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RESEARCH ARTICLE

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Knowledge management maturity assessment frameworks: A proposed holistic approach

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Abstract

The paper aims to provide a systematic overview of the maturity models used in knowledge management (KM) with the purpose of identifying different perspectives, contributions, shortcomings, and implementation gaps. This study can be characterized as a theoretical research based on a systematic literature review. As a result of this analysis, KM key points and knowledge management maturity models (KMMMs) critical success factors (CSFs) are pointed out and recorded. The concept of standardization and its relation to KM, presenting known KM Standards and their core principles is explored. Even though there is a large number of publications on KM, a literature gap is identified in publications regarding the field of KM Standards and corresponding case studies. Based on the most widely spread critical success factors used in the knowledge management maturity assessment presented in the literature survey, the objective of this paper is to propose a holistic and integrated knowledge management maturity assessment framework encompassing the core guidelines of ISO 30401 in order to be used by researchers and practitioners for future reference in the form of a generic maturity assessment web matrix.

1 | INTRODUCTION

Maturity is the degree to which an object, technology, process, or organization evolves over time (Klimko, 2001; Jiuling et al., 2012; Serenko et al., 2015; Escrivão & Silva, 2019). Maturity models (MM) in organizations methodically classify procedures and determine phases, which lead to the manager's plans (Churchill & Lewis, 1983; Gaál et al., 2008). Knowledge, even though intangible, is an asset that like any other asset needs to be managed (ISO, 2015).

Maturity in Knowledge management (KM)is the degree to which knowledge assets are effectively managed within organizations (Sajeva & Jucevicius, 2010). It symbolizes the ongoing phase-by-phase management of knowledge assets until knowledge is deliberately and methodically defined, managed, checked, stored, and shared while also generating useful results for the company (Kulkarni & Louis, 2003; Teah et al., 2006; Pee & Kankanhalli, 2009). The stages of evolution of KM efforts in an organization are described by KM maturity (KMM) (Pee & Kankanhalli, 2009). The phases of growth are defined by a knowledge management maturity model (KMMM), which also aids businesses in evaluating the development of KM practices, improving decision-making, and recommending performance improvements (Teah et al., 2006; Lin, 2007; Gaál et al., 2008; Oliveira et al., 2010; Lin, 2011; Abu Naser et al., 2016). An organization's KM maturity is determined by how well it constantly manages its knowledge assets and applies them (Kulkarni & Louis, 2003).

Seventy-eight percent of the corporations believe that they missed out on a fair number of commercial possibilities, due to not proper knowledge and 80% of the corporations regard knowledge as their strategic asset (KPMG, 2002/2003).

Knowledge management (KM) is becoming more important for achieving sustainable business success (Paulzen et al., 2002). Mainly knowledge-based companies (e.g., financial services, chemical

industry, consultants) have embarked on KM practices in order to rise to the challenges of the aggressively changing markets. This poses the question of whether these implemented practices are successful and whether the proper practices were selected to begin with. In an effort to address this question, both researchers and practitioners have designed several paths to measuring the success and efficiency of KM. The systematic management of knowledge resources is defined as one of the crucial factors for sustainable competing leverages (Lee & kim, 2005).

The process of defining "knowledge" and designing the metrics to determine if to what degree is an organization effectively managing its knowledge resources is a complex exercise. Assessment is the first step toward enhancement, as one cannot improve what one cannot measure (Kulkarni & Louis, 2003). There are benchmarks and indicators for assessing and evaluating the degree of acceptance and maturity of any business practice that could possibly affect business process and success. Essentially, maturity models present the evolvement of an object over time. This "object" can be anything within the operational spectrum: a human being, an organizational process, a business initiative, or a technology. Maturity models are a natural application of the life-cycle approach, in the sense that all entities grow through stages of maturity over time until they achieve the ultimate level (Ping Jung et al., 2009).

Organizations must learn how to learn, in order to become competitive (Aggestam, 2006). How an organization achieves maturity in this specific field is not determined. Knowledge management should concentrate on creating and managing knowledge stocks if knowledge is seen as an object or is equated with information access (Alavi & Leidner, 2001). If knowledge is viewed as a process, then the creation, sharing, and distribution of knowledge, as well as knowledge flow, are the suggested areas of focus for knowledge management. A knowledge management perspective that emphasizes developing core competencies, comprehending the strategic advantage of know-how, and generating intellectual capital is suggested by the notion of knowledge as a capability.

This three-fold perspective could serve as the foundation for an integrated knowledge and resources management framework.

In the next section a literature survey of research in KM assessment frameworks is presented. It was based on the most prominent literature review articles that assessed hundreds of frameworks and thousands of published papers in the field of KM assessment frameworks for the last 30 years. The research has formulated the research objective that this study addresses, namely: *the proposal of a novel holistic and integrated framework to KM Maturity Assessment*. The literature survey also revealed a series of research questions associated with the study's main research objective:

RQ1. What is the relationship between human resources and KM?

RQ2. What is the relationship between strategy and KM?

RQ3. What is the role of leadership in KM?

RQ4. What is the role of performance measurement in KM?

RQ5. What is the relationship between change management—continuous improvement and KM?

RQ6. What is the relationship between process and KM?

RQ7. What is the role of enablers in KM?

RQ8. Which are the required enablers for a successful KM?

Section 2 also presents the result of the research regarding the research objective. Section 3 includes a literature survey on the standardization of Knowledge Management Assessment, formulating the extended research objective: *the proposal of a holistic and integrated Knowledge Management Maturity Assessment framework encompassing the core guidelines of ISO 30401 in order to be used by both researchers and practitioners*. In section 4 the GQC model is proposed for implementation regarding the ISO 30401:2018 standard requirements. Finally, in section 5 a discussion regarding the research questions is presented followed by the proposal for a KM-specific integrated model is presented. Figure 1 below, depicts the approach followed in the paper in presenting the literature survey, research questions, proposed approach, and its application to ISO 30401:2018.

2 | LITERATURE SURVEY OF KNOWLEDGE MANAGEMENT AND CORPORATE RESOURCES MANAGEMENT MATURITY FRAMEWORKS

2.1 | Literature survey methodology and results table

For the selection of the literature survey used in this research, the Scholar database was selected as the primary search base and the following methodology was applied (as depicted in the corresponding scheme).

"Knowledge Management Maturity Assessment" was defined as the primary search objective, returning more than a million results. However, when peer-reviewed filter was applied, the number was restricted to 74.000 results.

In the next step, the secondary research objective "organizational" was applied to further restrict the results. Reviewing the titles and abstracts of the mostly cited papers, additional keywords were defined, the critical success factors, such as human resources, process, technology, enablers, leadership, change management, corporate culture, continuous improvement, strategy. When these factors were used, the results came up to 19.900. Afterward, strictly related to Information Technology Systems results were excluded to provide the final 13.000 results relevant to the research. These were sorted by relevance and the first 1.000 more relevant were abstract scanned manually, to select 100 of them. Finally, these 100 papers were full-text scanned manually to provide the 39 final selected results to be used in this research (Figure 2).

The research results of the literature survey on KM are shown in the table below, regarding subject focus (Table 1).

Knowledge management (KM) frameworks' aim is to collect the individuals' expertise knowledge and share it in the form of collective knowledge among the organizational entities, producing and establishing what is known as organizational knowledge

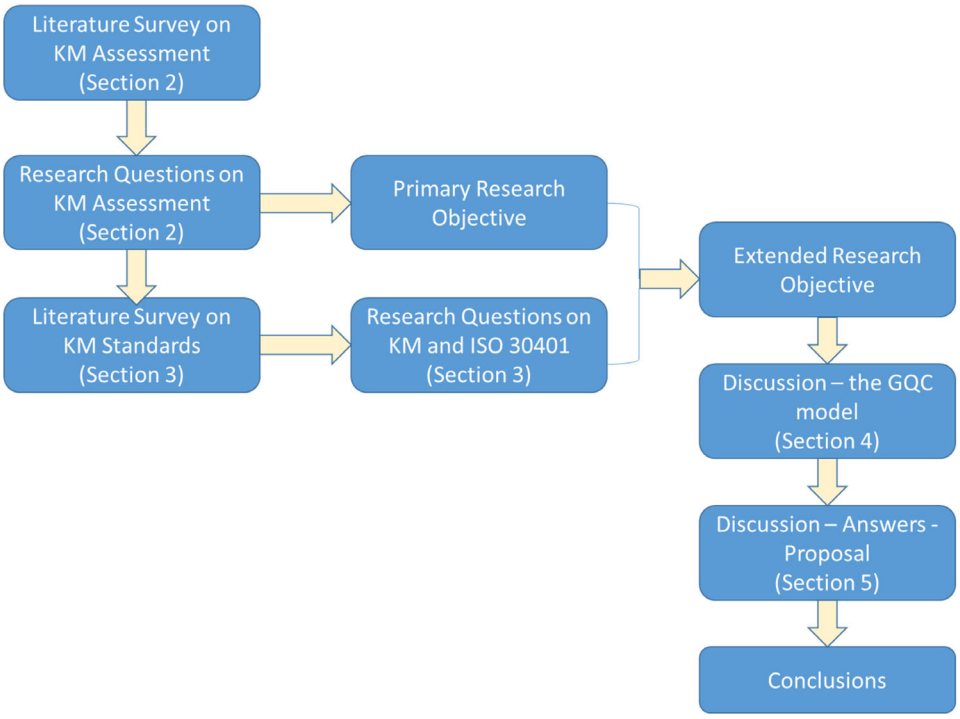

FIGURE 1 Research and presentation approach. [Colour figure can be viewed at wileyonlinelibrary.com]

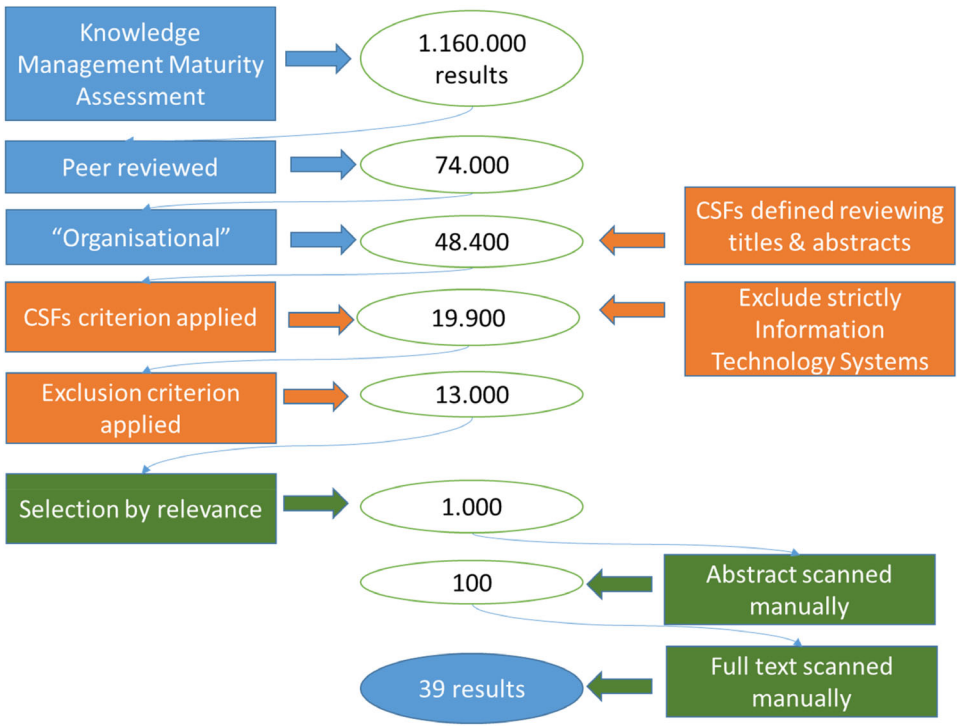

FIGURE 2 Literature survey methodology. [Colour figure can be viewed at wileyonlinelibrary.com]

(Kuriakose et al., 2010). The KM framework is dictated by business needs, aiming at performance improvement via collective knowledge. KM implementation within an organization is not strictly intended for -or limited to- certain fields, as KM covers various areas like Information and communication technology, Information science, Systems science, and engineering, Knowledge engineering, Collaborative engineering, Organizational development, Change management, Performance management and so forth.

The implementation of KM cannot happen radically over a short period of time, as it implies primary changes in technological infrastructures, organizational processes, people, and corporate culture. In that sense, KM is unlikely to be achieved in one giant leap (Teah et al., 2006). Starting from a point of deliberation and preparation, passing through strategic planning and training, the goal should be sustainable change, assessment, and improvement throughout all corporate processes and resources. Knowledge Management is an evolutionary

TABLE 1 Knowledge management references used in the literature survey (2000–2022)

Reference	Subject focus
Kochikar (2000)	In the framework of Infosys Technologies Ltd., created a generic KMMM. Default, reactive, conscious, convinced, and sharing are the model's five stages. People, process, and technology are the key areas taken into account.
Klimko (2001)	Developed a generic KMMM with five stages: initial, knowledge discoverer, creator, manager, and renewer, specifying each stage's characteristics in terms of focus, key processes, challenge, tool, and pitfall to foster consensus and shared understanding among managers of a firm using a top-down approach.
Paulzen et al. (2002)	A knowledge process quality model (KPQM) is proposed, based on quality management and process engineering, to assess and improve KM structures and processes. Supports systematic knowledge management learning and continuous quality improvement.
Berztiss (2002)	CMM for KMKE identifying KPAs: Knowledge requirements management, internal knowledge acquisition, uncertainty, awareness, training, knowledge representation, knowledge engineering techniques, user access and profiling, external knowledge acquisition, qualitative and quantitative cost/benefit analysis, technical change management.
Ehms and Langen (2002)	Focusing on strategy and goals, environment and relationships, people and competences, collaboration and culture, leadership and support, structures and forms, technology and infrastructure, and processes and roles organization, the KMMM of the Competence Center for KM at Siemens AG.
Kulkarni and Louis (2003)	Identified key maturity areas: lessons learned, expertise, data and structured knowledge in the form of a survey, the results of which indicate that self-assessment of KMM is possible.
Lee and Kim (2005)	Defined KMM factors through literature review and tested the model thorough a number of case studies. Confirmed the existence of four stages. Findings verified the existence of the temporal sequence in KM implementations, proposed a new management object, community of practice (COP).
Feng (2006)	Defined enablers and processes for: creation, storage, sharing and application, suggested factors for KMM, suggested a KMMM based on the concept of continuous process improvement and the capability maturity model (CMM).
Aggestam (2006)	KMMM aiming to set directions for Learning Organizations focusing on culture, leadership/ management, vision, organizational learning, work processes/ day-to-day activities, organizational IT memory, internal and external factors (system's thinking).
Isaai and Amin-Moghadan (2006)	Introduced an integrated framework built on evaluation, maturity level, and the APQC implementation road map toward a decision support system (DSS) for the methodical application of the framework with leadership, personnel skills, and process standardization as important components.
Teah et al. (2006)	Compared nine existing knowledge management maturity models (KMMM) to propose a General KMMM (G-KMMM), focusing on assessing the maturity of people, process and technology aspects with cross references to change management and strategy planning. Proposed that areas of key processes of an organization can be at different phases (one factor may be more evolved than another).
Yeh et al. (2006)	Through the case study of two companies, verified the KM factors concluded by other papers regarding: 1.strategy and leadership 2.corporate culture 3.people 4.information technology 5.organizational enablers.
Phelps et al. (2007)	Referred to the requirement for policy formation and identified the six "tipping points" as being people management, strategy direction, system formalization, customer needs, acquiring funding, and operational improvement.
Kruger & Snyman (2007)	Formulated a Knowledge Management Maturity Questionnaire consisting of six (6) sections, containing 101 descriptive questions, based on a seven - level KM maturity matrix, focusing on personnel and leadership awareness.
Lin (2007)	Developed a stage model that focuses on two key questions: (1) do organizations alter their KM practices over time in order to increase their effectiveness?, and (2) do these changes occur as a result of socio-technical support?
Rasula et al. (2008)	Proposed an integrated KMMM based on three categories of critical success factors: knowledge-related, organization-related and IT-related factors.
Grundstein (2008)	Proposed a Model for General Knowledge Management within the Enterprise (MGKME) based on a sociotechnical approach focusing on people and value-adding processes.
Pee and Kankanhalli (2009)	Proposed a General KMMM that encompasses the initial, aware, defined, managed, and optimizing stages, with human resource planning, technology change management, continuous learning and improvement as KPAs.
Ping Jung et al. (2009)	Formulated a knowledge navigator model (KNM™) consisting of five maturity stages, three target management objects (culture, KM process, and information technology), 68 KM activities, and 16 key areas (KAs).
Jennex et al. (2009)	Influence on business processes, impact on strategy, leadership, and knowledge content are the dimensions used to gauge the performance of KM as a multidimensional concept.
Kruger and Johnson (2010)	Devised a questionnaire to investigate KMM, tested it and confirmed importance of elements such as the formulation of strategy, measurement, policy, content, process, technology and culture as enablers for KM.
Kuriakose et al. (2010)	Developed a morphological framework of Knowledge Management Maturity Model identifying six dimensions: Context, applicability, stages, assessment, validation, key areas.

