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IMPLEMENTATION METHODOLOGY OF KNOWLEDGE MANAGEMENT SYSTEM PROJECTS

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Abstract. Knowledge management in higher education institutions is a research topic that has increased over the last ten years. Knowledge Management Systems (KMS) are solutions to attend to the knowledge gaps through projects. This research, with a hermeneutic literature review method, analyses prescriptive and hybrid knowledge management models for higher education institutions and general methodologies for implementing KMS. Based on the results of this analysis, a methodology for the implementation of knowledge management system projects is proposed with an agile and incremental approach and considering the recommendations of the ISO 30401 standard on Knowledge Management System Requirements. The proposed methodology includes other methodologies for knowledge management such as knowledge auditing and maturity assessment, and other methodologies for analysis, design, and development solutions.

Keywords: Knowledge management, Knowledge Management Systems Methodology, Higher Education Institutions.

METODOLOGÍA DE IMPLEMENTACIÓN DE PROYECTOS DE SISTEMAS DE GESTIÓN DE CONOCIMIENTO

Resumen. La gestión del conocimiento en las instituciones de educación superior es un área de investigación cuyo desarrollo se ha incrementado en los últimos diez años. Los Sistemas de Gestión de Conocimiento (SGC) permiten implementar las soluciones para atender las brechas de conocimiento mediante proyectos. Con esta investigación fundamentada en una de revisión de literatura hermenéutica, se analizan modelos de gestión de conocimiento prescriptivos o híbridos para instituciones de educación superior y metodologías generales de implementación de sistemas de gestión de conocimiento. Con base en los resultados de este análisis se propone una metodología de implementación de proyectos de sistemas de gestión de conocimiento con un enfoque ágil e incremental y considerando las recomendaciones del estándar ISO 30401 sobre requerimientos de SGC. Se integran en la metodología propuesta otras metodologías, propias de la disciplina de gestión de conocimiento como la auditoría de conocimiento y la

evaluación de madurez de gestión del conocimiento, así como otras metodologías de análisis, diseño y desarrollo de soluciones.

Palabras clave: Gestión de conocimiento, Metodologías de Sistemas de Gestión de Conocimiento, Instituciones de Educación Superior.

Introduction

In an organization, knowledge management has the purpose of improving performance through the creation, exchange and application of organizational knowledge. Its effectiveness depends directly on the people, processes, technology and organizational structure (Dalkir, 2005, p. 3; Girard & Girard, 2015).

Knowledge Management (KM) is a discipline that can be defined from different perspectives; thus, in the process approach, emphasis is placed on the processing of information to convert it into usable knowledge (Dalkir, 2005; Serenko, 2021). Therefore, the implementation of knowledge management initiatives depends on the perspective of the discipline considered; thus, from the computer science approach, the emphasis is more technical and is oriented to the implementation of Knowledge Management Systems (KMS).

A QMS is the knowledge part of the management system. The elements of the system include the organization's knowledge management culture, structure, governance and leadership; roles and responsibilities; planning, technology, processes and operation (International Organization for Standardization, 2018, p. 5). The integration of the components of a knowledge management system: people, processes and technology are generally represented by a model or framework, understood as a set of systematic approaches to analyze, organize and develop better ways to manage knowledge" (Wiig, 1993).

In the literature, three types of knowledge management models are distinguished in terms of their comprehensiveness: descriptive, prescriptive or hybrid (Fteimi, 2015; Heisig, 2009; Rubenstein-Montano et al., 2001, p. 7). Prescriptive models are task-oriented, dealing with knowledge management procedures; while descriptive models characterize the aspects of knowledge management that influence the success or failure of initiatives; hybrids are descriptive-prescriptive.

The implementation of knowledge management initiatives is based on the prescriptive perspective of the models. There are a significant number of knowledge management system models in the literature, but many are presented in a conceptual or descriptive manner and do not provide an action plan for implementation, resulting in a gap between theory and practice; therefore, models should incorporate guidelines for implementation and should be simple but complete so that they can be understood by non-expert knowledge management professionals (Arisha & Ragab, 2013, p. 895).

