

Strategic alignment of Knowledge Management Systems

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Abstract. Managing company knowledge and using it effectively is more than ever a strong competitive advantage in the business world. The scientific area of knowledge management and knowledge management systems have been intensively studied in the last years; however, we still see the unstructured implementation of knowledge management systems in organizations, the misalignment of knowledge management systems from the business model and the frustration non-use, lack of systems integration and/ or non-return on investment made either in technology or spent on heavy implementation processes. The state-of-the-art conducted during this study, showed that most knowledge management systems alignment models in the business context have a strong focus on the organizational dimension, e.g., culture, organizational processes, organizational structure, and leadership, having been identified only three models that also cover, simultaneous, the technological and strategic dimension. Our final objective in this study is, following the research survey methodology, to develop a proposed framework for the strategic alignment of knowledge management systems that can support company managers in their decision-making, and to contribute to the development of scientific knowledge in this area.

Keywords: Knowledge Management, Knowledge Management Systems, Learning Content Management Systems, Corporate Strategy, Business Context.

1 Introduction

Organizational knowledge management remains on the strategic agenda and is critical for organizations [1]. In the contemporary business environment, managers increasingly recognize that the ability to create (or acquire), retain, store, protect, disseminate, and reuse knowledge is crucial to gain a competitive advantage for the organization [2, 3]. Knowledge management (KM) emerged as a discipline that aims to enable organization members to acquire, share and collectively leverage knowledge to achieve business objectives [2, 4]. Alavi and Leidner [5] highlighted that it is not often the lack of knowledge that hinders organizational performance, but the lack of ability to transform knowledge into effective action. Several factors, related to individual characteristics,

process design, systems, and organizational culture, can contribute to individuals not applying the knowledge they obtain in their activities in the workplace [6, 7]. The authors then suggest that an important but lacking area of knowledge management research would encompass “the identification of these factors and the development of organizational practices and systems to fill the knowledge application gap”.

Knowledge management systems are a system, or set of information systems, applied to manage organizational knowledge, supporting, and improving the organizational process of creation, storage/ retrieval, transfer, and application of knowledge [5]. This type of information systems has as main objective to facilitate the sharing and integration of knowledge.

For the implementation of knowledge management systems, the organization requires a significant number of arrangements. If the process is not adequate, it will not only make the knowledge management system inefficient and unprofitable, but it will also incur harmful effects for the organization [8]. According to Frost [9], failure factors in the implementation of knowledge management systems include the lack of performance indicators and measurable benefits, inadequate management support, inadequate planning, design, coordination and evaluation, inadequate skill of managers and users and organizational culture.

The development of e-Learning has made it possible to sustain knowledge management systems in organizations. e-Learning and e-Knowledge are just two sides of the same coin, whose objective is to manage something that has a high value for the organization – the skills of employees. “Knowledge is information that gains value in interaction with intellectual capital. The same is to say that it gains value after being processed by the collaborators. Therefore, we cannot dissociate online training from knowledge management” [10].

In this context, this study aims to (1) understand how organizations position knowledge management in their corporate strategy; knowing the importance of the strategic alignment of knowledge management systems for the performance of organizations, (2) identify and understand what support models are available, (3) based on this study and after the identification of the gaps, to propose a conceptual framework for the strategic alignment of knowledge management system in the companies, which can be used by managers of the relevant areas in the organization.

To this end, and as a starting point, we carried out a Systematic Literature Review based on two research questions, the first, to understand how companies position training and knowledge management in defining their corporate strategy, and the second, to identify the current models that support the strategic alignment of knowledge management systems or learning content management systems in the business context and understand the current gaps.

2 Theoretical Background Foundations

2.1 Knowledge management

Knowledge management (KM) terminology has become more relevant with Wiig [11], defining knowledge management as a systematic, explicit, and deliberate construction,

renewal, and application of knowledge to maximize an organization's knowledge-related effectiveness and return on investment. According to Wilson [12], knowledge management is used synonymously with information management for the “management of work practices” that aim to improve knowledge sharing in an organization. Knowledge management is predominantly a construction of organizational science. However, knowledge management also has a strong link with business strategy. The referred benefits of knowledge management are to quote where considerable thought has been given to how good knowledge management practices can improve the competitiveness and financial performance of companies and how this can be measured [13]. Knowledge management practices aim to extract the tacit knowledge that people have, what they carry with them, what they observe and learn from experience, rather than what is usually stated explicitly. The distinction between tacit and explicit knowledge is critical to assessing the scope of knowledge management and how it differs from managing information and data. Broadbent [13] adds that an individual's tacit knowledge becomes explicit as part of the company's management processes. In the field of knowledge management, we must mention Nonaka et al. [14], referring to the knowledge spiral, where new knowledge always starts with tacit knowledge, not always visible or difficult to express. Knowledge is created through the interaction between tacit knowledge and explicit knowledge through 4 modes of knowledge conversion, namely Socialization, Externalization, Combination, and Internalization, also defined as the SECI method or spiral.

