, this work sought to bring together the main frameworks published in the last ten years, according to parameters presented in the method section. The main objective was to verify how the KM implementation is being presented in the frameworks. The dimensions and variables are represented in Figure 11.

4 DISCUSSION AND RESEARCH AGENDA

The characterization study of the KM implementation frameworks sought to gather the main publications in relevant journals, in order to assess the direction that research has taken in different sectors, as shown in Figure 11. The ten frameworks studied are marked with an X, according to the support for each of the "variable" column factors. These, in turn, are grouped in dimensions, according to the column with the same name that is based on the pillars and processes of KM. The discussion of the frameworks is accompanied by a research agenda in Figure 12, the research questions (RQ) of which are identified by the corresponding number in each gap. No structures were identified to measure the performance of KM in the studied frameworks. For Ragab and Arisha (2013), research must evolve towards the adoption of a global model, mirrored by the Balanced Scorecard (BSC). To help fill this gap, RQ2 was proposed.

It should be noted that, as recommended by Sunassee and Sewry (2002), the exclusive use of financial indicators is not recommended. Oliveira and Goldoni (2006), through a wide study on indicators that measure KM, found that KM indicators are generally based on the comparison between planning and execution. They add that KM indicators can present process metrics, which will be qualitative and quantitative, as well as financial and non-financial result measures. Thus, the introduction of purely theoretical models, without the perspective of performance evaluation, makes their application difficult, since organizations need to plan their investments and decide on different demands that consume resources that will ultimately reduce the number of comparisons needed to measure objectives. To help fill this gap, RQ3 was proposed.

		Prescriptive frameworks						***Descriptive frameworks***			
	Framework	KMG-SME	DICE	EKMM - KT	3FAC	SECI-AMB	ARQ	SCK	IPKMM	ARQK	SECI-GAM
	References	Lee & Lan (2011)	Chen, Liang & Lin (2010)	Oztemel & Arslankaya (2012)	Singh & Gupta (2014)	Martínez-Martínez *et al.* (2015)	An *et al.* (2017)	Tsai *et al.* (2012)	Wu *et al.* (2012)	Moradi *et al.* (2013)	Allal-chérif *et al.* (2016)
Dimension	**Variable**										
Pillars of Knowledge Management											
People (6)	Competition		X								
	Culture	X		X				X			
	Incentives						X				X
Processes (7)	Evaluation			X							
	Capabilities							X			
	Strategies			X				X			
	Structures	X		X							
	Legality						X				
	Standardization						X	X			X
	Planning			X							
	Routines			X			X		X	X	X
Technology (4)	Access						X				
	Control						X				X
	IT Infrastructure	X					X		X		
Knowledge Management Processes											
Application (10)	Use	X			X	X			X		X
	Evolution		X	X		X	X	X		X	X
	Flux		X		X	X			X		
	Intensity		X								
Storage (5)	Archiving				X				X	X	X
	Conversion	X							X		
Sharing (8)	Collection and donation				X	X	X	X		X	
	Diffusion				X				X	X	
	Diversity		X								
	Protection	X					X				
Creation (5)	Acquisition	X						X		X	
	Production				X				X		
	Gaps							X			

Figure 11. Integrative framework of frameworks on KM implementation
Source: the authors.

In relation to the pillars of KM, it can be identified that the People dimension still has a low forecast in the models, contradicting the principle of knowledge conversion, which recognizes the individual as the primary source of knowledge, generating value from the articulation and amplification that will allow the implementation of KM (Rubenstein-Montano et al., 2001). The Processes dimension appears with great emphasis, which is positive, in view of the objective of making the models more applicable, since one of the non-financial ways of measuring KM is through process improvement (Oliveira & Goldoni, 2006). The Technology dimension still finds incipient support in the models studied, which is surprising, given the current technological climate and the dependence of KM on technology. Regarding the dimensions of the four main KM processes, there is a balanced forecast in the models presented. To help fill these gaps, RQ1 and RQ6 were proposed.