In the particular case of this study, we are interested in the implementation of knowledge management initiatives in higher education institutions. Although the origins of knowledge management in business organizations date back to the 90s of the 20th century, interest in universities has increased in the last 10 years. The literature review shows a fragmentation of

knowledge management models applied to the context of higher education, as well as of strategies or guidelines to guide the implementation of initiatives.

Therefore, the objective of this article is to present a proposed methodology for the implementation of knowledge management initiatives in higher education institutions, based on the analysis of other methodologies and the requirements established by the literature.

Method

In order to define a methodology for implementing knowledge management initiatives, a literature review of knowledge management models for higher education institutions was conducted. Ten models were identified, analyzed and classified according to the categories of knowledge management models of Rubenstein-Montano et al. (2001, p. 7). Of these models, the five that included prescriptive characteristics were selected in order to analyze the methodologies applied to implement knowledge management solutions in higher education institutions.

Four methodologies for implementing knowledge management initiatives were also identified, but they are not directed at the higher education institution environment. The results summarize the characteristics of each and provide a comparative analysis.

Based on the results of the previous analysis, a methodology with an agile approach is proposed that can be applied to any type of knowledge management system project in a higher education institution. Projects may be solutions with a human, organizational or technological perspective.

The hermeneutic framework for literature review of Boell & Cecez-Kecmanovic (2014), which consists of iterations of the hermeneutic circles of search and acquisition, and analysis and interpretation, has been applied in the development of this study. Keyword search, forward and backward search techniques have been applied, which has allowed the identification of knowledge management models of interest for this research (vom Brocke et al., 2015, p. 214).

Databases were consulted during the source search process: Google Scholar, EBSCO Host, Emerald eJournal, ResearchGate, AIS eLibrary, IGI Global. The selected sources, written in English and Spanish, include: books, scientific journal articles, conference papers, conference proceedings, theses, standards, Web pages. Zotero software was used for source management.

Consultations were conducted on knowledge management models in higher education institutions in the period 2016 to 2021. Once the models were selected, an analysis was carried out to identify the purpose of the model, the research methodology used for its conception and validation, the origin and source of the study, and the model category (descriptive, prescriptive, hybrid). Given that the models analyzed reflected very specific characteristics for very particular solutions, we proceeded to consult other general methodologies for implementing knowledge management projects, in this case we identified four contributions of great value in the literature (American Productivity & Quality Center, s.f.; Milton & Lambe, 2020; Smuts et al., 2009; Tiwana, 2000).

Using an inductive categorization approach (Pantoja Vallejo, 2015, p. 306) , the analysis of the information sources was carried out in order to answer the research questions:

- What is the methodological approach applied to implement knowledge management solutions in higher education institutions?
- How are the models studied classified?

Results

This section is presented in three parts: A first analysis of ten knowledge management models aimed at higher education institutions, a second analysis of methodologies for the implementation of KM initiatives, and in a third section, the proposed Methodology for the implementation of knowledge management projects.

Analysis of knowledge management models for higher education institutions

Ten knowledge management models aimed at higher education institutions were analyzed (Baptista Nunes et al., 2017; Fernandes et al., 2019; Guevara B. et al., 2016; Meghji et al., 2020; Miake et al., 2018; Moscoso-Zea et al., 2016; Ojo, 2016; Pierre et al., 2017; Straujuma & Gaile-Sarkane, 2018; Zabaleta de Armas et al., 2016). It has been found that there is no single or standard approach to define a knowledge management model; therefore, each institution defines the purpose of its proposal in terms of its context. The models studied have varied purposes, some are conceptual, others have been defined seeking to improve a service and the effectiveness of the institution from an administrative perspective, others seek to support a process or institutional function such as research, teaching, extension; the orientation is also diverse; some support the management of tacit knowledge, others lean towards the management of explicit knowledge. Not all models are prescriptive or hybrid, the implementation methodology of those models that include it is presented at Table 1 .