Nonaka and Takeuchi's spiral of knowledge is represented as shown in Fig. 1.

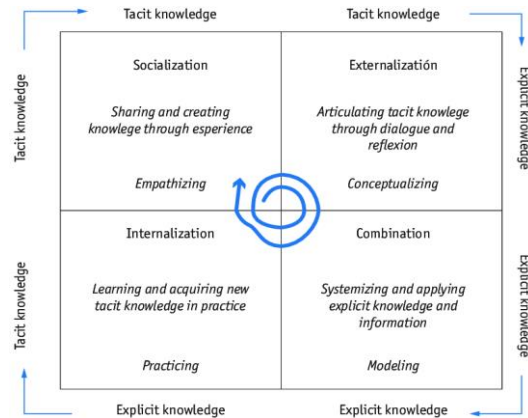


Fig. 1. SECI adapted from Takeuchi & Nonaka [15]

The great challenge for organizations is to focus on providing an appropriate context for the creation and sharing of organizational knowledge [15].

2.2 Knowledge management systems

Knowledge management systems (KMS) are a group of information technologies that support the extraction, storage, transfer, and distribution of knowledge among workers.

Typically, a knowledge management system is open and distributed, customizable, measurable, secure, accessible, available, and appropriate [16].

Alavi & Leidner [5], mentioned that “IT can support KM in sundry ways. Examples include finding an expert or a recorded source of knowledge using online directories and searching databases; sharing knowledge and working together in virtual teams; access to information on past projects; and learning about customer needs and behaviour by analysing transaction data, among others. Indeed, there is no single role of IT in knowledge management just as there is no single technology comprising KMS. There are three common applications of IT to organizational knowledge management initiatives: (1) the coding and sharing of best practices, (2) the creation of corporate knowledge directories, and (3) the creation of knowledge networks”, (p. 27).

Laudon e Laudon [17] adds that “KMS enable organizations to better manage processes for capturing and applying knowledge and expertise. These systems collect all relevant knowledge and experience in the firm and make it available wherever and whenever it is needed to improve business processes and management decisions. They also link the firm to external sources of knowledge” (p. 54).

The authors have identified three main types of knowledge management systems: enterprise-wide knowledge management systems (KMS), knowledge work systems (KWS), and intelligent techniques. Corporate KMS are related to the collection, storage, distribution and application of digital content and knowledge. These systems include features for searching information, storing structured and unstructured data. Systems also include supporting technologies, such as portals, search engines, learning management systems, or collaboration and social business tools. Knowledge work systems (KWS) are more specialized systems built for engineers, scientists or to create new knowledge for a company. Finally, the third type of knowledge management system, related to intelligent techniques, such as data mining, machine learning, computer vision systems, robotics, or other “smart” agents.

2.3 Knowledge engineering: CommonKADS methodology

CommonKADS is a methodology to support structured knowledge engineering. This method has been gradually developed and has been validated by many companies and universities in the context of the European ESPRIT Program. Since the 1990s, this methodology has been a *de facto* European standard for the analysis and development of knowledge-based systems, having been adopted in whole or in part into existing methods by many large companies in Europe as well as in the USA and Japan [18, 19]. The method has its origin in the need to build the knowledge system in a structured, controllable, and repeatable way [20]. Initially, the development of a method for acquiring knowledge in the process of building a knowledge-based system was proposed, and it was called KADS (Knowledge Acquisition Design System). Subsequently, the project was extended to the construction of a complete methodology for the development of KBS (Knowledge-Based Systems), which begins with the analysis of the organization where the KBS is oriented and for the management of projects through Programs. It is at this moment that the name CommonKADS results [21]. The methodology consists in three phases [22]:

(1) **Contextual Analysis (Context)**: in this phase, the focus is on the organization that will eventually use the system, describing the business processes, resources, and knowledge assets and the impacts that the knowledge-based systems will have.