TABLE 1 (Continued)

Reference	Subject focus
López & Meroño (2011)	Empirical study consisted of 310 Spanish organizations and structural equations modeling focusing on strategic knowledge management, innovation and performance. Organizational learning (OL) is acknowledged as a key issue on strategic management.
Lin (2011)	Survey data from 241 managers in large Taiwanese firms were collected and used to test the research model using the structural equation modeling (SEM) approach based on knowledge self-efficacy, top management support, and KM system quality.
Kim et al. (2014)	Defined four KM strategies: external codification, internal codification, external personalization, and internal personalization. A multiple contingency model of KM strategy is developed based on the technology-organization environment framework.
Massingham (2014a, 2014b)	4 KM toolkits and 16 KM tools were tested over a 5-year period. The highest rating toolkit was knowledge strategy, followed by knowledge measurement. The most value was created by using KM to introduce objectivity into future thinking (future capability requirements) and decisions when filling competency gaps (sourcing).
Abu Naser et al. (2016)	Used KMM to measure performance in two universities. Identified the most important factors affecting performance excellence as: Processes, KM Leadership, People, KM Outcomes.
Fashami and Babaei (2017)	Developed a behavioral maturity model for managers to examine effectiveness of knowledge management. An empirical case study showed that transformational leadership, human and social skills, knowledge orientation, emotional intelligence, trustful climate are identified as highly effective.
Escrivão and Silva (2019)	Provided a systematic review, an identification of main gaps and a comparison of existing KMMMs, which can potentially support the development of a complete and integrated KMMM.
Antunes and Pinheiro (2019)	Identified the link and evolution between the concepts of knowledge management, organizational learning and memory focusing on Human Resources.
Lee et al. (2019)	Suggested that the impact of KM capability on firm performance is more pronounced in the long term than in the short term. By contrast, knowledge management systems (KMS) is associated only with immediate, short-term financial benefits with such gains prone to instability in the long term.
Spanellis et al. (2020)	Contributed to KM literature by developing a dynamic model of KM, which shows how KM capability evolves over time within an organization. In this model, KM evolves from managing explicit knowledge through knowledge sharing to creating new knowledge.
Pereira et al. (2021)	Concluded that they are halfway through the adoption of KM systems after analyzing the general maturity level of European project-based organizations to determine which stages were more developed and what are the key steps to achieve successful organizational learning.
Demir et al. (2021)	This study looked at how KM practices and organizational sustainability interacted in ISO 9001-certified and non-certified businesses.
Bibi et al. (2020)	The need for information to be rethought theoretically. Provides a unified framework for corporate knowledge and sees knowledge management (KM) as a management role.
VelÃ¡squez et al. (2021)	Assessments of case study in two universities have demonstrated the university performance and challenges associated to KM during COVID-19 via interaction with capitals: Human, structure and relational.
Veeravalli and Vijaya lakshmi (2022)	Considered the impact of organizational HR and KM practices on knowledge seeking behaviors to support knowledge exchange dynamics and stimulate curiosity for learning among members.
Chen et al. (2022)	Constructed a comprehensive theoretical framework of "data-driven context—dynamic capabilities—knowledge hiding," proposing three dimensions of "institutional environment—organizational innovation—executive/individual cognition" on building dynamic capabilities.

process of constant change and continuous improvement (Paulzen et al., 2002; Pee & Kankhalli, 2009) (Figure 3).

The evaluation of the current situation, the quantity and quality of organizational knowledge, the design of a specific plan based on the evaluation findings, business strategy, and knowledge maturity indicators, and the definition of an action program at the managerial and operational levels to improve knowledge are all components of a comprehensive framework to determine an organization's level of maturity and implement knowledge management practices (Isaai & Amin-Moghadan, 2006).

Practitioners and researchers have advocated the need for "Knowledge Management Maturity Models" (KMMMs) (Escrivão & Silva, 2019). KMMMs provide a road map for KM implementation. The concept behind any such model is based on strategic objectives and the best possible use of corporate resources available (Kuriakose et al., 2010). KMMMs direct organizations to performance improvement (Zaim, 2006). There is a strong relationship between KM processes and an organization's performance, whereas knowledge distribution, sharing, and mostly knowledge creating have the greatest effect on KM practices' success and can also be used as performance benchmarks (Klimko, 2001).

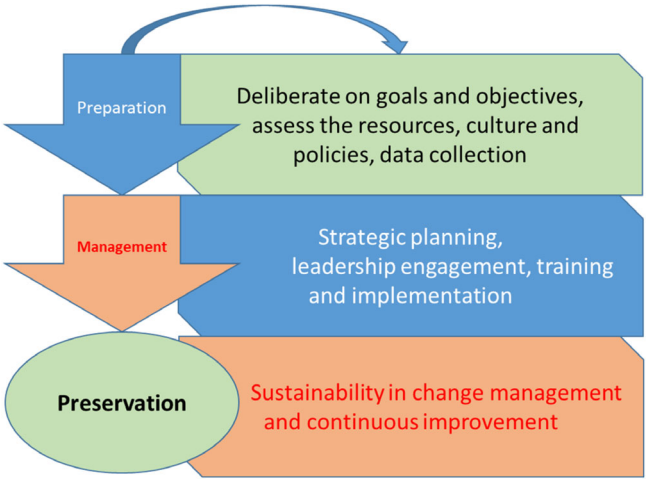

FIGURE 3 KM implementation process. [Colour figure can be viewed at wileyonlinelibrary.com]

KMMMs usually have the following properties in common (Kuriakose et al., 2010):

- The evolvement of any resource (object, human being, process, technology) is decomposed and presented through a small number of maturity levels (usually four to six).
- Levels are defined by specific demands that the "resource" has to meet on that specific level.
- Levels are progressively categorized, from a starting level to an ultimate level of excellence.
- While evolving, the resource graduates from one level and proceeds to the next, without the possibility to skip a level.

Some secondary principles dictate (Ehms & Langen, 2002; Paulzen et al., 2002; Teah et al., 2006) that the model should:

- Be applicable to different objects of analysis, for example, organizations as a whole, organizational unit, or KM systems. This can be achieved through targeting processes rather than specific objects of analysis.
- Consider the views of different participants. Specifically, Paulzen et al. (2002) suggest that employees should participate in the assessment of KM maturity.
- Provide a methodic well organized approach which will in turn provide transparency and reliability during the assessment phase, focusing on the significance of measurement and standardization.
- Procure qualitative and quantitative results.
- Be comprehensible and allow cross references to established management concepts or models.
- Support continuous learning and improvement.

KMMMS consists of stages, and a survey of the literature shows that the stages are typically presented in a similar way by different researchers (Escrivão & Silva, 2019). Despite some minor variations, KM is primarily caused by organizations not understanding the importance of their processes. With the goal of comprehending, gathering, preserving, and disseminating information, initiatives are designed or implemented as organizational awareness of the significance of KM grows. These initiatives are typically linked to supporting technology and activities. The creation of new knowledge is then given more attention. With time, KM procedures become formalized and widespread across the organization. The last level involves integrating KM techniques into enterprises' external environments and evaluating them in order to achieve continuous improvement.

The capability maturity model (CMM) is a well-known maturity model that is extremely well-liked by businesses (Kuriakose et al., 2010). The Software Engineering Institute of Carnegie Mellon University created its most recent version, the capability maturity model integration (CMMI), which employs both a staged maturity assessment depiction and a continuous maturity assessment portrayal for process improvement. The model contains five stages in the staged portrayal. "Initial" maturity level 1 is characterized by random and chaotic processes. The second maturity level is referred to as "Managed," and it is characterized by procedures that are organized and carried out in accordance with organizational policy. The third maturity level, "Defined," is distinguished by the usage of established procedures to create consistency throughout the business. The fourth degree of maturity, "Quantitatively Managed," is distinguished by the management of process performance through quantifiable goals. The fifth maturity stage, referred to as "Optimizing," is characterized by continuous process performance improvement through ongoing, creative process and technical advancements.

Four CMM-based KMMM were identified (Teah et al., 2006): Siemens' KMMM (Ehms & Langen, 2002); Infosys' KMMM (Kochikar, 2000); Paulzen et al. (2002) Knowledge process quality model (KPQM); and Kulkarni and Freeze's (2004) Knowledge management capability assessment model (KMCA).

Kochikar (2000) developed a generic KMMM, in the context of Infosys Technologies Ltd. The model has five stages: default, reactive, aware, convinced, and sharing. The assessment methodology is objective. The model does not specify anything about validation. The Key Areas considered are people, process & technology (Kuriakose et al., 2010).

Paulzen et al. (2002) developed a maturity model for quality improvement in knowledge management, called Knowledge process quality model (KPQM). The model has five stages: initial, aware, established, quantitatively managed, and optimizing. The model addresses the assessment on a universal level; however, it does not clearly define a methodology. The model's validation is discussed as potential future work. The three key areas are technology, people, and organization. The model's basic tenet is that corresponding management structures can be made better in order to enhance knowledge processes. KPQM is designed as a maturity framework that ensures the identification of different levels of maturity and the implementation of a continual quality improvement procedure.

A KMMM was created by Ehms and Langen (2002) to satisfy Siemens' requirements. Initial, repeated, specified, managed, and optimizing are the first five stages of the model. The described assessment

process is unbiased. The validation process is not covered by the model. The model identifies eight key areas: leadership and support, people and competencies, collaboration and culture, people and objectives, environment and partnerships, processes/roles and organization, strategy and knowledge goals, and knowledge structures and forms. These three components make up this methodology: a model for development, one for analysis, and one for auditing. Because these model tools may be used to gather important information in terms of quantity and quality to direct the KM implementation project, using them can generally lead to an understanding and evaluation of an evolving and at the same time complete expansion of knowledge management.

A knowledge management capability assessment model (KMCA) was created by Kulkarni and Freeze in 2004 to specify the capability levels of a company in several knowledge disciplines. Six capability levels—difficult, achievable, encouraged, enabled, managed, and continually improved—are presented by the model. The model employs common questions to determine the subjective assessment process. The process of validating a model involves using empirical approaches. Expertise, lessons learned, knowledge papers, and data are the four categories under which knowledge can be arranged. These regions, which are essentially the key areas, are referred to as knowledge capability areas (Kuriakose et al., 2010).

Feng (2006) created a new KMMM and tested it in a business bank using the concepts of continuous process improvement and the Software Engineering Institute's Capability Maturity Model (CMM). Previously, the approach for evaluating the maturity of models was created from the viewpoint of enablers. A model was created by Feng from the viewpoint of the knowledge management process. Then, isolating knowledge management from the viewpoint of the knowledge management process, KM enablers are utilized as components of tools or methodologies to accomplish every knowledge management process objective of every maturity level (five maturity levels in total).

Escrivão & Silva (2019) draws the conclusion that by default, KMMMs based on CMM see the organization as an information-processing machine and ignore characteristics that pertain to people, knowledge, and learning. Such approaches devote too much time to dealing with technological challenges and neglect to take organizational culture, a crucial component of knowledge management (Kruger & Snyman, 2005; Lee & Kim, 2001). Additionally, software engineering is composed of highly structured procedures, narrowly focused process regions, and quantifiable outcomes. But KM procedures are not standardized, and its operations are distributed across the business and among a large number of knowledge handlers. As a result, KM outputs are not clearly recognized (Berztiss, 2002; Kulkarni & Louis, 2003). To obtain a comprehensive evaluation of KM development, KMM must be measured from a variety of angles. As a result, KMMMs have crucial regions that, in some way, differ from CMMs (Kulkarni & Freeze, 2004). As a result, CMM-based KMMMs can present a limited viewpoint by treating the organization as a product, disregarding the more accurate perception that an organization is a social creation formed out of live humans with goals and aspirations. The difficult challenge of managing organizational knowledge has less to do with technology and more to do with the relationships between competency, context, and human resources.

Non-CMM-based KMMMs share less common characteristics among them than CMM-based KMMMs (Teah et al., 2006). They are based on the process of maturity of organizations and are based on the concept of supremacy of a managerial perspective above others (Gaál et al., 2008; Klimko, 2001) as opposed to CMM-based models which are based on the maturity process of products, like software, and often advocate the supremacy of a technical perspective above others(Gaál et al., 2008; Klimko, 2001).

Klimko (2001) developed a generic KMMM. The model has five stages: initial, knowledge discoverer, knowledge creator, knowledge manager, and knowledge renewer. The model does not define a validation or assessment methodology and defines the requirements of each stage in the sense of focus, key processes, challenge, tool, and pitfall (Kuriakose et al., 2010).

Lee and Kim (2005) used a triangulation approach to develop a stage model. It addresses the process of building organizational capacity of knowledge management. According to the model, organizational capability of knowledge management grows through the following four stages: initiation, propagation, integration, and networking. In the survey results, it is possible to observe the temporal sequence of knowledge management implementation which Lee and Kim could not verify in their earlier study in 2001.

Aggestam (2006) presented a draft version of a maturity model with the objective of setting guidelines on how to become a learning organization and to help people and organizations in identifying where they are in this process, using a set of stages. The method is an analysis of quality terms based on both theoretical and empirical data. The main target groups for the results are practitioners in strategic positions and researchers in this field of research.

Isaai and Amin-Moghadan (2006) presented an integrated approach that addresses three issues, including implementation road mapping, maturity stages, and evaluation. Two modules that are taken into account for maturity and assessment are connected as two parallel procedures. This implies that with thorough investigation, we may first determine the organization's KM maturity level's score (based on the assessment module), and then map the score to a maturity level (using the CMU maturity model). The relationship between the maturity and implementation modules can be used to determine the best course of action for KM promotion.