In general, the application of the systems approach is observed, with diagnostic, design, implementation and evaluation phases. In the diagnostic stages, studies of the organizational context, process mapping, knowledge prioritization, needs identification, stakeholder analysis, evaluation and tool selection are carried out. In the design stages, tools and techniques are proposed to support the knowledge management processes according to the organization's knowledge management activities. The implementation stage is the implementation of solutions through knowledge management practices and Information and Communication Technology (ICT) tools that support knowledge management processes and activities. The evaluation stage includes mechanisms to validate results and provide feedback to the system so that learning is achieved and allows the organization to increase its knowledge spiral. Depending on the focus of the model, there are implementation methodologies that involve organizational processes and the structure of the organization (Fernandes et al., 2019; Guevara B. et al., 2016), others are more oriented to the implementation of IT solutions to generate or process knowledge (Meghji et al., 2020; Moscoso-Zea et al., 2016), and others integrate organizational and technological elements (Miake et al., 2018; Ojo, 2016).

Table 1
Methodology for the implementation of knowledge management models for higher education institutions

Author	Model implementation method
(Fernandes et al., 2019)	Phase 1. Diagnosis: Organizational context Process mapping Knowledge prioritization Identification of the degree of qualification of employees Identification of action points. Phase 2. Implementation: Link between QA practices and critical knowledge Proposal for QA practices Implementation of QA practices. Phase 3. Control: Proposal of QA indicators
(Guevara B. et al., 2016)	Layer 1. Organization (institutional philosophy and business processes) Layer 2. Knowledge (life cycle, processes and knowledge management activities) Layer 3. Integration (modify, store, consult and delete knowledge) Layer 4. Physical (databases, archives and repositories)
(Meghji et al., 2020)	Execution of QA processes on the data to be analyzed, using data mining techniques, by the identified experts.
(Miake et al., 2018)	Data acquisition and integration Data processing and analysis Interactions with customers Feedback
(Moscoso-Zea et al., 2016)	Stakeholder analysis Tool evaluation and selection Infrastructure, enterprise architecture and data warehouse implementation Knowledge creation
(Ojo, 2016)	5-phase cycle: Identify needs Store in repositories Share Apply to improve efficiency and innovation Evaluate the results.

QA implementation methodologies

In the previous section, methodologies with very specific characteristics are observed, to meet very particular needs. In general, it is desirable that the models incorporate detailed and easy-to-understand guidelines for the implementation of the solutions (American Productivity & Quality Center, 2019), preferably with an incremental and iterative approach (Milton & Lambe, 2020), until the expected results are achieved. The QA implementation roadmap is a "detailed plan of the steps an organization will take to implement a QA strategy and/or program, as well as the estimated time frame for each step" (American Productivity & Quality Center, 2019).

Based on these general precepts and the results of the literature review, general methodologies for implementing knowledge management projects have been found and are

analyzed in this article (American Productivity & Quality Center, s.f.; Milton & Lambe, 2020; Smuts et al., 2009; Tiwana, 2000). The phases and steps of these general methodologies are summarized on Table 2 .

Tiwana (2000), proposes a ten-step roadmap in four phases, based on the general systems approach, with phases of infrastructure assessment to align QA with the organization's business strategy; another phase of analysis, design and development of the QMS architecture in which knowledge assets are audited, the QA team is designed and the QMS is developed; in the implementation phase an incremental methodology is applied; and finally, an evaluation phase is identified to measure the return on investment and incrementally refine the system.

Smuts et al. (2009) suggests five stages and defines the steps for each one: in the first stage, the KM strategy is developed by performing a requirements analysis and considering the organizational structure, as well as knowledge management principles; in the next, evaluation stage, the current state of knowledge management is determined through a knowledge audit and initiatives are prioritized; the next stage is the development stage, where solution blocks are built for the prioritized initiatives; in the next, validation stage, pilot tests are dealt with; and in the last, implementation stage, results are published, maintenance, support and measurement of results are performed.

Milton and Lambe (2020), identify five stages: In the first stage, the need to implement KM to support a business case is identified; in the second stage, a plan is designed based on a knowledge audit and context assessment; in the third stage, cycles of testing, improvement and incorporation of KM components in the organization are successively repeated; in the fourth stage, the solution is implemented and delivered, it becomes operational and policies and governance are defined; in the last stage, operation and improvement, knowledge management becomes an integral part of the organization.