(2) **Conceptual Analysis**: this phase intent to clarify the knowledge that will be represented in the knowledge-based systems, the reasoning that will need to be conducted on this knowledge and the interactions that will be required with users and other external agents.

(3) **Artifact**: at this stage, the project is created for the knowledge-based systems that can be translated into code in some appropriate programming language.

In addition to the three phases mentioned above, the CommonKADS methodology comprises six independent models, which capture various sources of information, allowing the feasibility and implementation of the project to be analysed. The six models, despite being independent, are related to the others and can be developed at various times and by different teams.

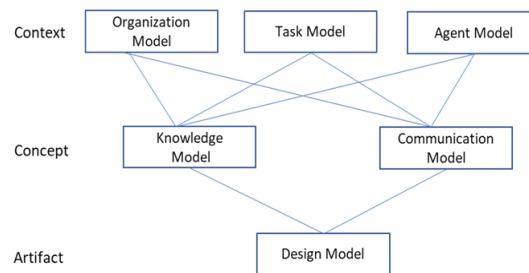


Fig. 2. CommonKADS Methodology adapted from Schreiber et al. [20]

For Dias and Pacheco [22], the CommonKADS methodology can be considered the most complete as it involves all stages, ranging from planning to implementation, encompassing not only the technology aspects, but also the characteristics and aspects of the organization, being able to make the most of your own knowledge.

3 Methodology

This research paper applied a systematic literature review (SLR) method and followed Kitchenham's [23] approach, considering three steps:

1. **Planning**: identifying the needs for review, summarizing all existing information about some phenomenon in a complete and unbiased way. For this, we specified the research questions and developed the review protocol.

2. **Conducting**: selection of primary studies and data extraction, using the review protocol developed in the first stage.

3. **Reporting**: summarize the extracted data and report the results. The purpose of our review is to bring definite evidence as a synthesis of the best quality scientific studies on our specific topic or research questions and to identify gaps to suggest areas for further investigation.

3.1 Planning

The most important pre-review activities are defining the research questions that the systematic review will address and presenting a review protocol, i.e., the plan defining the basic review procedures [24]. The research questions are the follow:

- RQ 1: How do companies position training and knowledge management in defining their corporate strategy?
- RQ 2: What models or artifacts exist to support the strategic alignment of knowledge management systems in a business context?

The first step in developing a Review Protocol is to define the search string that will be used to search the chosen data sources and find the maximum number of articles or works on the subject. For its definition, the adaptation of the PICOC criteria (Population, Intervention, Comparison, Outcome, Context) was used [24]:

- Population: CIO, CEO, Chief Learning Officer, corporate directors
- Intervention: strategy, learning systems
- Comparison: knowledge management systems, learning content management system, learning management systems
- Outcome: framework, model, artefact
- Context: business organization, business corporation, business

The data source used for the research was the b-on platform (<https://www.b-on.pt/>) provided by Universidade Aberta and Scopus (<https://www.scopus.com/>), to which the following search string was applied:

((CIO OR CEO OR “Chief Learning Officer” OR “Corporate Directors”) AND (strategy OR “learning systems”) AND (KMS OR LCMS OR LMS) AND (framework OR model OR artefact) AND (“business organization” OR “business corporation” OR business)).

The second step was to define the inclusion and exclusion criteria and apply them to the set of articles that we obtained in the first step. It is often useful to evaluate selection criteria on a subset of primary studies [23]. The defined criteria are shown in Table 1:

Table 1. Inclusion and Exclusion criteria

Inclusion	Exclusion
Research papers or academic articles	Papers prior to 2006
English or Portuguese papers	Incomplete papers
Papers available in the search platform	Subject not correlated
Papers reviewed by peers	Without citations
	Duplications

Although the research area has studies prior to 2006, the technological development of information systems and the concern to align company strategies and knowledge management have gained greater expression in the last 15 years. Other criteria were based

on quality assessment, therefore, we also excluded incomplete articles or articles without citations. After applying the defined criteria and obtaining the first set of articles, the abstract and conclusions of all articles were analysed to assess their relevance to the research. The resulting set consisted of selected articles, which were read in full in the next step, to obtain the final set of selected works. The review protocol is shown in Figure 3.