Teah et al. (2006) reviews, compares, and integrates existing Knowledge Management Maturity Models (KMMM) to propose a General KMMM (G-KMMM), which focuses on assessing the maturity of people, process and technology aspects of KM development in organizations.

Kruger and Snyman (2007) developed a Strategic KMMM. Six stages in maturity are identified: Information and Communications Technology (ICT) as an enabler for KM, deciding on KM principles, ability to formulate organization-wide knowledge policy, building knowledge strategies, formulation of KM strategies, and omnipresent knowledge. An assessment or validation methodology is not defined

by the model, however, the maturity requirements for each level are described in general terms.

Grundstein (2008) suggests that knowledge is not manageable, as if it were data or information. In that sense, Knowledge Management (KM) should refer to actions that both generate and use knowledge, instead of dealing with knowledge itself. In this way, Grundstein presented a sociotechnical approach of KM within the organization and evolved it into an empirical model called the Model for General Knowledge Management within the Enterprise (MGKME).

Pee and Kankanhalli (2009) proposed a generic KMMM. The model includes five stages: initial, aware, defined, managed, and optimizing. The assessment methodology used is objective and the proposed approach was used in a case study to provide validation for the model. The Key Areas considered are people, process & technology (Kuriakose et al., 2010).

Researchers most commonly define five stages of KM maturity (Rasual, 2008): Start-up stage 1. the organization is characterized by only a few KM activities; Take-off stage 2. the organization's KM strategy is developed and its development is characterized by the need of KM structure and resources; Expansion stage 3. the organization is increasing visibility of KM leadership and initiatives and is characterized by a more structured approach to address the barriers and risks; Progressive stage 4. the performance of KM activities is enhancing and the organization is characterized by a focus on KM measuring methods increasing maturity low performance high performance; Sustainability stage 5. the highest stage, where the organization expends effort in sustaining the performance of KM practices and KM becomes an integral part of the organizational culture.

An organization acquires and creates knowledge for different goals and using different methods, and we need to consider the aspect of how to collect knowledge, insights, and significant expertise over time (Wiig, 1994). When it comes to human resources, people need to be trained and educated on how to In people: Train and educate people in order to distribute their know-how and skills as well as to enhance the ways they perform everyday tasks. When it comes to storage and archiving, knowledge needs to be documented and databases need to be built to spread knowledge. Finally, knowledge needs to be integrated in standards, technology, and operating practices in order to improve technology and the way it is used. If practitioners in strategic positions want to initiate a process aiming to become a Learning Organization (LO), Aggestam (2006) recommends that they start with a KM project on a functional level in the sense that there is no point in beginning by arguing "why" since an answer to that question would be too vague (Senge, 1994). This suggests the use of KM as an approach to becoming a LO. Senge (1994) advocates that by simply providing an organization with methods and instruments to use, new ways of thinking are bound to emerge.

The majority of the KMMMs reviewed identify people-related, process-related, and technology-related KPAs (Teah et al., 2006). The remaining KMMMs also refer to these aspects even if they do not explicitly mention these KPAs. Together, it is expected that these KPAs can provide a comprehensive KM assessment.

Yeh's (2006) research and case study intended to identify the critical part that enablers play in implementing knowledge management within an organization. The findings on the part played by the enablers showed that: regarding strategy and leadership, acquiring tangible support by top management is gravely important. Findings regarding organization culture enablers suggest that the formulation of a culture of sharing is the most important factor but also should be supported by information technology. The research on people enablers revealed that, in addition to training programs and educational courses that guarantee learning, a program centered on the motivation of the workforce is a crucial critical element. Findings of information technology enablers revealed that, in addition to digitizing documents, creating a dedicated team focused on putting knowledge management into practice is one of the most important factors. Its role goes beyond merely managing knowledge, as it simultaneously broadens knowledge management by being in charge of coordinating several departments and facilitating communication between them.

Rasula (2008) advocates that the model should consist of more than one factor, observing that: one factor cannot represent a general situation of KM maturity in an organization because the latter is dependent on more than one critical success factor (CSF); Some factors are interdependent and cannot be taken out of context (e.g., high quality of IT tools does not yet mean there is an adequately developed organization climate to support the use of it). Thus, the eight chosen factors that should build the KM maturity model are: Knowledge-related (accumulation, utilization, sharing, and ownership); Organization-related (people & organizational climate and processes); IT-related (capturing knowledge and usage of IT tools).

The initial step to creating a KMMM is to define the factors necessary for KM development, in order to be able to understand how these factors behave in each phase and level in the future (Escrivão & Silva, 2019). However, practitioners often choose the key factors without validation from a scientific point of view, whereas others dismiss certain key factors to the evolvement of KM, considering them to be quite complicated and difficult to measure. These observations point to the conclusion that existing models are inadequate, dictating thus a need for selecting key factors that should comprise a KMMM systematically and using scientifically validated empirical data (Teah et al., 2006; Pee & Kankanhalli, 2009; Lin, 2011).

KM and KMMMs have been widely researched and analyzed in theory, but not adequately in project-based environments (Pereira, 2021). There is a need for a KMMM conceived for the reality of projects, and for implementing KM practices with as minimum as possible effect projects' time schedules and budgets. In addition, it should be interesting to study whether more adjustable models can result in more reliable assessments and can assist in guiding the sequential steps of KM framework implementation. People, infrastructure, and organizational culture are often studied separately, even though it is more possible that they are in different maturity phases and need to be measured separately.

2.2 | Knowledge categorization: Tacit vs explicit knowledge, internal vs external, public vs individual

Knowledge is often classified as either tacit (implicit) or codified (explicit) (Massingham, 2014a, 2014b). Tacit knowledge is the knowledge in an individual's head (Polanyi, 1967). Knowledge that can be transferred using a formal, systematic language is referred to as codified knowledge (Nonaka & Takeuchi, 1995). In the sense that you need one to utilize the other, tacit knowledge and codified knowledge are two sides of the same coin. When describing the KM toolkits that assist in managing knowledge resources, this distinction is crucial (Massingham, 2014a, 2014b). The distinction between tacit and explicit knowledge was first made by Polanyi (1967), who made the following claim: "While tacit knowledge can be possessed by itself, explicit knowledge must rely on being tacitly understood and applied".

As a source of distinctiveness and competitive advantage, tacit knowledge is frequently more valuable. However, it may or may not be observable in usage, be complicated or simple, and may be a component of a system or an independent feature (Winter, 1987). There is an extra difficulty, though: tacit knowledge, which people carry around with them, can only fully contribute to the economy when it is expressed explicitly in organizational processes. However, this conversion procedure or flow is neither automatic, simple, or readily repeatable (Nonaka & Takeuchi, 1995). According to Demir et al. (2021), "intangible knowledge management" refers to a company's internal and external performance, including strategies for customer happiness and loyalty, brand reputation, stakeholder policies, and staff engagement and retention (Brito et al., 2020; Darroch, 2005). When compared to tangible resources, it is extremely unlikely for a rival firm to imitate and apply these variables and strategies in order to gain an edge (Bratianu & Orzea, 2010; Karamustafa & Ülker, 2020; Pereira et al., 2019).

The SECI (Socialization, Externalization, Combination, Internalization) Spiral of Conversion model I is a four-step process of knowledge creation including: socialization, externalization, combination, and internalization (Nonaka & Takeuchi, 1995). Between tacit (implicit) and codified (explicit) information, there is a conversion process that produces knowledge. According to Nonaka and Konno's (1998) SECI model of organizational knowledge creation, there are three levels of social aggregation (individual, group, and organization), and the model relies on gathering externalized knowledge and editing and processing it through documents, plans, reports, and market data in the combination stage (Grundstein, 2008; Demir et al., 2021).

Any business that attempts to market new products must establish a thorough understanding of tacit and explicit knowledge. The stages that should be taken into consideration in the following step are innovation, creativity, management, and commercialization (Isaai & Amin-Moghadan, 2006).

Explicit knowledge is "knowledge that can be expressed in words and numbers and shared in the form of data, scientific formulae, specifications, manuals, and the like" (Nonaka & Konno, 1998). This kind of knowledge can be readily transmitted between individuals formally and systematically (Demir et al., 2021). Tacit knowledge is defined as being "highly personal and hard to formalize, making it difficult to communicate or share with others" (Nonaka & Konno, 1998). Dzenopoljac et al. (2018) suggest that an effective KM pushes an organization's members to share their expertise which in turn ensures the formulation of tacit knowledge into explicit knowledge for obtaining KM success. However, if explicit knowledge is poorly managed, the potential for creating new knowledge might be limited (Spagnellis, 2020). KM's attractiveness is based on the argument that intangible assets, such as knowledge, have replaced tangible assets as the principal driver of economic growth (Boisot, 2002) (Figure 4).

Apart from tacit and explicit knowledge, Demir et al. (2021) also classifies knowledge as private/public and individual/social knowledge (Bryant, 2003; Zaim, 2006). Berztiss (2002) distinguishes internal from external knowledge. Internal knowledge resides in an organization itself, in the form of data bases and data warehouses, and, most importantly, the skills of people. External knowledge is gathered via personal contacts and communication media. After the knowledge requirements have been determined, a systematic approach to the gathering from internal sources of items of knowledge relevant to the requirements needs to be established.

2.3 | Literature discussion and research results

During the literature survey, some commonly referenced critical success factors, enablers, and key elements were identified to be presented in this section and grouped in the following table (Table 2).

2.3.1 | Human resource management (education, training, inspiration, rewards, sharing) as a critical success factor in KMMMs

The ability of an organization to use and leverage knowledge is greatly dependent on its Human Resources, which is practically who generates, uses, and shares that knowledge (Antunes & Pinheiro, 2019). KM projects happen in an organization. Implementation of a KM system and practices ignites questions that guide the members to new ways of thinking, for example, about organizational learning, shared vision, leadership, and learning culture. This can be identified as the beginning, first in the minds of people, and then in processes, discussions, operations and so forth, (Aggestam, 2006).

The institutionalization of a training program is considered a priority task(Berztiss, 2002). Initially, everybody in the organization is to be informed about the purposes of KM and Knowledge Engineering, and how the KM-KE program will affect them. Specialized training needs will become apparent as the KMKE program develops, particularly with respect to KE techniques, and the group in charge has to provide appropriate training opportunities for the rest of the groups.

According to Yeh et al. (2006), since knowledge is maintained within the individual, the most crucial aspect of knowledge management is figuring out how to allow a person's hidden knowledge to be

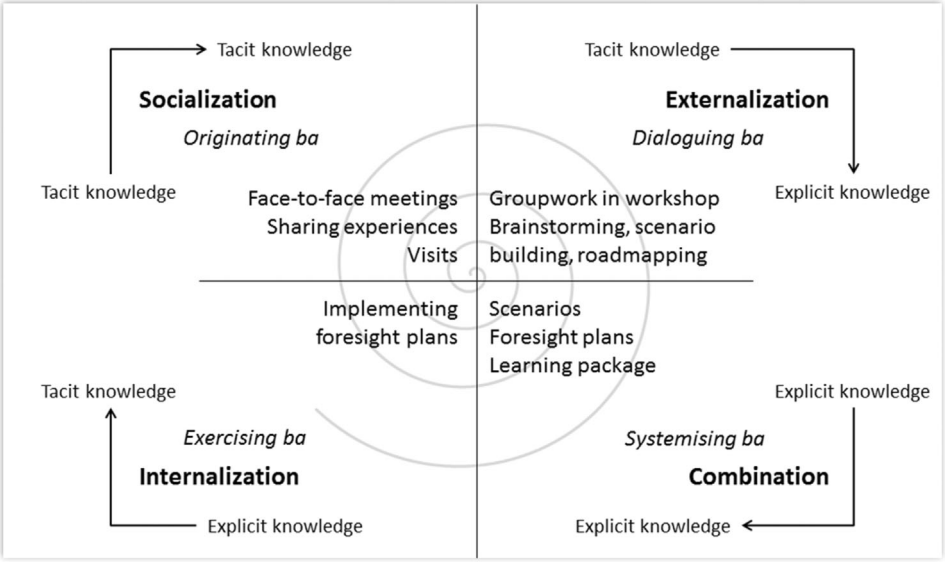

FIGURE 4 Nonaka's SECI spiral model, 1995.

shared with other employees so they can use it and turn it into knowledge for the company. As a result, encouraging employees to interact and share their expertise with others is a crucial component for an organization to advance knowledge management (Nonaka & Takeuchi, 1995).In terms of the organizational environment, encouraging a culture of knowledge sharing and top management support may lead to managers and employees interacting and socializing with one another, which will likely increase the effectiveness of KM. To execute KM programs, managers need to make an effort to encourage healthy social contact among staff members and provide them the freedom to develop initiatives for new opportunities (Lin, 2011). Participation will be improved by organizational practices including pertinent training, knowledge-sharing-enabling HR policies, and curiosity-fostering KM practices (Veeravalli & Vijayalakshmi, 2022). Knowledge is developed and managed through human activities and technical methods to connect people from different departments and administrative levels in certain situations, such as educational institutions, where knowledge management is such organizations' primary goal. Individual and collective learning processes are improved by the process of forming working groups and trusting relationships that produce and share their own knowledge, which in turn improves and evolves both individual and organizational performance (Abu Naser et al., 2016) (Figure 5).

Experience shows that there can be strong resistance to the introduction of KM-KE (Berztiss, 2002). A common cause of this resistance is that users have to go through very complex access procedures and extensive search to arrive at items of knowledge they are looking for. Moreover, users who could benefit from knowledge that has been collected by an organization are often unaware of its existence. The setting up of user profiles that reflect the interests of users in some detail would allow the matching of knowledge needs and knowledge availability. Knowledge can be encouraged by a set of collaborative practices of HRM (Antunes & Pinheiro, 2019).

Knowledge hiding (KH)—an intentional attempt to withhold or conceal knowledge from others (Connelly et al., 2012)—is quite a prevalent phenomenon in the workplace (Peng, 2013; Singh, 2019), but KH has always had negative influences on creative performance, interpersonal relationships and organizational development (Cerne et al., 2014; Connelly & Zweig, 2015; Jiang et al., 2019; Chen et al., 2022). In the era of big data, a majority of traditional organizations have transformed into knowledge-intensive ones (Ciampi et al., 2020), where big data aspects can motivate KH behaviors and then have adverse consequences for firms (Ghasemaghaei, 2018; Ghasemaghaei & Turel, 2020).

2.3.2 | Process (acquisition, storage, conversion, dissemination, application, creation) as a critical success factor in KMMMs

Various representations of knowledge have been studied in different contexts. Knowledge can be expressed as interpreted data, rules, and processes (Berztiss, 2002). Knowledge management is seen as the management of the processes of generating, storing, accessing, and disseminating of the intellectual assets of an organization (Antunes & Pinheiro, 2019).

Paulzen et al. (2002) define: 1. Managing Knowledge processes to support business processes. This includes the management of activities such as using or distributing knowledge and 2. Managing Knowledge processes to support the organizational knowledge base (organizational memory), for example, the management of storing new knowledge, or evaluating existing knowledge (Figure 6).