At American Productivity & Quality Center (Guevara B. et al., 2016; Meghji et al., 2020; Moscoso-Zea et al., 2016) they conceive of a first stage of solicitation to explore the value of the QA program to the organization, identify critical knowledge and obtain the organization's consent; in the second stage the QA strategy is developed by determining the current state and designing the implementation plan based on the prioritization of opportunities; in the third stage the QA initiatives defined through a plan, project and budget are designed and implemented; in the fourth stage of evolution and maintenance the QA program is valued and embedded within the organization.

Table 2
Methodology for the implementation of knowledge management initiatives

Tiwana (2000)	Smuts et al. (2009)	Milton and Lambe (2020)	APQC (s.f.)
Phase 1: Evaluation of infrastructure Step 1: Analyze existing infrastructure Step 2: Align QA with business strategy.	*Strategy*: Develop the entire QA strategy for the organization including desired outcomes. *Steps*: QA and governance principles Organizational structure and sponsorship Requirements analysis Measurement.	*Stage 1: Strategy* Identify the need for QA implementation to support a business case.	*Stage 1: Call for action* Shares: Explore the organizational value of the QA program. Identify critical knowledge. Align QA with business priorities and functions Obtaining consent Results: Consent of the organization Value proposition QA Management
Phase 2: QMS Analysis, Design and Development Step 3: Design the QA architecture and its integration with the existing structure. Step 4: Audit existing knowledge assets and systems. Step 5: Design QA equipment Step 6: Create the QA project Step 7: Develop the QMS	*Evaluation*: It focuses on the assessment of the current state of knowledge and KM in the organization, as well as the scope and prioritization of initiatives. *Steps*: Knowledge audit Scope of the initiative Prioritization Evaluation of the technological solution.	*Stage 2: Planning* Knowledge audit, assessment of framework elements, assessment of stakeholders, assessment of culture and preparation of a communication strategy and plan.	*Stage 2: QA strategy development* Shares: Determine the current status Create a governance framework Design the phased implementation plan Scope and prioritization of opportunities Create business cases and budgets Results: QA Strategy QA Roadmap
Phase 3: Implement the system Step 8: Implement the system using a results-oriented incremental methodology. Step 9: Managing change, culture and reward structure	*Development*: It deals with the building blocks required for the implementation of the prioritized initiatives. *Steps*: Planning Obtaining knowledge Construction.	*Stage 3: Testing and piloting* Successively, the QA components are tested, improved and incorporated effectively within the organization.	*Stage 3: Design and Implementation of QA Capabilities* Shares: Form operational design teams Design the knowledge flow process Designing QA approaches Design the resources and capabilities model Leveraging and improving information technologies Develop measurements Ratify plans and budgets Results: Dynamic plans for projects and infrastructure Detailed budget QA implementation

Tiwana (2000)	**Smuts et al. (2009)**	**Milton and Lambe (2020)**	**APQC (s.f.)**
Phase 4: Evaluation Step 10: Evaluate QA results, measure ROI and incrementally refine the QMS.	*Validation*: It deals with the components required to launch the pilot program of knowledge management practices, as well as the testing and updating of the pilot initiative. *Steps*: Definition of the pilot initiative Review and update Knowledge maintenance processes.	*Stage 4: Implement and deliver* Application of the QA framework to the rest of the organization that was not included in the pilot test. Preparation for the operational stage: documenting the framework, training people in their new roles, the new processes and the use of new technologies. It ends with the governance system and CG policies.	*Stage 4: Evolution and Maintenance* Shares: Developing QA capabilities Ensuring alignment between QA and organizational priorities Maintain awareness and commitment. Expand QA infrastructure to meet demand. Results Dynamic QA program: valued and embedded.
	Implementation: Focuses on publishing QA results and everything related to communication and change management. *Steps*: Publishing, communication and change management Maintenance and support Measurement and reporting.	*Stage 5: Operation and improvement* At this stage, QA is integrated into the organization's way of working. The QA team adopts a role of supporting and monitoring knowledge management activity in the organization with the aim of continuous improvement.	