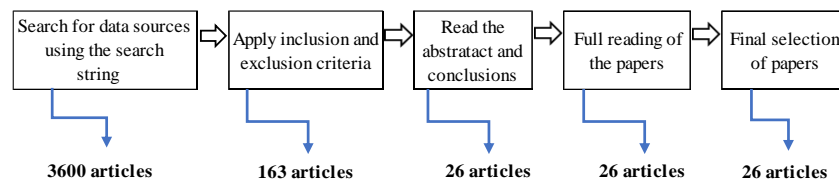


Fig. 3. Review Protocol

3.2 Conducting

After choosing the data source and applying the defined search string, we obtained more than 3,600 articles, which we later reduced to the first set of 163 articles, applying the inclusion and exclusion criteria presented in Table 1, and finally after reading the full articles we obtain 26 articles that were used to answer to our research questions and that are mentioned in the next tables on the section 3.3.

As per Fig. 4, there was a greater interest in this specific topic in the years 2012, 2013 and between 2015 and 2017, with an increase in the number of studies in 2020.

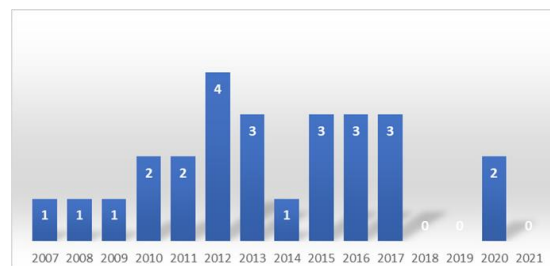


Fig. 4. Quantity of selected papers per year

Our search string brought some articles in the year 2018 and 2019, however, after reading the abstract and conclusions, they were rejected as they were not directly correlated to our scope of study.

3.3 Reporting

Based on the twenty-six selected works, an investigation was conducted to answer **RQ1: How do companies position learning and knowledge management in defining their corporate strategy?** Of the twenty-six final works selected, five are related to information systems strategy and indirectly to knowledge management, and how this reflects in business or corporate strategy. Corporate strategy takes a portfolio approach to strategic decision making, analysing all a company's businesses to determine how to create the most value. To develop a corporate strategy, companies must observe how the various businesses they own fit together, how they impact each other and how the holding company are structured to optimize human capital, processes, and governance. Corporate strategy is based on business strategy, which is concerned with making strategic decisions for an individual business. Based on this concept, the selected works were grouped in table 3, using three elements and correlated to the information systems strategy, namely: Organizational Structure, Processes and Governance.

Table 2. Corporate Strategy and IS

Corporate Strategy and Information Systems				
Paper Id	References	Organizational Structure	Processes	Governance
P004	[28]	√	√	
P005	[29]	√		
P013	[37]	√		
P020	[44]			√
P025	[49]		√	

The selected studies focus on organizational structure, showing the influence of the CIO or the structure of top information technology executives [29] and the understanding of the CEO and CIO in facilitating the alignment of organizations' information systems with business strategy and the contribution of information systems to business performance [28, 37].

Khaiata et al. [49], propose an instrument that measures the maturity of the alignment between business and information technologies, with the objective of identifying the main gaps. The proposed instrument was based on the Strategy Alignment Maturity Model (SAMM); it directly encodes all attributes of the SAMM alignment areas using a one-dimensional structure. The instrument was successful in identifying six major gaps for the company in the various areas of alignment. These gaps were benchmarking, business metrics, strategic business planning, inter and intra organizational learning, architecture integration and the impact of information technologies on business processes.

A study conducted by Chau et al. [44], addresses the effects of the strategic alignment of information technologies, the business, and their governance, on company performance and investigates the curvilinear relationship between alignment, misalignment, and company performance. They conclude that the results emphasize that managers of initiative-taking organizations must pay attention to alignment and governance

to leverage information technologies more effectively and ensure powerful performance results.

Related to the answer to **RQ2: What models or artifacts exist to support the strategic alignment of knowledge management systems in a business context?** The data collected from Table 3, was organized, and analysed to correlate the KMS models or frameworks proposed by each article, with the three main dimensions of knowledge management implementation [51]: Organizational, Technological and Strategy.

From the analysis, we identified three articles whose proposed models consider the three dimensions of implementation of a knowledge management system and which we will discuss in greater detail (Paper Id P002, P006 and P025).