In Ehms & Langen's model (Ehms & Langen, 2002), emphasis is placed on characteristics of procedural organization within the context of a process-based organization when discussing concerns relating to organizational structure and the assignment of knowledge management tasks. Finding a way to incorporate knowledge

TABLE 2 Literature survey finding table: Critical success factors

	CSF focus										Enablers	
Reference	Human resources	Process	Leadership	Change management	Performance measurement	Continuous improvement	Information and knowledge management	Strategic	Customer	Supplier relationship	Organizational resources enablers	Organizational element enablers
Kochikar (2000)	✓	✓					✓					
Klimko (2001)	✓	✓	✓			✓	✓	✓			✓	✓
Paulzen et al. (2002)	✓	✓			✓	✓	✓				✓	✓
Berztiss (2002)	✓	✓		✓			✓		✓	✓		
Ehms and Langen (2002)	✓	✓	✓				✓	✓	✓		✓	✓
Kulkarni and Louis (2003)	✓	✓		✓	✓	✓	✓					
Lee and Kim (2005)	✓		✓	✓	✓		✓		✓	✓	✓	✓
Feng (2006)	✓	✓				✓	✓	✓	✓	✓	✓	✓
Aggestam (2006)	✓	✓	✓				✓	✓			✓	✓
Isaai and Amin-Moghadan (2006)	✓	✓	✓		✓		✓	✓		✓	✓	✓
Teah et al. (2006)	✓	✓		✓	✓	✓	✓	✓			✓	✓
Yeh et al. (2006)	✓		✓				✓	✓			✓	✓
Phelps et al. (2007)	✓	✓				✓	✓	✓	✓			
Kruger and Snyman (2007)	✓	✓			✓		✓	✓				
Lin (2007)	✓	✓		✓		✓	✓				✓	✓
Rasula et al. (2008)	✓	✓	✓		✓		✓	✓			✓	✓
Grundstein (2008)	✓	✓	✓				✓		✓	✓	✓	✓
Pee and Kankanhalli (2009)	✓	✓	✓		✓	✓	✓	✓			✓	✓

(Continues)

TABLE 2 (Continued)

Reference	CSF focus										Enablers	
	Human resources	Process	Leadership	Change management	Performance measurement	Continuous improvement	Information and knowledge management	Strategic	Customer	Supplier relationship	Organizational resources enablers	Organizational element enablers
Ping Jung et al. (2009)	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Jennex et al. (2009)	✓	✓	✓		✓		✓	✓				
Kuriakose et al. (2010)	✓	✓	✓	✓			✓	✓				
Kruger and Johnson (2010)	✓	✓	✓		✓		✓	✓				
López & Meroño (2011)	✓	✓			✓		✓	✓			✓	✓
Lin (2011)	✓	✓	✓				✓				✓	✓
Kim et al. (2014)	✓	✓	✓		✓		✓	✓	✓		✓	✓
Massingham (2014a, 2014b)	✓	✓	✓	✓	✓		✓	✓	✓			
Abu Naser et al. (2016)	✓	✓	✓		✓		✓					
Fashami and Babaei (2017)	✓		✓				✓				✓	✓
Escrivão and Silva (2019)	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Antunes and Pinheiro (2019)	✓	✓	✓				✓	✓			✓	✓
Lee et al. (2019)	✓	✓			✓		✓				✓	✓
Spanellis et al. (2020)	✓	✓	✓	✓		✓		✓				
Pereira et al. (2021)	✓	✓	✓		✓	✓					✓	✓
Demir et al. (2021)	✓	✓	✓		✓	✓	✓	✓	✓			

TABLE 2 (Continued)

Reference	CSF focus										Enablers	
	Human resources	Process	Leadership	Change management	Performance measurement	Continuous improvement	Information and knowledge management	Strategic	Customer	Supplier relationship	Organizational resources enablers	Organizational element enablers
Bibi et al. (2020)	✓	✓					✓	✓			✓	✓
VelÃ¡squez et al. (2021)	✓	✓			✓		✓				✓	✓
Veeravalli and Vijayalakshmi (2022)	✓		✓		✓		✓				✓	✓
Chen et al. (2022)	✓		✓	✓			✓				✓	✓

Note: The Significance of tick mark includes-elaborates on.

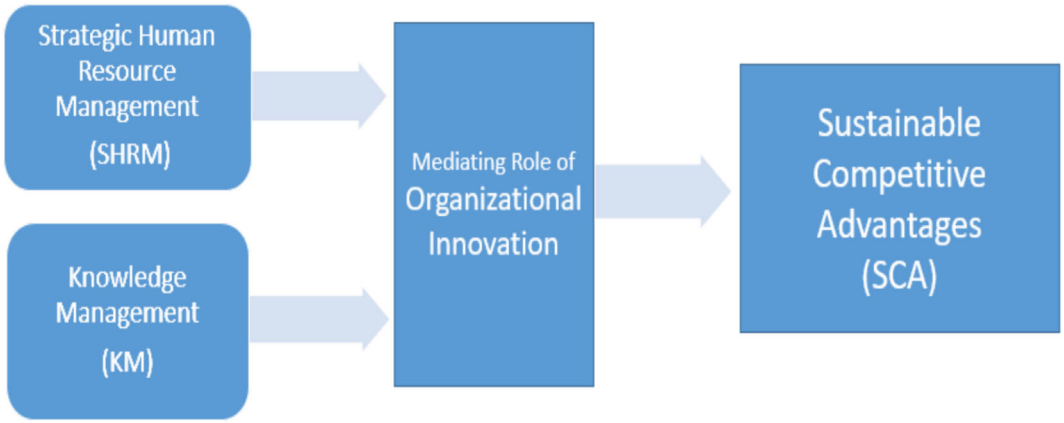

FIGURE 5 KM research model, by Alfawaire & Atan, 2021. [Colour figure can be viewed at wileyonlinelibrary.com]

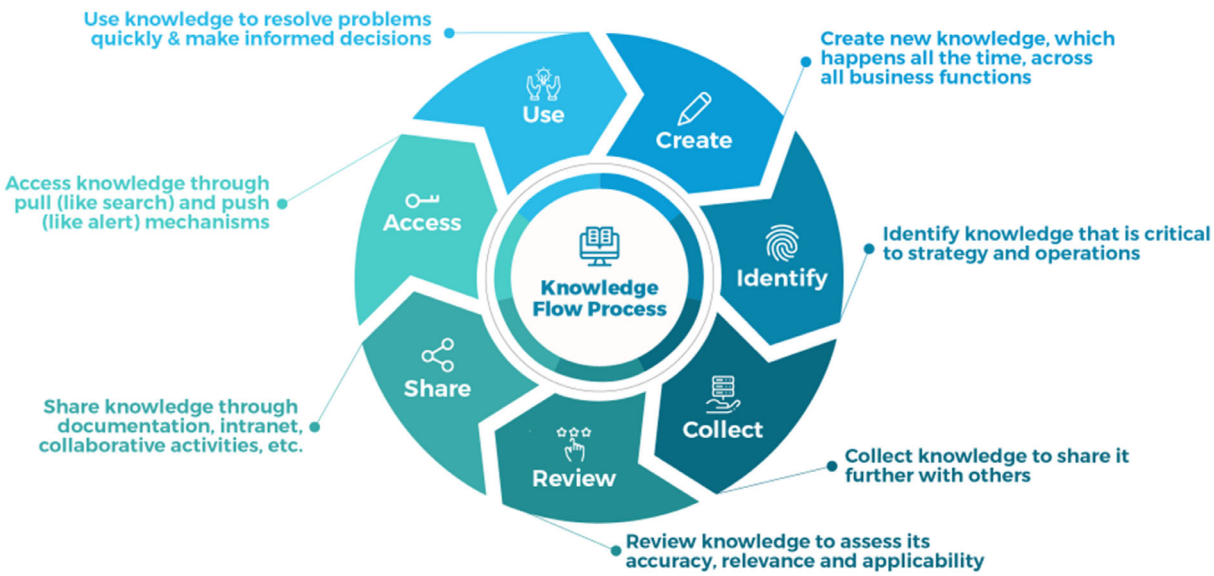

FIGURE 6 Knowledge flow process. *Source*: https://www.searchunify.com/blog/7-ways-to-future-proof-your-knowledge-management-strategy/ [Colour figure can be viewed at wileyonlinelibrary.com]

management activities into these particular business operating procedures is the goal in this situation. This CSF addresses a number of topics, including "processes and their documentation"; important processes, including their knowledge components, are described; KM activities and "knowledge explication" have been appropriately added to "business processes"; attempting to explicate implicit knowledge to an appropriate extent, "using knowledge in decisions"; knowledge relevant to decision-making is not simply available, but is used systematically in decision-making processes, "KM roles"; there are new roles such as Content Steward, Knowledge Coach or CKO, "organizational structure"; the organizational structure fosters extensive knowledge management networks and activities, "projects," the processing and use of knowledge obtained from projects as well as knowledge needed for projects, new knowledge generation is encouraged both directly and indirectly through "innovations."

Common and particular objectives can be used to categorize the KM process goals (Feng, 2006). The goal that should be accomplished in the knowledge management process is called the common objective, and the goal that should be accomplished in the knowledge management sub-processes is called the specialized objective. Likewise, there are two types of management practice: common management practice and specific management practice. Common management practices can be used to accomplish general objectives, and specific management practices can be used to accomplish specific objectives. To reach a certain maturity level, an organization must meet the necessary goal of a particular level. A company's knowledge management maturity can also be determined by looking at the management techniques that have been implemented.

Top management seeking to establish effective KM programs must support four processes: knowledge acquisition, knowledge conversion, knowledge application, and knowledge protection (Lin, 2007).

FIGURE 7 Knowledge management chart. *Source*: https://stangarfield.medium.com/100-knowledge-management-specialties-50-km-components-and-50-alternative-names-for-km-87f2d8b09c6 [Colour figure can be viewed at wileyonlinelibrary.com]

For instance, knowledge acquisition, which involves the gathering of data and the generation of knowledge, is crucial because it fosters creativity at all levels of an organization, from the individual to the collective. Knowledge conversion is the process of organizing, structuring, storing, and combining organizational knowledge for later use. This helps establish an organizational memory to provide quick and easy solutions. Knowledge application involves the utilization of the knowledge for work-related problems. The application of knowledge improves employee job satisfaction and creates business value. Knowledge protection is important to protect the creativity and interests of knowledge owners.

Massingham (2014a, 2014b) points that the most useful definition of KM for the purposes of managing knowledge resources is the product versus process view. The product view implies that knowledge is a thing that can be located and manipulated as an independent object. This is based on managing structural capital—document management systems, data bases and lessons learned. It is about sharing best practices, standard operating procedures, and about storage and retrieval (i.e., structuring repositories). This view of KM tries to separate the knowledge from the knower (Mentzas et al., 2003). On the other hand, the process view places emphasis on ways to promote, motivate, encourage, nurture or guide the process of knowing, and abolishes the idea of trying to capture and distribute knowledge (Mentzas et al., 2003). It views KM as a social communication process, facilitated by collaboration and cooperation support tools. Knowledge is closely tied to the person who created it and is shared through person-to-person contact. This view of KM does not try to separate the knowledge from the knower.

Organizational memory can be seen as the outcome of organizational learning, which can be thought of as a process. Establishing the viewpoint that organizational memory is a result of organizational learning will have this effect (Antunes & Pinheiro, 2019). Tools including document management systems, information management systems, search and index systems, expert systems, communication and collaboration systems, and intellectual asset systems, according to Nazim and Mukherjee (2016), should make it easier to create, share, and use knowledge (Demir et al., 2021).

2.3.3 | Technological enablers in process oriented KMMMs vs people oriented KMMMs as a critical success factor

According to Weber's (2002) theory, there are two types of knowledge management (KM) thinking: one is based on technology and is mechanistic, productivity-driven, and based on the deployment of systems; the other is based on constructivism, cognitive principles, and interaction techniques [Gaßen, 1999].Rules form the basis of expert systems, and logic programming provides one way of representing them. Knowledge representation has been an important concern of AI and cognitive science (Berztiss, 2002).In level one of their maturity model, Kruger and Snyman (2007) propose that before any formal endeavor in knowledge management commences, an organization must have a certain amount of ICT and information management (to render effective knowledge management) (Figure 7).

The ISO 30401:2018 ("Knowledge Management Systems") takes the process view of knowledge. This is why it's essential to have its development, consolidation, retention, sharing, adaptation, and application so that workers may make wise decisions and take coordinated action, resolving issues based on past experience and fresh future insights (ISO, 2018, pp. 04).

Models of social/technological enablers identify the factors that may affect the foster and success of KM practices and related instruments. Contingency models acknowledge that the success of KM initiatives depends on the context in which they are implemented. Knowledge-oriented models concentrate on the processes of knowledge collection, sharing, application, and generating to understand the mechanisms through which value is derived from knowledge (Pee & Kankhalli, 2009). Human-oriented, operational, technology-oriented, and process-oriented management are the four types of knowledge management processes that, according to Demir et al. (2021), are most helpful in improving organizational effectiveness (Heisig, 2009; Inkinen et al., 2015; Kianto et al., 2018).

Organizations have to increase the use of information technology in order to address the issue regarding the flow of information (Yeh, 2006). The knowledge needs can be expressed as requirements, that is, statements of what is needed without the details of how the needs are to be satisfied. Considerable literature exists on requirements gathering and software management. An important part of requirements determination is the identification of stakeholders, that is, people who, in the case of software, will authorize, develop, use, and be affected by a software product, and therefore need to be consulted in the requirements acquisition stage. In most cases, the stakeholders are gatherers and organizers of knowledge, and people who will benefit from the knowledge (Berztiss, 2002). So, initially there is the need to identify key aspects of KM process (knowledge capturing, knowledge transformation, knowledge implementation and knowledge protection), KM effectiveness (individual-level and organizational-level KM effectiveness) and socio-technical support (organizational

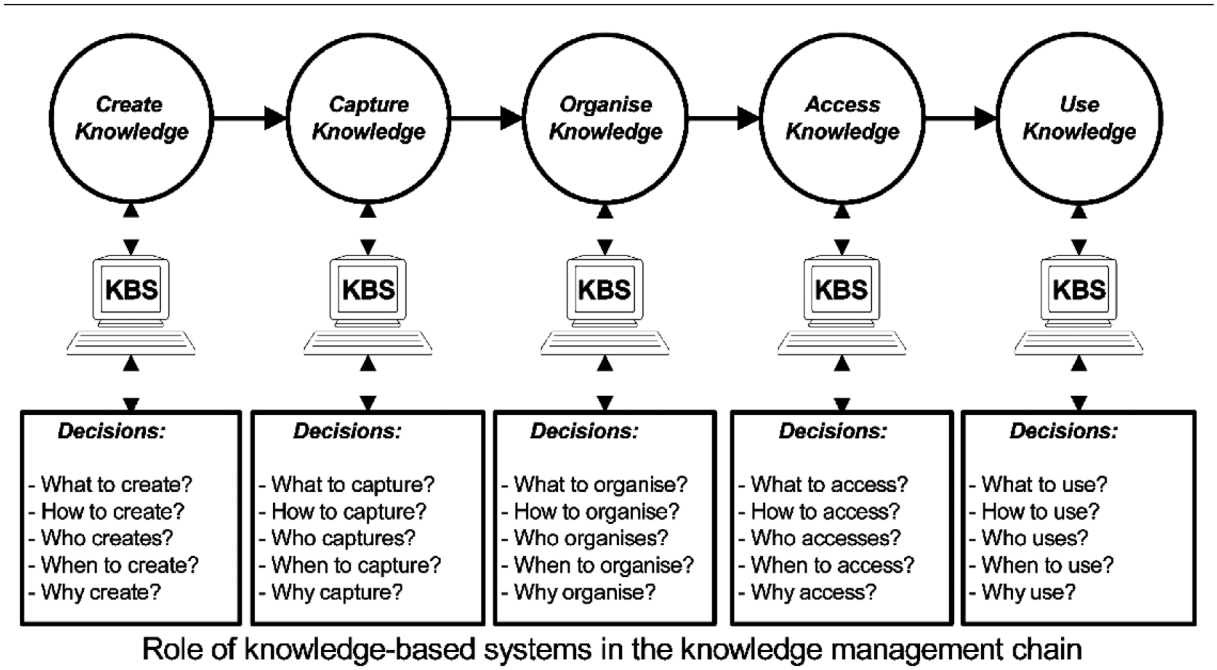

FIGURE 8 Role of KMS in KM, by Soliman & Spooner, 2000.

support and information technology dissemination)(Lin, 2007).Lin's fundamental proposition is that: 1. KM adapts over time through the development of its process dimensions and more effective KM; and 2. Socio-technical support results in more mature KM practices, with the two variables of the socio-technical perspectives being: organizational support and IT diffusion.