The authors agree on the need to align QA with the organization's processes, to base the proposal on the audit of knowledge assets (Milton & Lambe, 2020; Smuts et al., 2009; Tiwana, 2000) and requirements analysis, considering the organization's structure and governance (American Productivity & Quality Center, s.f.; Smuts et al., 2009). Before undertaking the QA initiative, it is necessary to obtain the consent of the organization(American Productivity & Quality Center, s.f.). Technology solution assessment and prioritization of initiatives, needs and opportunities is necessary, as well as pilot testing to test QA initiatives (American Productivity & Quality Center, s.f.; Milton & Lambe, 2020; Smuts et al., 2009). There are also common ground among the authors regarding the implementation strategy, Milton and Lambe and Tiwana (2020; 2000) suggest the use of incremental and iterative methodologies to implement the solutions, others such as Smuts et al. (2009) refer to building blocks that include planning, knowledge gathering and construction, also considered a cyclical and iterative approach; these design and implementation stages are expected to have dynamic project and infrastructure plans (American Productivity & Quality Center, s.f.) that also include budgets. During the process it is necessary to manage cultural and organizational changes to incrementally refine the QMS through evaluation processes (Tiwana, 2000), leading to the maintenance of knowledge and measurement of the QMS (Smuts et al., 2009). Milton and Lambe(2020) identify the need to document the model and train people in new roles, new processes and the use of new technologies. It is necessary to have a team of people (Tiwana, 2000) to lead the implementation of QA initiatives and, once QA is integrated into the way the organization works, this team will take on a support and monitoring role (Milton & Lambe, 2020).

Finally, it is expected to have QA programs embedded in the organization's ways of working with ongoing evaluation and measurement activities (American Productivity & Quality Center, s.f.; Milton & Lambe, 2020; Smuts et al., 2009; Tiwana, 2000). In this sense, QA maturity models have been defined with which the organization can measure the maturity level of its QA program, which applied in a cyclical manner contribute to the continuous improvement and evolution of the program (American Productivity & Quality Center, s.f.; Collins, 2017)

Each organization must define its own knowledge management strategy and its own QMS, because as Tiwana (2000) points out "knowledge is the only resource that cannot be easily copied..., it is protected by the context".

Methodology for the implementation of knowledge management projects

Based on the results of the above analysis, a methodology is proposed for implementing knowledge management projects to put into practice the QMS Model defined for a higher education institution. A draft is a "first outline or plan of any work that is sometimes done as a test before it is given final form" (Real Academia Española, 2020[a], p. definición 5). Knowledge management projects must start with a recognized organizational problem related to knowledge. Based on the needs analysis, the solution is designed and developed, which may be aimed at improving organizational processes, implementing information and communication technologies, or defining improvements in human resources.

Unlike the prescriptive models analyzed in the Table 1 the proposed stages include specific methodologies for the stages proposed by the ISO 30401 standard on requirements for Knowledge Management Systems (International Organization for Standardization, 2018): planning, organizational support, operation, performance evaluation, improvement. Specific methodologies include the knowledge audit as one of the first stages in order to determine the knowledge gaps, as well as the knowledge map and flow. Another specific methodology included is the maturity assessment of knowledge management in an organization. Methodologies for solution design can be dynamically incorporated, depending on the type of solution identified, which gives freedom to knowledge managers to make adjustments to their needs and experiences.

Table 3 summarizes the steps of the proposed methodology and identifies commonalities with the methodologies discussed, which also use a systems project approach (American Productivity & Quality Center, s.f.; Milton & Lambe, 2020; Smuts et al., 2009; Tiwana, 2000).