Table 3. KM dimensions / KMS Models

KM dimensions / KMS Models				
Paper Id	References	Organizacional	Technological	Strategy
P001	[25]	√		
P002	[26]	√	√	√
P003	[27]	√		
P006	[30]	√	√	√
P007	[31]	√	√	
P008	[32]	√	√	
P009	[33]	√	√	
P010	[34]	√	√	
P011	[35]			√
P012	[36]			√
P014	[38]	√	√	
P015	[39]	√	√	
P016	[40]	√		
P017	[41]	√		
P018	[42]	√		
P019	[43]	√		
P021	[45]	√		
P022	[46]	√	√	
P023	[47]	√		
P024	[48]	√		
P025	[49]	√	√	√
P026	[50]	√	√	

Baloh et al. [30], referred as Paper Id P006, unlike conventional research, arguing that the development of a knowledge management solution for the entire company is of limited value. Not only do different knowledge challenges exist in organizations, but people also have different tasks in the course of their daily work. The authors propose a model to guide the design of knowledge management systems based on knowledge needs. The model shows in Fig. 5.

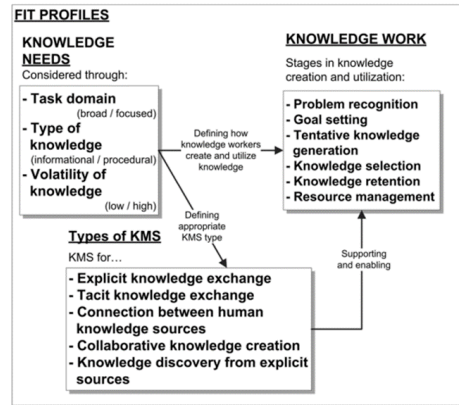


Fig. 5. KMS design model [30]

The model consists of “ideal” combinations of knowledge needs and characteristics of knowledge management systems, which should result in improvements in the use and creation of knowledge. The design model developed allows the knowledge management community to critically evaluate ongoing efforts to leverage organizational knowledge with support systems. The proposed model can also apply to retroactively analyse successful and unsuccessful KMS implementations. Finally, they present guidelines for professionals on how to use the model to build a knowledge management system as part of knowledge-related organizational change projects, as shown in Figure 6:

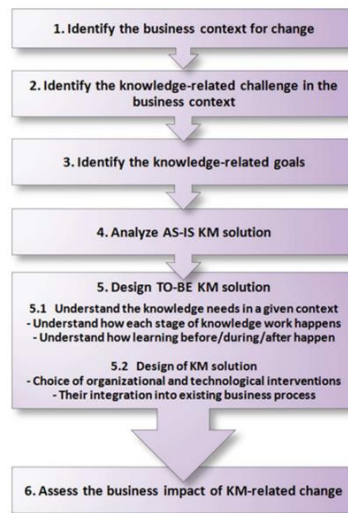


Fig. 6. Process of designing and implementing solutions for KM [30]

The authors mention that the results of their research show that the model of technology choices and the guidelines for its use form a highly relevant KMS design model, and that the findings represent the first step towards a robust approach to the design science that supports a new construction of the appropriate knowledge management systems.

Mehregan et al. [26], Paper Id P002, takes a different approach, using Critical Success Factors (CSF) as a method to define knowledge management systems evaluation criteria and uses the Gray Relational Analysis (GRA) matrix to score and prioritize knowledge initiatives. Critical Success Factors (CSF) refers to something that must be implemented if companies want to succeed in a specific field. These factors must be controllable and measurable. The study defined eight categories of CSFs, which, after applying a survey to five target companies, presented the following results by category and company:

Table 2: value of each company in each criterion and the relational coefficient of each company

value of each company in each criterion								
Company	Critical Success Factors (CSF)							
	Top management support	Communication	Document management	KM user satisfaction	Knowledge quality	KMS quality	KM-Business alignment	Culture
1	1.8	2.4	4.2	0.8	2.4	4.4	3.2	4.6
2	4.8	2.2	1.2	2.4	3.4	3.8	2.2	1
3	3	2	4.6	3.6	1.2	3.2	2.2	2.4
4	1.8	1	4.6	3.2	1	1.4	3.6	3.6
5	3.2	2.2	1.4	1.8	4.6	2.8	2.8	4
the relational coefficient of each company in each criterion								
1	0.286	1	0.769	0.286	0.396	1	0.58	1
2	1	0.741	0.286	0.482	0.548	0.667	0.286	0.286
3	0.4	0.58	1	1	0.298	0.5	0.286	0.396
4	0.286	0.286	1	0.741	0.286	0.286	1	0.588
5	0.43	0.741	0.298	0.396	1	0.43	0.412	0.702

Fig. 7. Critical Success Factors by company [26]

The main contribution of this article is to propose a novel approach to evaluate knowledge management systems. The study enumerates three advantages in the proposed model, (1) it proposes a tool to compare the performance of knowledge management solution providers, (2) it provides a comprehensive evaluation to reveal the weaknesses and failure points of KM initiatives in a particular organization and helps managers to improve the performance of those systems and (3) is generic in nature and is applicable to any organization such as industry, healthcare, consulting firms, etc. and can overcome the disadvantages of statistical methods.