For example, an organization should cultivate a social interaction culture that encourages employees to create and share knowledge with colleagues and acts as the engine of the evolution of KM. Moreover, the path taken from "initiation" to "maturity" can potentially be influenced by IT diffusion. IT helps an organization generate, store, and exchange knowledge with employees, suppliers, or customers, thereby assisting the KM process. Consequently, organizations should strive to balance the efficiency of the KM process with socio-technical support's potential for knowledge creation (Lin, 2007). One's willingness to seek information is likely to be influenced by the amount of knowledge on KM systems that is available and the value that is attached to it (Veeravalli & Vijayalakshmi, 2022).

Information systems (IS) facilitate the development of knowledge management systems (KMS) that enables KM initiatives (Alavi & Leidner, 2001; Sarka et al., 2019; Bibi et al., 2020). This perspective conceptualizes knowledge in relation to information, adopts an hierarchical view of knowledge, for example, data- information-knowledge (Alavi&Leidner, 2001; McInerney, 2002; Schultze & Leidner, 2002). The primary focus is to develop IT infrastructure and create KMS (Mao et al., 2016; Spender, 2005). The purpose of KMS is to facilitate the creation, sharing, and utilization of organizational knowledge (Alavi & Leidner, 2001). However, IS should not be confused as a solution to capture knowledge (Darroch, 2003); it is rather an enabler that facilitates the knowledge processes (Centobelli et al., 2017; Fink & Ploder, 2009).Organizations should consider as their main objective to increase the capacity of individuals and organizational knowledge enhancers (Antunes & Pinheiro, 2019). Information technology is the fundamental tool for knowledge management, because it enables the transference of experience among employees much faster. An information system can provide instant, integrated, or even smarter interface platform to make knowledge management much easier to employ (Yeh, 2006) (Figure 8).

Situational considerations may be crucial to take into account in the development of KM in addition to people, process, and technology elements (Pee & Kankhalli, 2009). For instance, the manager of the Call Center Unit in Pee's case study at an IS company that supports a large university highlighted that the local legal jurisdiction did not recognize the legality of electronically filed documents unless their process flow was certified by an established accounting firm as a major barrier impeding users' adoption of documentation systems. The institution determined that it was more cost-effective to stay with paper documents because the certification process was time-consuming and expensive, and the usage of an EDMS (electronic document management system) was frequently viewed as optional. This implies that hypothetical models for the future could have to take environmental factors outside of organizational control into account.

2.3.4 | Leadership (support of top management, team guidance, motivation, coordination) as a critical success factor in KMMMs

Top management support does not directly influence members to participate in KM systems to seek knowledge (Veeravalli &

Vijayalakshmi, 2022). In the process of carrying out knowledge management, the designated teams have to deal with the different aspects of corporate culture, workflow processes, and the integration of group members' knowledge. They also need significant and explicit support from top management, because it is likely that during the process they will encounter resistance from employees (Yeh, 2006).

Organizations can provide opportunities for behavioral maturity of managers to establish knowledge management (Fashami & Babaei, 2017) and managers should pay special attention to the more general knowledge associated with the context of the firm, as is supports the introduction of various types of innovation (Antunes & Pinheiro, 2019).

Leadership sets the tone for the corporate culture, and as culture is the product of the team's acquired knowledge, it will eventually define the necessary leadership on its own (Schein, 2004). A visionary leader is needed as the first step in creating a learning organization (LO) (Senge, 1990). According to Zaim (2006), managers typically do not recognize the value of current experience in their organizations, despite the fact that knowledge exchange is a crucial component for organizations (Figure 9).

Fashami and Babaei (2017) proposed and tested a Behavioral Maturity Model in an Iran Insurance Company. The top five priorities included transformational leadership, human and social skills, knowledge orientation and organizational knowledge, emotional intelligence of managers and trustful climate. As the results showed, training courses for managers, personnel empowerment and transformational leadership are highly important.

When Teah et al. (2006) proposed and tested a generic KMMM, findings showed that the main concern of unit managers was that their units might be unfavorably rated. Therefore, in order for a KMMM to correctly reflect reality, management must refrain from using it as a tool for punishing and reprimanding underperforming units. Instead, it should highlight any areas in need of more support and direction.

Kruger and Snyman (2007) argue that the next level of maturity constitutes a conscious commitment, especially from business managers, to start embracing endeavors in knowledge management. At this level of maturity, ICT should already be geared toward supporting knowledge management endeavors. Additionally, managers should alter their management style to encourage creativity, sharing, and utilization of new knowledge among employees. Organizational rewards may provide temporary incentives for KM initiatives, but are not a fundamental force in organizational KM evolution. Managers thus should not emphasize organizational rewards (such as salary incentive, bonuses, promotion incentive, or job security) as a key driver of more mature KM practices (Lin, 2011).

Lin (2011) advocates that when it comes to the individual aspect, efforts to cultivate targeted mutual relationships of employees are significant for the initiation of a structured and effective KM system. Thus, managers can improve employee perceptions of mutual benefits and address the crucial issue of establishing interpersonal trust into their organizations, which is an important issue in initial KM initiatives and strives. Lin's study also demonstrates open communication with

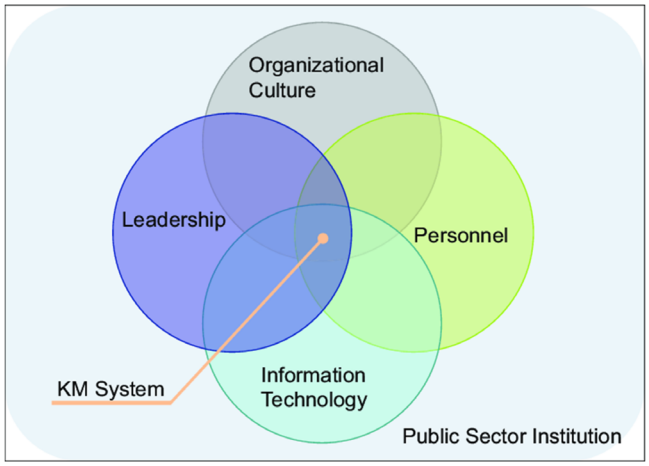

FIGURE 9 Knowledge management implementation in public sector, by Almudallal et al. (2016). [Colour figure can be viewed at wileyonlinelibrary.com]

employees to be an important variable to facilitate the success of KM implementation and institutionalization. Managers must consider that KM can continue to evolve when employees believe that the organization is offering a safe environment in which they can express themselves. Openness in communication helps eliminate resistance barriers to KM implementation, and without open communication, successful KM evolution might not exist. Knowledge self-efficacy is an important enabler during KM evolution. This finding suggests that managers should pay more attention to providing useful feedback to enhance employee knowledge self-efficacy. For instance, by choosing and hiring pro-active workers with high cognitive attitudes, high self-esteem, and intrinsic motivation, a highly self-efficacious workforce can be created. Managers can also improve perception of knowledge self-efficacy among valued knowledge employees by pointing out to them that their contribution in knowledge management gravely affects the KM further development.

2.3.5 | Change management and continuous improvement as critical success factors in KMMMs

Knowledge is sustained by sharing and supporting technologies. The processes and constructions, the interconnections between knowledge assets align with its distribution and interpretation while retention takes place through the organizational memory (Antunes & Pinheiro, 2019). Building capacity for continuous learning, sustainability, and knowledge renewal is one of the organization's main objectives (Pereira, 2021).

Examining the adequacy of the current activities and, if required, making reasonable alterations seems logical in order to manage knowledge in a permanent and successful manner in the future (Ehms & Langen, 2002). For KM to be further evolved efficiently, it needs to grow from simple enthusiasm into a cross-sectional operation permanently instilled in the company.

In Massingham's case study (2014) the Knowledge Creation toolkit (KCT) provided participants with learning capabilities to increase their creativity. In this way, the KCT aimed to create value through problem-solving and continuous improvement. The techniques were grounded in the learning theory. The KCT selected for testing comprised: creative abrasion (Leonard & Sensiper, 1998); parallel thinking (De Bono, 1985); SECI Model (Nonaka & Takeuchi, 1995); expert teams (Easterby-Smith & Lyles, 2005, p. 169); and double-loop learning (Carroll et al., 2005).

While developing and implementing a KM proposal, an organization will often examine a change management process, by trying to alter some of the attitudes and beliefs of the management and the employees. In spite of the long-term perspective of most change management plans; short-term enhancements need to be accomplished so as to maintain enthusiasm and dedication on all organizational levels (CWA 14924–1:2004). Change management most often is expressed in the form of corporate culture change.

Corporate culture is the combination of value, core belief, behavior model, and emblem. It represents the value system of the company and will become the employees' behavior norm. Every organization's culture is an independent entity different than any other organization (Yeh, 2006). Corporate culture is a fundamental tool for knowledge management, because only a culture of mutual trust helps the employees trust and depend on the information provided by one another, thus raising the motivation for mutual sharing (Figure 10).

2.3.6 | Strategy as a critical success factor in KMMMs

Kruger and Snyman (2007) hypothesized that progressions in knowledge management maturity (from a strategic perspective) are directly related to an increased ability to speed up the strategic cycle of imitation, consolidation and innovation. Organizational culture and strategy are the most important components for successful knowledge management, followed closely by IT (Hung et al., 2005). Growth clearly depends on switching from an opportunistic strategy to one that targets and accepts certain specific types of work and clients or builds a brand and market position (Phelps, 2007). The usefulness of outside interventions that support small and medium-sized firms (SMEs) in developing strategy, however, has not been thoroughly studied in the literature. Although it is well recognized that strategy consultants are frequently employed, there is little proof of the value or knowledge they provide.

Research was conducted by Massingham (2014a, 2014b) to evaluate a variety of best practice knowledge management (KM) concepts used to manage knowledge resources. As part of a large-scale longitudinal transformation initiative, four KM toolkits and 16 KM tools were examined over a five-year period (2008–2013). Each tool was evaluated using a strategy, implementation, and performance evaluation methodology created to test KM complaints. The highest rating toolkit was knowledge strategy, followed by knowledge measurement. The most value was created by using KM to introduce objectivity into future thinking (future capability requirements) and decisions when filling competency gaps (sourcing). Massingham defined the management of knowledge resources as identifying the firm's competitive position in terms of what it knows (strategy), protecting this position (retention), growing this position (creativity) and benchmarking (measurement). Strategy was considered to be a management capability and not something to be taught to all staff. The need for a knowledge strategy emerged during management meetings to identify existing and future capability requirements in each discipline (e.g., mechanical engineering). The research team worked with discipline leaders to develop capability plans. This later evolved into work with a special committee, formed to develop a method for making objective decisions on knowledge strategy. The toolkit selected for testing included

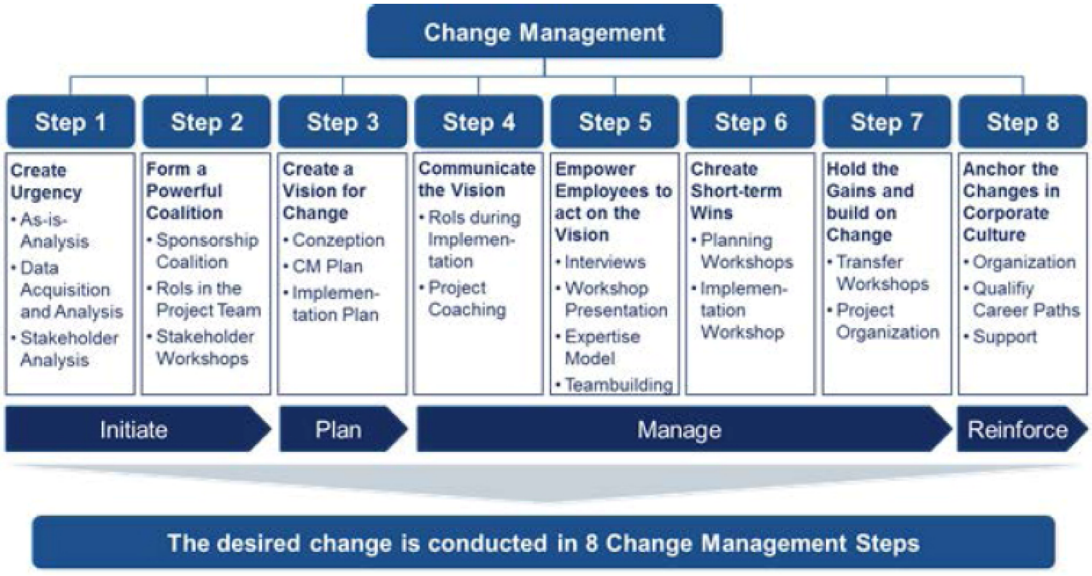

FIGURE 10 Kotter's change management model, by Wanner (2013). [Colour figure can be viewed at wileyonlinelibrary.com]

competency mapping, which is evaluating competency levels, surpluses and deficits, in many traditional (e.g., experience) and non-traditional (e.g., external relationships) ways. The results were compared against management expectations, that is, a baseline score, to quantify organizational needs—that is, competencies—against actual capability—and produce competency gap analysis at very finite levels. Knowledge strategy had the most direct impact on performance, particularly financial impact in terms of more efficient workforce management (e.g., strategic alignment). This reduced the total workforce cost.

2.3.7 | Performance measurement as a critical success factor in KMMMs

Responding to debate surrounding the evolution of performance measurement and management, Kruger (2005) is of the opinion that a merger between strategy formulation, performance management and knowledge management has the capacity to add a dimension of geography to the knowledge–strategy cycle, opening up social interplay and enabling organizations to interact and trade knowledge (even tacit knowledge) with the very forces that shape competitiveness.

Lee et al. (2019) attempted to address the issue of how sustainable the economic rewards achieved through efficient use of knowledge management (KM) capabilities and resources are. To answer this question, a study was conducted in a company for a number of years and the data formed the basis in his research of defining the degree to which KM resources affect over time the company's performance from a financial aspect. The study's outcomes point to the fact that the effect of KM capabilities on the financial performance within an organization become more definite in the long term rather than in the short term. By contrast, knowledge management systems (KMS) is associated only with immediate, short-term financial benefits with such gains prone to instability in the long term.