Table 3
QMS implementation methodology

Stage	Activities	Tiwana (2000)	Smuts et al. (2009)	Milton and Lambe (2020)	APQC (s.f.)
Strategy	Identification of problem areas oriented to knowledge management and of interest to users and authorities.	x	x	x	x
	Obtaining the consent of the authorities.		x		x
	Designation of the work team.	x			x
	Project feasibility assessment.		x		x
Knowledge audit	Definition of the methodology for data collection and analysis.	x		x	

Stage	Activities	Tiwana (2000)	Smuts et al. (2009)	Milton and Lambe (2020)	APQC (s.f.)
	Obtaining the knowledge map and knowledge flow of the study area.				x
	Identify knowledge gaps and recommendations for addressing them.		x	x	
	Prioritize the knowledge gaps to be addressed with the design of the solution.	x	x		x
Solution Analysis, Design and Development	Analysis of solution requirements not covered in the knowledge audit.		x		
	Solution design.	x	x		x
	Solution development.	x	x		
	Pilot testing of the solution with potential users.	x	x	x	
	Presentation of the proposed solution to the authorities.				
Solution implementation	Design of the implementation strategy.			x	x
	Implementation of the solution.	x		x	x
Evaluation and improvements	Definition of the methodology for the evaluation of results and maturity of knowledge management.	x			
	Application of data collection instruments.				
	Analysis of results.				
	Formulation of an improvement plan.		x	x	
	Presentation of the results to the authorities.		x		

The following is a description of the stages, the main activities to be carried out in each stage and the expected results. Figure 1 shows the diagram of the relationship between the stages of the methodology, an initial strategy stage is conceived to identify needs and obtain an initial assessment of the context, then a knowledge audit is included as a second stage, with the purpose of detecting knowledge gaps and prioritizing needs; in the third stage, repeated cycles are carried out with an agile approach of analysis, design and development of the solution; in the fourth stage of implementation, the developed solution is inserted in the institution and in the last stage of evaluation and improvement, an assessment of the level of maturity of knowledge management in the institution is obtained, the results are measured and improvement plans are proposed.

Figure 1
Methodology for the implementation of the knowledge management system model

Stage 1. Strategy

Objective: Identify the need to develop a knowledge management initiative to improve a process of the institution, based on a preliminary assessment of the context.

Description: At this stage, it is recommended to identify knowledge-oriented problem areas that can be viably addressed with the resources available in the institution. It is necessary to have the support of the authorities, organize the work teams, define the scope of the project, and have an assessment of the project's feasibility.

Activities:

1. Identification of problem areas oriented to knowledge management and of interest to users and authorities.
2. Obtaining the consent of the authorities.
3. Designation of the work team.
4. Project feasibility assessment.

Results:

1. Priority area of attention and its viability.
2. Consent of the authorities.
3. Work team.

Stage 2. Knowledge audit

Objective: Determine existing knowledge gaps through an assessment of the technological infrastructure, organizational processes and knowledge management practices.

Description: At this stage, it is recommended to apply a knowledge audit methodology to analyze organizational processes, knowledge management practices and the available technological infrastructure.

Activities:

1. Definition of the methodology for data collection and analysis.
2. Obtaining the knowledge map and knowledge flow of the study area.
3. Identify knowledge gaps and recommendations for addressing them.
4. Prioritize the knowledge gaps to be addressed with the solution design.

Results:

1. Knowledge map.
2. Prioritization of knowledge gaps.

Stage 3. Solution Analysis, Design and Development

Objective: Apply an agile systems development methodology to analyze, design and develop the proposed solution, considering the components of the proposed knowledge management model.

Description: At this stage, it is recommended to apply a methodology of analysis, design and development of systems to build the solution that satisfies the detected knowledge need. This solution may be related to the human, organizational or technological factor, or involve a combination. It is recommended at this stage to consider all the elements of the proposed knowledge management model, and to use an agile approach that allows implementing partial solutions in an iterative way.

Activities:

1. Analysis of solution requirements not covered in the knowledge audit.
2. Solution design.
3. Solution development.
4. Pilot testing of the solution with potential users.
5. Presentation of the proposed solution to the authorities.

Results:

1. Solution developed.
2. Approval for implementation.

Stage 4. Solution implementation

Objective: Incorporate the solution effectively into the institution's processes.

Description: With the consent of the authorities and the positive results of the pilot test, the solution is incorporated into the institution's processes.

Activities:

1. Design of the implementation strategy.
2. Implementation of the solution.

Results:

1. Solution implemented.
2. Documented knowledge management initiative.

Stage 5. Evaluation and improvements

Objective: Evaluation of the results of the implementation of the solution, with a view to defining improvement plans.