Khaiata et al. [49], Paper Id P025, state that the alignment of information technologies (IT) strategy with the business clearly has an impact on organizational performance, in the same way that they mention that the big problem of this alignment is knowing how to “measure” it. The study approach proposes an instrument that measures the maturity of the alignment between business and information technologies, with the objective of identifying the main gaps. The proposed instrument was based on the “Strategy Alignment Maturity Model” (SAMM) [49]. The instrument explicitly ad-

dresses four distinct groups. Group Management is best suited to address business strategy issues. The IT Management group, on the other hand, can better handle IT strategy issues. The Staff group is more familiar with business operations. Finally, the IT team group is the most competent to manage operational IT issues.

SAMM [49] proposes that IT-Business alignment can be captured according to six areas of maturity, namely:

Communication maturity: to ensure continuous knowledge sharing across the organization and IT understanding of the business and vice versa.

Value Measurement Competency / Maturity: to demonstrate the value that IT is contributing to the business.

Governance maturity: to ensure that appropriate business and IT stakeholders are reviewing IT priorities and resource allocation.

Partnership maturity: to reflect the level of trust developed between IT stakeholders and the business, in sharing risks and rewards.

Scope and Architecture Maturity: the level of flexibility and transparency that IT is providing to the business.

Skills Maturity: to reflect the level of innovation, change, hiring and retention, and how they are contributing to the overall effectiveness of the organization.

For each of these areas, this maturity model classifies the alignment between business and information technology at five levels:

1. Initial/ad hoc process, where business and IT are not harmonized or aligned.
2. Committed process, where the organization is committed to aligning with IT.
3. Established/focused process, where the alignment between IT and business is established and focused on the business objectives.
4. Improved/managed process, where the concept of IT as a “Value Centre” is reinforced.
5. Optimized process, where strategic business planning and IT is integrated and have reached a co-adaptive stage.

All other items listed in table 4 reflect a strong focus on the organizational dimension, being 100% of articles pointing “culture” as a key factor in knowledge management and in the process of implementing a support system, followed by factors related to processes. Structure and leadership are less mentioned as a relevant factor. In the technological dimension, despite the technical aspects of information systems and infrastructure, the quality factors of the information systems and the return on investment stand out.

4 Conclusions and future work

In conclusion, while knowledge management (KM) is about people and human interaction, the support systems have evolved far beyond an optional part to being a critical component today. The establishment of an effective knowledge management system (KMS), inseparable from the business context, also requires a clear strategy, reflecting

the different dimensions mentioned to be successfully implemented and aligned with the corporate strategy.

The answer to the first research question, "how do companies position learning and knowledge management in the definition of their corporate strategy?", we conclude that there is a clear influence of the organizational positioning of the functions that lead the knowledge area or information systems strategy with the corporate strategy and its contribution to the business performance.

The answer to the second research question, "what models or artefacts exist to support the strategic alignment of knowledge management systems in a business context?", from the articles analysed, we conclude that only three present models that somehow support the strategic alignment of knowledge management systems or IT in the business or enterprise context, covering the three dimensions (organisational, strategic, and technological). The first article [30], it's a model proposal for the design of knowledge management systems, considering the specific needs of knowledge, starting from the assessment of the AS-IS situation to TO-BE. The second article [26], brings us a model for evaluating the critical success factors of knowledge management systems, which may differ from company to company. The third article [49], proposes a model for assessing the maturity of IT and business alignment as a fundamental step to improve an organization's performance, addressing alignment gaps, and allowing the organization to set the focus.

This study shows that there is a lack of a model or framework that represents the alignment between: company strategy, knowledge management strategy and the strategy of the systems that support it.

In our future work, based on the information obtained from the literature, and with the combination of the knowledge engineering methodology, CommonKADS [20], we will carry on our investigation to propose a conceptual framework for the strategic alignment of knowledge management systems in the business context. For that purpose, and to obtain information, the research survey methodology [52] will be used.

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