In Massingham's large- scale study (2014) the results showed that KM has direct and indirect, financial and non-financial, impact on firm performance. First, in terms of the aspirational business model LOC, knowledge strategy increases awareness of organizational direction, purpose and role clarity, improving the capacity to respond to change; knowledge measurement enables strategic alignment and career management producing growth in capability; knowledge retention increases productivity through reduced knowledge loss and better use of experience; and knowledge creation increases change, initiative and motivation, leading to improved problem-solving and business improvement. Second, in terms of practical outcomes, knowledge strategy improved strategic alignment and created financial impact in terms of cost–benefit analysis, that is, the incremental cash flows generated by the investment; knowledge measurement improved value management in terms of input measures: increased resource acquisition (budget), and output measures: increased value for money for stakeholders from improved work quality (critical activities). Knowledge retention improved psychological contract (employees' emotional relationship with their organization), and knowledge creation improved value management (improved performance).

Lee et al. (2019) suggest that organizational performance is not determined by how much firms know, but how effectively firms use what they know through KM Systems. On the other hand, the advantages resulting from the use of KM Systems are not sustainable over time. A consequent suggestion, therefore, is for managers to foster and support organization-wide KM capabilities to ensure long-term economic sense of security through KM initiatives. When it comes to KM performance, organizations need to learn "how to fish" rather than "how to eat a fish" meaning that other than using KMS to promote a short-term success, they more importantly need to obtain knowledge in enhancing KM capabilities to achieve long-term and sustainable financial outcomes.

2.3.8 | What constitutes KM success leading to performance excellence

Success in KM is a multilayered idea. The right knowledge must be captured, delivered to the appropriate user, and applied to enhance organizational and/or individual performance. The factors of influence on corporate operations, impact on strategy, leadership, and knowledge content are used to gauge the success of KM (Jennex et al., 2009).

López & Meroño (2011)conducted an empirical study that consisted of 310 Spanish organizations and structural equations modeling using two proposed KM strategies: codification and personalization. They concluded that both KM strategies impact on innovation and organizational corporate performance directly and indirectly (through an increase on innovation capability). Both codification and personalization strategies have a positive impact on financial results. Managers can use these findings as an argument to negotiate with and convince to stakeholders about the goodness of implementing KM projects. Also, findings demonstrate a different effect of KM strategies on diverse dimensions of organizational performance. With a clear KM strategy organizations can be more innovative, achieve better financial results, improve processes and develop human resources' capabilities. And, in turn, those benefits foster the link innovation-performance.

The overall results of Massingham's two-part study (2014) indicate that performance excellence can be measured using KM maturity. An important conclusion from the study is that KM is embedded in other organizational systems (OS), and the influence of these OSs should be taken into account in any assessment of KM's success or failure. Processes, KM leadership, people, and KM outcomes are the most crucial variables affecting performance excellence (Abu Naser et al., 2016).

On the one hand, there is the viewpoint that sees KM achievement as a process indicator. The efficient accomplishment of clearly defined organizational and process goals through the systematic application of both organizational tools and information/communication technologies for a targeted creation and utilization of knowledge as well as for making knowledge available can be characterized as successful knowledge management (KM). Improved knowledge-intensive

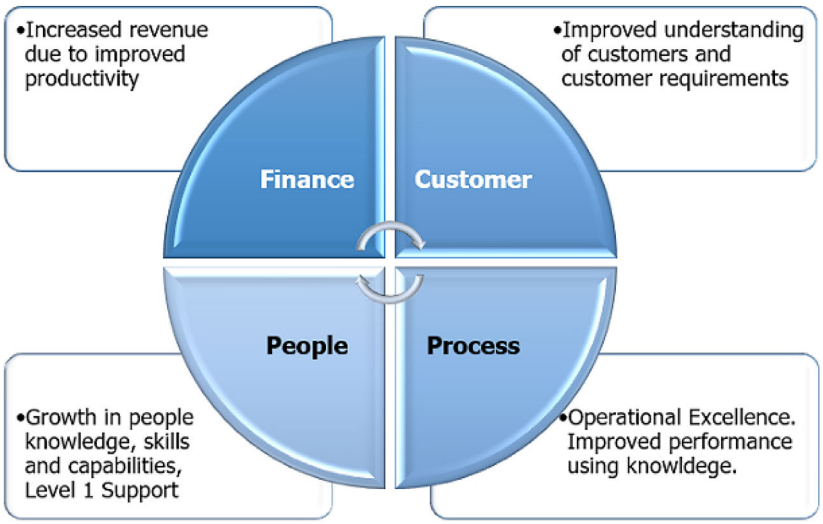

FIGURE 11 Balanced scorecard components for KM, by Neetu Choudhary on October 21, 2019. Posted in articles, KPI. [Colour figure can be viewed at wileyonlinelibrary.com]

business processes are supported by KM. An illustration would be the technical KMS components supporting the technology forecasting process of an IT consulting firm (Henselewski et al., 2006).Additionally, a component of the success of KM is the efficient application of knowledge processes (such as acquisition, creation, sharing, and codification). Therefore, this viewpoint focuses on quantifying the extent to which KM enhances the efficiency of business and knowledge operations (Jennex et al., 2009) (Figure 11).

KM success, on the other hand, can be seen as an outcome metric. The varied results of knowledge process capabilities that exist inside an organization as a result of undertaken KM efforts are consequently seen as a metric of KM success. The improvement of product and service quality, productivity, innovative activity, competitive capacity, market position, proximity to customers, customer satisfaction, employee satisfaction, communication, knowledge sharing, knowledge transparency, and knowledge retention are typical outcomes in terms of organizational performance (Jennex et al., 2009).

The inability of knowledge management practitioners to correctly measure the level of knowledge management maturity attained within organizations is preventing them from doing so, but more crucially, it is causing managers to lose faith in knowledge management as a strategic enabler. Unless theory culminates in usable tools, contributions made by knowledge management scholars will be of no or very little value to organizations embarking on knowledge management endeavors (Kruger, 2005; Kruger & Snyman, 2005; Kruger & Johnson, 2010).

Ultimately, it is probable that practitioners and researchers have different priorities when it comes to KM success. While practitioners appear to be focused on KM success as being connected to its impact on organizational performance and effectiveness, researchers do not appear to have a clear understanding of KM success. Since there aren't enough practitioners providing input, it's impossible to declare this with certainty. However, it is expected that practitioners would focus on organizational impact as a measure of KM and KMS success. Given that KM is an action discipline, researchers should accept this focus and incorporate it into their investigations. The preliminary set of success dimensions must be examined critically, though, as previous discussions have shown that there is conflict between what is regarded as an antecedent and thus necessary for success, and what is regarded as a reflection of success. This is made more complex as factors that are antecedents to KM need to be preserved to sustain continued KM success (Jennex et al., 2009).

To provide answers to the research questions, a literature survey was presented in Table 1 with the approaches used per reference in the survey. In addition, in the following Table 2, the CSF occurrence per reference is presented. The literature review revealed the need for KM classification and the development of an integrated approach that encompasses all these different KM categories has been advocated through the literature survey.

3 | STANDARDIZATION AND KNOWLEDGE MANAGEMENT

3.1 | ISO 9001/2018

Organizational knowledge management was introduced on September 15, 2018 to the followers of ISO 9001 as KNOWLEDGE MANAGEMENT RESEARCH & PRACTICE 3 "7.1.6, organizational Knowledge—The organization shall determine the knowledge necessary for the operation of its processes and to achieve conformity of products and services. This knowledge shall be maintained and be made available to the extent necessary. When addressing changing needs and trends, the organization shall consider its current knowledge and determine how to acquire or access any necessary additional knowledge and required updates" (ISO, 2015; Wilson & Campbell, 2016). Knowledge is acknowledged throughout the standard, not just in clause 7.1.6 where it is referred to as "organizational knowledge" (Wilson, 2016). The different iterations of ISO 9001's process and procedure description indicate a capturing of organizational experience and knowledge. According to Mosch (2007), standards are information that has been codified. They reflect generations' worth of labor and expertise, and a

company's quality manual serves as a repository for its process knowledge (Zetie, 2002).

Clause 7.1.6 of the ISO 9001:2018 implies that to meet the new version of the standard, an organization should have:

- A definition of the critical organizational knowledge (knowledge about operation, process, goods and services);

- A system for maintaining, protecting and accessing that knowledge;

- A system for acquiring or accessing (and potentially for creating) any new knowledge, as things change.

This new provision does not establish a Knowledge Management standard or make Knowledge Management a statutory prerequisite for an organization. It is a requirement in a quality standard and calls for giving knowledge the attention it needs to guarantee high-quality products and services. However, in order to comply, a company must have plenty Knowledge Management components already working as part of its Quality Management system, as opposed to only planning them. Therefore, there has to be a suitable structure for experience-based learning, including lesson learning. Mentoring, recording tacit knowledge, and sharing knowledge are all necessary components of a proper knowledge retention strategy. An organizational knowledge audit, benchmarking, and strategy must also exist in order to identify the key knowledge gaps and the critical knowledge required to deliver high-quality goods and services. A system (including roles, procedures, and enabling technology) must exist for maintaining knowledge and making it accessible to the level required.

Not enough empirical studies exist that support the correlation between ISO 9001 practices, KM, and organizational sustainability (Demir et al., 2021). Demir conducted a case study and observed that ISO 9001 certified companies performed adequately better when it came to knowledge creation, use and sustainability, yet when it came to storing and sharing, great issues arose. From the knowledge generating stage to the use process, managers need to promote initiatives across their organizations. Utilizing knowledge effectively has a direct impact on how sustainable an organization is. Organizational sustainability is an area in which ISO 9001 certified companies do better, but this is so because they rely less on explicit knowledge and more on tacit knowledge. If businesses wish to maintain their organizational sustainability over time, they must establish techniques to turn their tacit knowledge into explicit knowledge. According to Wilson (2016), businesses that utilize explicit knowledge and are more mechanical than those that use tacit knowledge and are more organic would seem to be more compatible with ISO 9001 certification.

There are two main reasons why this organizational knowledge requirement clause was added: 1. to protect the organization from knowledge loss, such as that caused by employee turnover or the inability to record and communicate information; 2. to promote knowledge acquisition inside the organization, such as through learning from experience, mentorship, and benchmarking (Fitzgerald, 2021). Intellectual property, knowledge gained through experience, lessons learned from failed and successful projects, capturing and sharing undocumented knowledge and experience, and the outcomes of improvements in Processes, Products, and Services are among the Internal Sources of Knowledge of Products and Services to showcase within the new clause of ISO 9001;Standards, academia, conferences, and receiving information from clients or outside suppliers are examples of External Sources. A big, complicated company can decide to put in place a formal knowledge management system. A smaller, less sophisticated business, however, might opt for simpler approaches, including keeping a logbook of design choices or the characteristics and performance of chemical compounds that were created and evaluated.

Every business, according to Hammar (2016), has unique expertise that makes them stand out from the competitors. It is generally known as "tribal knowledge" when this knowledge resides with specific long-term employees and is not recorded. While this can be effective, it runs the risk of being lost when these employees leave the organization. Using the ISO 9001:2018 clause on organizational knowledge, Hammar suggests a few knowledge management techniques: The most obvious method of gathering information is through work instructions. A work instruction can be one of the simplest ways to capture information if a procedure must be carried out in a certain way to avoid issues and can be readily written down and understood; Checklists are another obvious way to capture basic knowledge. A checklist can be a useful tool to utilize if the knowledge consists of several things to check before a work is accomplished; Training Programs: The greatest technique to record information is sometimes to capture the key aspects of the process, which might be done by including them in a training program; On-the-job training: When the information simply cannot be recorded in writing, it may be advantageous to use on-the-job training, in which a senior and knowledgeable individual instructs others on the unrecorded organizational knowledge; Knowledge database: Since many businesses save "lessons learned" for the end of a program, designs that are still in development may not reap their benefits until much later. By entering them into a database for review throughout design, you can record the knowledge, issues, or successes that have arisen with a good or service. When the next product design is being developed, using the immediately captured organizational knowledge, the knowledge may be reviewed. After capturing organizational information, you must apply it in your system, especially when making changes. The knowledge database serves as a feedback mechanism for the design function. A change needs to be made to the design process to guarantee that the knowledge database for "lessons learned" is closely checked during design so that a correction or improvement that has been found and recorded in the database does not go unnoticed (Figure 12).

The possible need for more thorough documentation could force quality systems back toward the strict ISO 9001: 1994 requirements that were later lowered as a result of excessive bureaucratization and the development of rigid and unresponsive systems. Many of these worries should be allayed by the fact that ISO quality standards are more about processes than prescriptive methods and practices. Nevertheless, some 36 years after the release of British Standard BS 5750: 1979, ISO 9001: 2015 has acknowledged the strategically

significant role of knowledge as a resource (Andreeva & Kianto, 2012; Grant, 1996; Kianto & Ritala, 2010; Van der Speak et al., 2002). This is crucial and shows how information is becoming more and more important within firms (Wilson, 2016).

3.2 | The European guide to good practices in knowledge management (edited by the European Committee for Standardization, CEN-CWA 14924–1, 2004)

Grundstein (2008), who made significant contributions to the creation of this Guide, identifies two key KM approaches: 1. A technological perspective that emphasizes technical and application viewpoints; this perspective leads one to see knowledge as an object and ignores the significance of people 2. A sociological perspective that emphasizes that people's minds and social interactions are where information is largely found. While drafting the CEN-CWA 14924, Weber (2002) defines the five core knowledge activities as: (a) Identify knowledge (b) Create (new) knowledge (c) Store knowledge (d) Share knowledge (e) Use knowledge. To get better results from these core knowledge activities, two crucial conditions must be met. The first step is to align or integrate the key activities into the routine duties and organizational procedures. The second need is that the core activities be properly balanced to take into account the unique characteristics of each business process and organization. A KM solution should not just concentrate on one or two discrete tasks.

Weber (2002) also provides a first draft of the core modules, as shown in the figure below, with a short description (Figure 13).

KM strategies—In the sense of direction, meaning to set goals and objectives by clearly defining at the same time the means to achieve these goals.

Human and social KM concerns–By describing the role played by human resources, issues pertaining to culture and trust relationships, and so forth, this module especially tackles the reality that knowledge is dependent on people and exchanged on a social level.

A knowledge-friendly organization can be built, operated, and maintained with the help of the KM framework. This will cover both the organizational structure and job descriptions for a "KM organization." It must be regarded as a guideline for adjusting current organizational structures to support KM.

Knowledge management (KM) processes: This module will explain how business processes have been adapted to KM. It will also cover general organizational processes, which will assist the entire target group become more effective at obtaining, disseminating, and preserving information.

Which KM technology should I use for what purpose? The module "KM technologies" of the KM framework will provide an answer to this basic query. It provides an overview of current and emerging KM technology and will aid organizations in making the best choice regarding this challenging KM issue.