Description: At this stage, it is recommended to apply knowledge management maturity assessment models to identify the level of maturity of the institution's capabilities in the various human, organizational and technological factors. With the results, a continuous improvement plan can be defined to guarantee the growth of the institution in its knowledge spiral.

Activities:

1. Definition of the methodology for the evaluation of results and maturity of knowledge management.
2. Application of data collection instruments.
3. Analysis of results.
4. Formulation of an improvement plan.
5. Presentation of the results to the authorities.

Results:

1. Evaluation results.
2. Improvement plan.
3. Knowledge management program.

Discussion and conclusions

A knowledge management model must be consistent with systems thinking, i.e., consider the knowledge management process as a whole, analyze the interrelationship between all parts and evaluate the results to solve the problems (Rubenstein-Montano et al., 2001). In the models analyzed, Table 1, the importance of the relationship between the knowledge management initiative and the organization's strategic objectives and/or goals is emphasized, as well as the need for a needs assessment. The sequence of steps to design, develop, implement and evaluate the results of the solutions is varied, depending on the purpose of the model and the type of solution to be implemented. The evaluation of results, as an adaptive mechanism of the system, is not always explicit, nor is the response capacity. In the general methodologies for the design and implementation of knowledge management systems shown in Table 2, improvement phases such as system responsiveness and results evaluation phases are observed. The proposed methodology, in contrast to those analyzed in Table 1, uses an agile approach, with analysis, design and development cycles that adapt to the type of solution required to meet the detected knowledge management need. Unlike other authors, (Guevara B. et al., 2016; Meghji et al., 2020; Moscoso-Zea et al., 2016) applies evaluation and improvement stages in order to guarantee the increase of the organizational knowledge spiral.

All models show that one of the initial activities is the identification of the need, by means of a diagnosis or knowledge audit; other authors agree with this criterion (Cheung et al., 2007; Daghfous et al., 2013; Lambe & Tan, 2013; Liebowitz et al., 2000; Perez-Soltero et al., 2007; Taheri et al., 2017). The proposed methodology includes a knowledge audit stage.

The knowledge audit, over other forms of needs detection, has the advantage that it allows to obtain the knowledge map, the organization's knowledge flow and an analysis of the knowledge gaps; in this way it is possible to detect organizational, technological and human needs related to knowledge. With these results it is possible to design a solution, considering a methodology that fits the type of need detected. This is the principle on which the proposed methodology is based. The evaluation of results and continuous improvement can be done by applying a knowledge management maturity model with which the institution can obtain a parameter on the growth of the knowledge spiral until it becomes a learning organization (American Productivity & Quality Center, 2021; Cuadrado-Barreto, 2020; de Freitas, 2017; Demchig, 2015; Kulkarni & Freeze, 2004; Secundo et al., 2015).

The agile approach of the methodology allows, in an incremental and continuous way, to design, develop, implement and evaluate solutions, in this way there is a greater probability of achieving the acceptance of changes by users and quickly assess the benefits that will bring to the institution the modification of ways of working, the incorporation of new technologies, or make the necessary adjustments in order to achieve the improvement of the institution's performance.

The analyzed knowledge management models for higher education institutions correspond to the period 2016-2021, have been taken from bibliographic databases such as Google Scholar, EBSCO Host, Emerald eJournal, ResearchGate, AIS eLibrary, IGI Global. General methodologies for implementing knowledge management initiatives come mainly from books and organizations such as APQC. The proposed methodology considers aspects of the different methodologies analyzed (see Table 3), unlike the methodologies for implementing knowledge management models for higher education institutions (see Table 1), the proposal uses a project approach and is based on the ISO 30401 standard on knowledge management system requirements (International Organization for Standardization, 2018).

As future work, it is recommended that the proposed methodology be implemented to design organizational, human and technological solutions applicable to higher education institutions, and based on the results, make the necessary adaptations. Although the model has been designed for higher education institutions, as a future line of research it could be applied to other types of organizations and the results evaluated. In this way, it would be possible to move towards the achievement of a standardized methodology for the implementation of knowledge management system projects.

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