Regarding KM Processes, there is a positive highlight on the Application and Sharing dimensions, which are, in fact, the processes of greatest interest to managers. The application of knowledge is the process that is closest to the generation of value in the context of KM, but it should be emphasized that the application depends on quality requirements, in order not to frustrate managers' expectations of implementation of KM. This quality is supported by the other three processes, especially the storage process, which had the least support in the models presented. Treating knowledge as an asset, the Storage dimension would be a way to validate the ownership of knowledge by the company, with the advantage that storage can also generate the expansion of this asset, given that new knowledge is not created from the absolute zero, but depends on the reordering of what is already known, to nurture new processes that will ultimately generate new knowledge (Al Ahbabi et al., 2019). The Creation dimension showed reasonable support in the models, but little support in the variables, and without the necessary relationship with the Storage dimension, as already mentioned. The studies suggested to fill these gaps are RQ1 and RQ5.

RQ	Construct or research question	Methodological Approach	Observation units	Practical and / or theoretical implications
RQ1	What dimensions and variables are common to most sectors for implementing KM?	Exploratory, case studies (single or multiple)	Various sectors	Propose a prescriptive framework that can be adapted for different sectors and a starting point for more descriptive frameworks.
RQ2	What performance measures can be integrated into KM implementation models?	Exploratory, quantitative, deductive	Knowledge-intensive companies	Make KM assessment more pragmatic and understandable, promoting its greater adoption.
RQ3	How can KM implementation measures be integrated with organizations' indicators?	Exploratory, case studies (single or multiple)	Knowledge-intensive companies	Promote the integration of KM measures with performance measures adopted by practitioners.
RQ4	How to integrate the steps of implementing KM and its variables in a base model?	Exploratory, case studies (single or multiple)	Knowledge-intensive companies	Promote the development of KM maturity in organizations.
RQ5	How to encourage the storage of knowledge in organizations?	Exploratory, quantitative, deductive	Various sectors	Accelerate the conversion from tacit to explicit, consolidating knowledge ownership for the company.
RQ6	How can social media assist in the implementation of KM?	Exploratory, case studies (single or multiple)	Technology companies	Promote the modernization of the structures that support KM processes.

Figure 12. Research agenda on Knowledge Management frameworks
Source: the authors.

Concerning the reasons that lead to the adoption of KM, based on a study of eleven companies operating in Portugal, Oliveira, Caldeira and Romão (2012) highlight increase in efficiency, customer image, knowledge retention when an employee leaves the company, and innovation capacity. The results demonstrate that the practitioners' interests are connected with the generation of value. Therefore, proposals for the implementation of KM need to focus on these expectations, and to consider evaluation metrics in line with these objectives. The findings also support the proposal that

the implementation of the KM occurs in stages that have groups of associated factors. The steps described are: planning, initiation, development and integration. This differs from most of the proposals analyzed in this article, which understand the implementation of KM as an indivisible process. Therefore, there is a need to integrate the models with the lessons learned in the various sectors and, in particular, to meet practitioners' expectations. The classification of dimensions should consider Oliveira, Caldeira and Romão's (2012) proposal for implementation in stages, facilitating the identification of critical points. To help fill these gaps, RQ4 was proposed.

The current research is not intended to be exhaustive, and there are several perspectives that can still be explored with regard to the implementation of KM in different institutions, especially financial and knowledge-intensive services, which have greater gaps because technological advances and rapid obsolescence of knowledge means that traditional KM models may not offer the most complete support (Hun, Chou & Tzeng, 2011).

5 CONCLUDING REMARKS

The present research characterizes the KM implementation frameworks and discusses the ability to apply the proposals. This is important from the perspective of creating value for organizations, which, ultimately, is the main purpose of research in the administration area. The frameworks presented different dimensions such as people, processes and technology, and are dispersed, making it difficult to gain an integrated view of them and apply them in the daily lives of organizations. When analyzing the characteristics of the KM implementation frameworks published in high-impact journals, we sought to characterize research on this theme through the individual analysis of each framework, which allowed the generation of an integrative framework that synthesizes the dimensions and variables considered. Among the identified gaps, there was a shortage in measuring processes, measuring results, and solutions that envision IT as a fundamental structure for KM. A research agenda was proposed to encourage empirical studies and the application of KM frameworks by managers. This article contributes to research in the field of KM by bringing together frameworks from different sectors under the classification of processes and pillars of KM, allowing the identification of gaps not yet filled and reflections on the motives that have led research professionals in the field to avoid this subject area. For managers, the study encourages discussion on the applicability of the implementation frameworks, invoking more pragmatic studies to help measure, apply and conduct KM processes. This study was limited to the frameworks for KM implementation. Therefore, articles with other structures were not included in the analysis. Future research can provide overview with different perspectives, i.e., more generic or more specific, analyzing the KM processes and their mechanisms individually.

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