FIGURE 12 Capturing the organizational knowledge in ISO 9001, by mark Hammar (2016). [Colour figure can be viewed at wileyonlinelibrary.com]

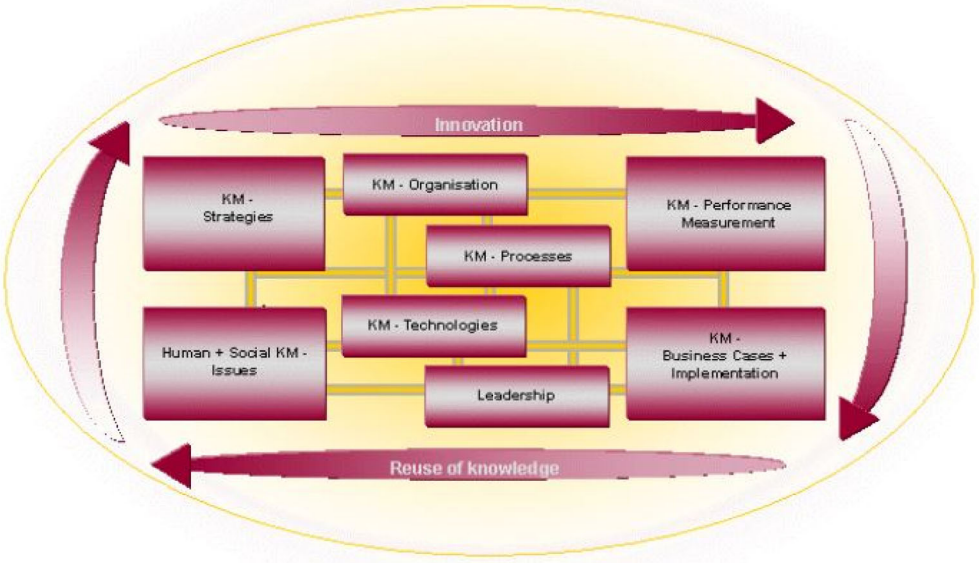

FIGURE 13 Core modules of the CEN-CWA 14924–1, 2004, by Weber (2002). [Colour figure can be viewed at wileyonlinelibrary.com]

What are the essential ingredients for a KM leader's introduction within the organization? Which qualities are preferred or assumed? Which tasks ought the leader to prioritize? Leadership and the environment are the main topics of the "leadership" KM framework module.

A KM system cannot be enhanced if the performance of the system cannot be quantified. Additionally, this module "KM performance measurement" offers criteria for evaluating a KM system's maturity as well as guidelines for advancing a KM system.

KM business cases and implementation - Business cases and execution for knowledge management are covered in this module, along with a basic roadmap. It will guide firms in developing the business case for KM as well as assist them in installing and establishing their KM system. This implementation methodology can be tailored to meet particular business objectives and requirements because of its broad nature.

A higher priority is given to soft issues in business settings that use knowledge management (KM), such as social and cultural considerations, individual motivations, change management strategies, and new and improved business procedures that promote cross-disciplinary knowledge sharing, communication, and collaboration with technology serving as an enabler.

The following is a definition of the CEN-CWA 14924–1, 2004, scope: KM success is a delicate balance. However, it is equally important to keep in mind the "bigger picture" — the larger financial, technological, and structural issues facing the company as it strives to innovate more quickly and within which any corporate KM initiative invariably takes place. Although it has been demonstrated through experience that socio-cultural issues are frequently the most difficult to address, This work item aims to establish a complete framework for KM implementation within and among companies throughout Europe, with a focus on SMEs, by referring multiple aspects, such as economic, socio-technical, techno-structural, and socio-organizational. This framework can evolve and adapt in the future. This study will address aspects of organizational performance, added value, financial and economic standards, interactions between information systems and people, and interactions between information systems and the organization (missions, structure, processes and relationship networks). It will also cover socio-organizational topics like governance, power dynamics, managerial techniques, knowledge transfer, incentive and reward structures, corporate culture, and morals and values. One would think that by taking into account such a framework, socio-culturally motivated KM activities might be guaranteed to produce fair outcomes rooted in a thorough examination of the organizational context. Approach: In Europe and abroad, there are numerous intriguing and useful frameworks. Finding a framework (or combination of frameworks) that is relevant and useful to European business organizations, particularly SMEs, will be the main goal of this effort. This framework will serve as a foundation for decisions on the use of KM in various business settings (CEN-CWA 14924–1, 2004).

Two primary types of the enablers—personal knowledge capabilities and organizational knowledge capabilities—complement one another. The knowledge-related actions mentioned above should be considered as being enabled by these capacities. Personal knowledge is made up of the traits that must be developed on an individual and group level in order to produce gains in knowledge handling, including ambition, skills, conduct, experience, tools, and time management. Leadership must develop organizational knowledge capabilities to enable efficient knowledge handling by internal stakeholders (such as managers and staff) and external partners throughout value-adding operations (such as providers and customers). The creation of an organization's collectively available information, or its so-called "knowledge assets," as well as the usage of technology and infrastructure are all examples of these capabilities. They also include the organization's goal, vision, and strategy (CEN-CWA 14924–1, 2004).

3.3 | ISO 30401 knowledge management systems: The requirements for effective organizational knowledge management

A collection of recommendations and standards for knowledge management are proposed in ISO 30401 (ISO, 2018), which is made available by the International Organization for Standardization. The standard is an effort to assist companies in standardizing their management of the information they have gained and will continue to obtain. According to ISO 30401, managing knowledge requires valuing a number of knowledge-related factors, including its nature (which is intangible, complex, and human-created), value, focus (on organizational goals, strategies, and needs), adaptability, shared understanding, environment, culture, and interactivity (Zeferino et al., 2020).

The scope of the ISO Knowledge Management Standard, according to the ISO documentation is to "set requirements and provide guidelines for establishing, implementing, maintaining, reviewing and improving an effective management system for knowledge management in organizations. All the requirements of this document are applicable to any organization, regardless of its type or size, or the products and services it provides".

In the purpose section, the ISO Knowledge Management Standard states "The purpose of this ISO management system standard for knowledge management is to support organizations to develop a management system that effectively promotes and enables value-creation through knowledge". The KM Standard's guiding principles are summarized in the list below:

1. The influence of information on an organization's mission, goals, objectives, policies, procedures, and performance is what makes it valuable. Unlocking the potential value of knowledge is accomplished through knowledge management.

2. Focus: Knowledge management supports corporate goals, plans, and demands.

3. Adaptive: There is not a single knowledge management solution that works for every firm in every situation. Depending on the requirements and environment, organizations may design their own approach to the breadth of knowledge and knowledge management, as well as how to implement these efforts.

4. Knowledge management should involve interactions between people, employing content, procedures, and technologies as necessary for common understanding.

5. Workplace environment: rather than managing knowledge directly, knowledge management focuses on fostering the lifecycle of knowledge.

6. Culture: Knowledge management efficacy depends on culture.

7. Iterative: Knowledge management needs to be phased and include feedback and learning cycles.

Determining the organization's pertinent concerns for knowledge management is its responsibility. For instance, recognizing stakeholder needs and expectations, establishing KM's scope, fostering continuous improvement in KM, ensuring that outdated knowledge is discarded, transforming and transferring knowledge, activating knowledge through processes, human capital, technologies, and infrastructure, and fostering KM culture are all examples of things to consider. Support, Planning, Leadership, and Governance, information documentation and protection, and operation, performance evaluation, and continuous improvement, are the most recent needs (Zeferino et al., 2020).

A strong point of the standard is that it includes mechanisms for transforming different types of knowledge through human interaction, externalization (recording, documentation, or coding of knowledge), curation and combination (synthesis, formalization, structuring, or classification of codified knowledge), accessibility, and internalization (for easy access and understanding). Additionally, there are four processes in the knowledge management system: socialization (explicit/tacit), combining (explicit/tacit), externalization (tacit/explicit), and internalization (explicit/tacit) (Zeferino et al., 2020) (Figure 14).

Analysis of the standard, shows that in order to meet a great number of its requirements many organizational management capabilities need to be previously established, like process flow, strategic planning, internal audits and performance indicators (Zeferino et al., 2020). As a result, it is challenging to construct a uniform criterion for determining adherence based on individual standard items. It seems that a model for the simultaneous implementation of all of the Standard's requirements should guarantee the effective implementation of the framework in order for the KM assessment to be finished. It was also observed that the standard encourages leadership to form a structure of working groups and teams designated with tasks focused on the implementation of KM, which makes it difficult for small sized companies to implement the Standard. Also, the Standard does not take into account the diversity in KM strategies, given that organizations set different knowledge goals (Figure 15).

The research regarding the Standardization of KM and existing standards, as presented in this section, posed three more research questions, related to the primary research objective:

RQ9. What is the link between KM Standards and KM Maturity models?

RQ10. Can a KM maturity assessment framework be applied for the assessment of ISO 30401 implementation?

RQ11. Can a generic KM maturity assessment matrix be developed for ISO 30401 implementation?

The study's research objective was extended to accommodate and address these questions to: *the proposal of a holistic and integrated Knowledge Management Maturity Assessment framework encompassing the core guidelines of ISO 30401 in order to be used by both researchers and practitioners*.

4 | DISCUSSION - THE GQC QUALITY MANAGEMENT MATURITY MODEL& ISO 30401:2018 APPLICATION

Organizations view knowledge as a strategy that improves their management processes and helps them address issues and challenges (Zeferino et al., 2020). There is no disputing the value of knowledge

FIGURE 14 Knowledge management system based on ISO 30401, by Zeferino et al. (2020). [Colour figure can be viewed at wileyonlinelibrary.com]

Strengths	Weaknesses
Creating a pattern	Is knowledge standardizable?
Guiding principles	t is necessary to invest in a KM audit?
Manage knowledge	There is a need to certify the KMS?
Audit	Expensive consultancies
Certification	False impression of the actual use of KM
Evaluation	Indirect metrics
Recognition	Lack of focus on learning
Unconformities	Lack of assessment of the dissemination of KM
Measuring system	Small business deployment
Knowledge measurement	High investment
ISO dedicated teams	Casting the KM system
Focus on supporting documentation	Lack of control of standard effectiveness

FIGURE 15 Positive and negative points of ISO 30401, by Zeferino et al. (2020).

and, in particular, its management. However, there is still a lack of consistency and dependability in the management of this crucial strategic asset. Standardization must be based on needs because it does not automatically give benefits (Weber, 2002). Standardization's overarching goals include facilitating global trade in goods and services and fostering collaboration in the fields of knowledge, science, technology, and business (ISO, 2001).

Many KM ideas like system approaches or continuous learning are also fundamental ideas of Quality Management (QM). Adopting the established QM concepts for the relatively new theory of KM could therefore give valuable insights for further developments. From a QM perspective, an ideal model for evaluating KM should contain the following elements (Wilson & Asay, 1999): 1. Focus on processes; 2. Employee involvement; 3. Continuous learning and improvement; 4. Measurement and standardization. The level of "standardization" instruments may range among, for example, best practice, common approach, guideline, reference framework, or finally a real standard (Weber, 2002).

The most important standardization components, according to experts, are a single KM framework, consistent KM terminology, and a common KM implementation strategy (Weber & Kemp, 2001). Standardization is an evolving process that is motivated by user issues.

It is necessary for multinational corporations (MNCs) to manage their knowledge flows effectively in order to gain or maintain competitive advantage (Kang, 2012). The knowledge management (KM) process needs to be cost effective, which can be achieved through a standardized "one-size fits all" strategy. Some scholars argue that a standardized KM strategy is not possible in international KM, since countries are different and cultural differences make it necessary to adapt the KM strategy with regard to different cultures. This reveals a question about standardization versus adaptation of KM.

One can recognize that method or process standardization has produced significant benefits from a variety of viewpoints (e.g., organizational, financial, production, etc.), using the analogy of other industries like information technology or the automotive industry (Weber, 2002). The KM domain, however, consists primarily of soft objects as opposed to these rather hard-driven themes, making it more challenging to be viewed holistically. KM is a young discipline; thus it is possible to discuss the value of standardization from a variety of intriguing angles. The following are the primary factors that speak against a uniform KM approach: It takes a long time to standardize something properly. This is due to the compromising nature of standardization, the difficulty, and the possibility to achieve a critical mass and wide range of consensus. Any standardization process can only be effective if this wide understanding is gained by all interested parties, most particularly the users and stakeholders of the standardized items. Standards run the risk of falling behind the needs of everyday practice because of the length of the procedure and the required steps of preparation. The question of "what is a sensible degree of standardization of a soft subject like knowledge management in a comprehensive and structured, but yet useful, manner?" is another important one regarding standardization. Standardization and constructivism may be mutually exclusive ideas that cannot possibly coexist.

Most of the time, standards are considered as a hindrance to human progress in terms of creativity and adaptability (Weber, 2002). People view standards as a framework that prevents them from developing original, novel solutions outside of the predetermined parameters. Standards are viewed as a restriction to these particular aspects of freedom, not just in the context of creativity but also in the sense of peoples' adaptability. Because if knowledge is used, attention will be drawn to non-compliance rather than to learning and/or distributing knowledge, which is a knowledge management system's goal (Zeferino et al., 2020). A generalizable model of stages is difficult to use because of the varied structure of the small and expanding business sector, according to Phelps et al. (2007).

However, Weber (2002) notes a variety of factors that support standardizing KM, including the following: Transparency will result from the activity itself, which will bring together all relevant institutions and bodies and lead to a single understanding and terminology through the process itself. The advantages of KM development will be accessible to a wider audience thanks to "standardized" KM elements (such as common approaches to KM processes, knowledge technologies, knowledge-based human resources, KM strategies, etc.). Additionally, from the perspective of KM experts, standardized KM procedures will enable the experts to adopt a verified global (or even globalized) common vocabulary. This suggests that communication will be simpler and can begin from a higher shared base. Standardizing some of the key KM elements can free up more energy and creative space for (customized) specifications for specialized and unique solutions. Finally, venues for further study and instruction will include standardized KM components, such as a shared KM framework. Future work in the KM area will be able to start from a higher level thanks to an established KM framework.

According to Weber (2002), the majority of reasons raised against KM standardization can be categorized as general objections to standardization, meaning they are not KM-specific.

Following the aforementioned key points identified during the research, this research proposes an integrated holistic framework for the KM maturity assessment which will apply to the ISO 30401 standard requirements. The proposed framework that was selected is the GQC Maturity Model. Many research questions have arisen in the literature regarding the association of KM maturity assessment of CFS with main management principles. In Glykas Quality Compass (GQC) (Glykas, 2022; Glykas et al., 2015), these principles are considered as necessary conditions or factors to accomplish 10, quality concepts, which are divided in three categories (Glykas, 2019b, 2019a): Five core concepts (Customer focus, Human Resources management, Leadership, Process focus, Strategic focus), three intra-core concepts (Performance Measurement, Change Measurement, Continuous Improvement) and two auxiliary concepts (Information-Knowledge management, Partnership, Social Responsibility and Stake holders' value).

The core concepts are:

1. Customer focus: Focusing on the way the product or services are delivered to the customers. Focusing on the customer segment and supporting processes. For example, Quality Function Deployment is a technique for analyzing customer focus.

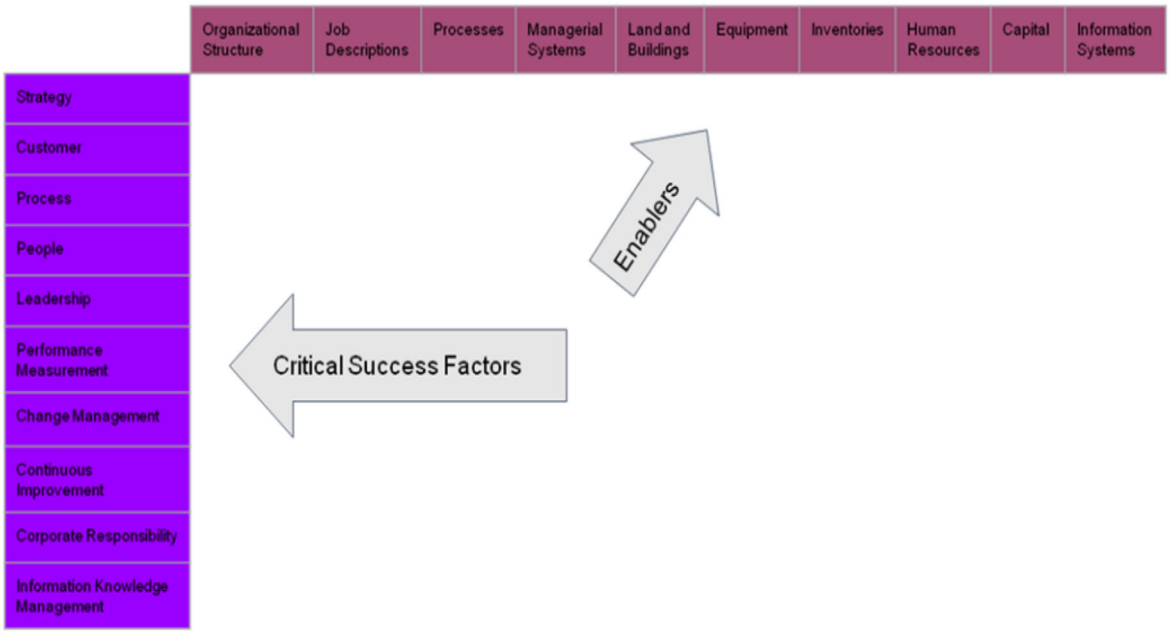

FIGURE 16 Framework of Glykas quality compass (2019). [Colour figure can be viewed at wileyonlinelibrary.com]

	Organizational Structure	Job Descriptions	Processes	Managerial Systems	Land and Buildings	Equipment	Inventories	Human Resources	Capital	Technology and Information Systems
STRATEGY	4.1	7.2		4.3, 7.3	7.1	7.1	7.1	7.1, 7.2	7.1, 7.2	7.1
CUSTOMER	4.2							7.4		
PEOPLE	7.1, 7.2, 7.3, 7.4	7.1, 7.2, 7.3, 7.4	7.1, 7.2, 7.3, 7.4	7.3			7.1	7.1, 7.2, 7.3, 7.4		7.1, 7.2, 7.3, 7.4
PROCESS	8	8	8		8	8	8	8	8	8
LEADERSHIP	5.1, 5.3	5.3		5.2				5.1, 5.3		
CHANGE MANAGEMENT	7.3, 7.4									
PERFORMANCE MEASUREMENT	9.1, 9.3	9.1, 9.3	9.1, 9.2	9.1, 9.2, 9.3				9.3		9.1
CONTINUOUS IMPROVEMENT	10.2	10.1, 10.2	10.1, 10.2	10.1, 10.2	10.2	10.2		10.1, 10.2	10.2	10.2
INFORMATION AND KNOWLEDE MANAGEMENT	9.3	9.3	7.1, 8, 9.1, 9.2, 10.1	4.3, 8, 9.1			7.1	9.1, 10.1		7.1, 9.1, 10.1
PARTNERSHIP, CSR, STAKEHOLDERS	4.2			7.4				8		8

FIGURE 17 Implementation of the ISO 30401:2018 requirements on the GQC framework. [Colour figure can be viewed at wileyonlinelibrary.com]

2. Human resource management: It comprises of four elements namely performance measurement, training and education, rewards and incentives and career pathing.

3. Leadership: It is a soft skill which involves empowering of individuals in an organization. It is very important and deals with how authority and decision making is delegated to the human resources.

4. Process focus: Process flow is the sequence of activities. Process management deals with the activities and flow of activities.

5. Strategic focus: Deals with developing business objectives and the critical success factors.

The intra-core concepts are:

6. Performance measurement: Measurement of the efficiency and effectiveness of all organizational elements namely managerial system, job description, organizational structure and processes-procedures.

7. Change management: The management of the change in all organizational elements in a controlled manner.

8. Continuous improvement: Using PDCA (the Deming Cycle) to continuously improve all elements of the organization.

The auxiliary concepts are:

9. Information-Knowledge management: Knowledge comprises of education, experience and training. Knowledge management is serving knowledge, using knowledge to achieve something. It deals with the way knowledge is documented in an organization.

10. Partnership, Social Responsibility and Stake holders' value: Partnership is the relation with the suppliers, subcontractors and outsourcing firms. Social responsibility is the responsibility with all other authorities in the wider community. Stake holder is anybody who has influence or interest in the company functioning.

The aforementioned factors have been encountered in the literature survey, in all of the models and frameworks that were researched, individually or combined with each other. The Glykas Quality Compass (GQC) framework provides a matrix, a ten-to-ten table, founded on the ten, most crucial, critical-success factors, which are identified in current, maturity-assessment frameworks and the ten, best-known enablers, which are identified in literature. The matrix can be used with reference to the CSFs during the design of the framework and with reference to the enablers during the implementation of the KM framework, for the three-fold managerial perspective Processes—Human Resources—Information Technology (Figure 16).

TABLE 3 Documentation requirements of the ISO 30401:2018

4.1	**Understanding the organization and its context**
4.2	Understanding the needs and expectations of interested parties (stakeholders)
4.3	Determining the scope of the knowledge management system
5.1	Leadership and commitment
5.2	Policy
5.3	Roles, responsibilities and authorities
7.1	Resources
7.2	Competence
7.3	Awareness
7.4	Communication
8	Operation
9.1	Performance evaluation (monitoring, measurement, analysis and evaluation)
9.2	Internal audit
9.3	Management review
10.1	Non conformity and corrective actions
10.2	Continual improvement

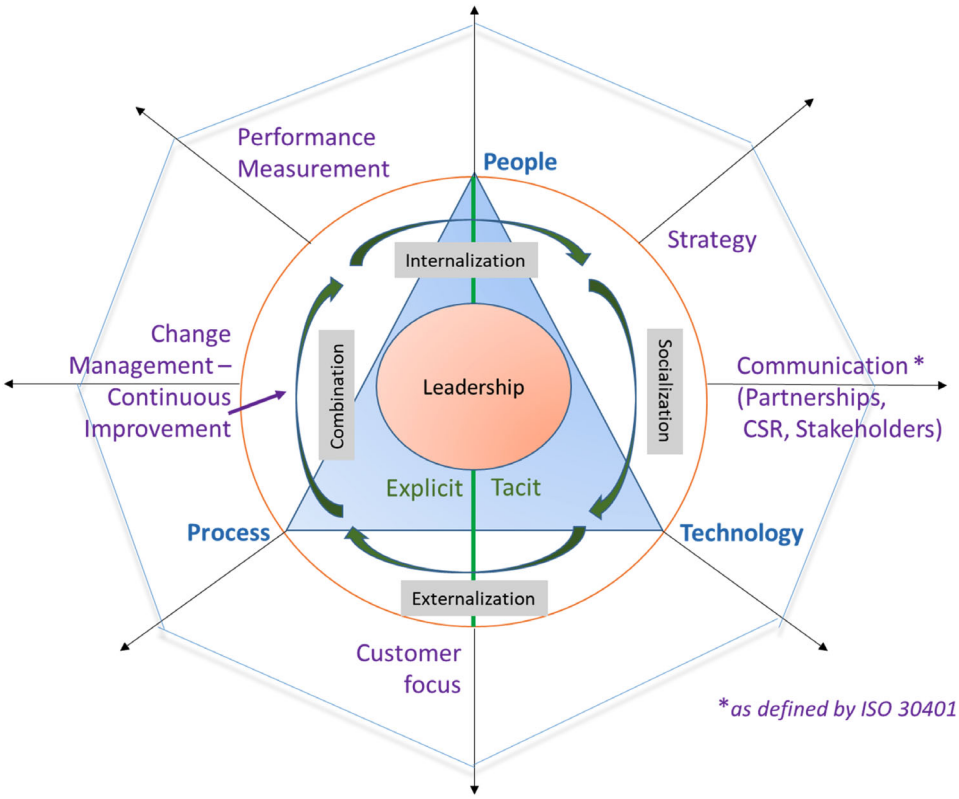

FIGURE 18 The GQC spider-web version KM proposal model. [Colour figure can be viewed at wileyonlinelibrary.com]

In order to examine whether the GQC can be expanded to apply to the ISO 30401 requirements, given that the standard's scope is to "set requirements and provide guidelines for establishing, implementing, maintaining, reviewing and improving an effective management system for knowledge management in organizations. All the requirements of this document are applicable to any organization, regardless of its type or size, or the products and services it provides", the 30,401 clauses presented in the following table were compared to the factors of the ten by ten matrix defined by the GQC, as shown in Figure 17 (Table 3).

The holistic approach of the GQC maturity assessment model, combining CSFs with quality management principles and organizational resources could be implemented for the assessment of the ISO 30401:2018 knowledge management systems Standard, providing a useful guide for the continuous improvement of organizations while at the same time, providing an image of the level of maturity when it comes to knowledge management in everyday processes. The GQC approach could also assist the members of the knowledge management implementation team clarify the KM theory and link it properly and easily to everyday activities (Glykas, 2019).

This research could be used as a recommendation and implementation guide according to the ISO 30401:2018 for an organization in order to test the GQC method. Such a case study would provide findings, tools and categories to expand the GQC model, producing thus a generic GQC KM maturity framework to be used as reference by future researchers in the field of KM maturity assessment.

5 | DISCUSSION AND A PROPOSAL FOR A GQC KNOWLEDGE MANAGEMENT MATURITY MODEL

Based on the extended literature survey of section 2, questions (1–8) have been adequately researched providing answers and conclusions. Through the literature survey which included case studies publications:

-Human resources, processes and technological enablers have been identified as primary factors and enablers in the prominent literature. The reference Table 2 of the literature survey section, clearly identifies this People—Process—Technology three-fold perspective as the most commonly encountered and referenced in KM theory and KM frameworks (RQs 1,6,7, 8).

-Leadership may be a factor not so much encountered in literature and case studies results, however it is the core principle defined by the ISO 30401:2018, around which all KM concepts and steps evolve (RQ3).

-Strategy is an often highly rated CSF in KM case studies, in a more generic perspective, as encountered in most management systems (RQ2).

-Performance Measurement, Continuous Improvement and Change Management (mostly presented through the prism of corporate culture) are identified as secondary but still necessary factors for a successful KM implementation system (RQs 4, 5).

Regarding research questions (10) and (11) and the primary research objective (proposal), the following literature and methodology milestones have been identified and taken into account:

a. The Tacit—Explicit Knowledge distinction combined with
b. The SECI (Socialization, Externalization, Combination, Internalization) Nonaka spiral model for continuous improvement
c. The People—Process—Technology three-fold perspective
d. The existing KM frameworks CSFs: Human resources, Process, Technology, Leadership, Customer focus, Strategy, Performance Measurement, Change Management and Continuous Improvement
e. The Leadership- cored cycle of the ISO 30401:2018

The GQC ten-by-ten CSFs-enablers model was examined as a possible answer to these research questions, providing an integrated solution to the overlap of the aforementioned literature key points while at the same time dealing with the non–overlapping, but still critical factors and core principles encountered in the KM literature. We constructed a design of this overall matrix proposal to represent these five KMMMs theories, covered by a spider-web version of the GQC model (Figure 18). This integrated spider-web edition GQC KM model can be used for testing and further examination of the KM implementation and assessment systems.

The design methodology steps were the following:

1. The Knowledge is depicted as a triangle, where each one the three–fold GQC enablers perspective People—Process—Technology points is a vertex. The "PPT" three—fold factors are also the most encountered in the literature CSFs as previously presented in Table 2.
2. Leadership, another GQC CSF, is placed as a core inside the triangle around which all other aspects rotate, as defined by ISO 30401. This is presented as a concentric circle outside the triangle.
3. The Knowledge triangle is split in the middle, with the Explicit form of Knowledge on the left and the Tacit form on the right.
4. The SECI model is applied, by the rule Tacit to Tacit–> Socialization, Tacit to Explicit–> Externalization, Explicit to Explicit–> Combination, Explicit to Tacit–> Internalization, representing thus another CSF, the Continuous Improvement factor.
5. The GQC CSFs matrix is applied as an octagonal web to encompass the already included five CSFs (People, Process, Technology, Leadership, Continuous Improvement), placing the remaining five GQC CSFs: Strategy, Communication (Partnerships, Corporate Social Responsibility, Stakeholders' value), Customer Focus, Change Management and Performance Measurement on the corresponding five axes.

In the resulting design, Socialization begins with defining Strategy, uses Communication (third parties input) and is used in Technology. Externalization begins with Technology, uses the focus on Customer needs, and is incorporated in Processes. Combination begins with Processes, is applied through Change Management tactics and is used in Performance Measurement. Internalization begins with proper

Performance Measurement, focuses on People and ends in redefining the Strategy and so forth.

This perpetual sequence design can be used for both implementing and improving a holistic KM system, while at the same time staying in line with the ISO 30401 guidelines and requirements.

The web-like relationships between factors, enablers and KM aspects can be used as a Knowledge management maturity assessment model's parameters, constants and KPIs (Figure 17).

6 | CONCLUSIONS

The aim of this research was to propose a holistic and integrated knowledge management maturity assessment framework. To reach this primary objective, a methodology comprised of steps, literature milestones and questions was designed.

In section 2, an extended literature survey on KM and KMMs was presented and analyzed. The literature survey of research in KM assessment frameworks and standards, as presented in the previous sections addressed a series of research questions associated with this study's research objective:

RQ1. What is the relationship between human resources and KM?

RQ2. What is the relationship between strategy and KM?

RQ3. What is the role of leadership in KM?

RQ4. What is the role of performance measurement in KM?

RQ5. What is the relationship between change management—continuous improvement and KM?

RQ6. What is the relationship between process and KM?

RQ7. What is the role of enablers in KM?

RQ8. Which are the required enablers for a successful KM?

The literature survey results and method research conclusions were also presented in Section 2.As a result of this analysis, KM key points and KMMMs CSFs were identified and recorded. Section 3 is dedicated to the concept of standardization and its relation to KM, presenting known KM Standards and their core principles. Even though there is a large number of publications on KM, a literature gap was identified in publications regarding the field of KM Standards and corresponding case studies. This gap can be mainly explained by the fact that the ISO 30401:2018 is a recently published Standard which has just ran its 3-year pilot implementation cycle, as typically encountered with newly designed Standards.

Three more questions have arisen:

RQ9. What is the link between KM Standards and KM Maturity models?

RQ10. Can a KM maturity assessment framework be applied for the assessment of ISO 30401 implementation?

RQ11. Can a generic KM maturity assessment matrix be developed for ISO 30401 implementation?

The study's research objective was extended to accommodate and address these questions to: *the proposal of a holistic and integrated Knowledge Management Maturity Assessment framework encompassing the core guidelines of ISO 30401 in order to be used by both researchers and practitioners*.

In order to answer these questions, the GQC holistic QM model was referenced in section 4 to examine the possibilities of its application to implement and assess KM Systems based on the guidelines of ISO 30401:2018. The results of this research were summarized in section 5, *concluding with the design of an integrated GQC KM web model encompassing known KM key principles as a proposal for testing in KM implementation and assessment future case studies*. This version of the GQC KM Web model will be further analyzed, enriched with parameters and requirements in order to be tested in future case studies (Figure 18).

DATA AVAILABILITY STATEMENT

Data Availability StatementMode: Basic, Share upon Request. Data available within the article or its supplementary materials. The author confirms that the data supporting the findings of this study are available within the article.

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