International Journal of Knowledge Management
Volume 18 • Issue 1

A Framework for Implementing a Computer-Based Knowledge Management System in Healthcare Organisations

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ABSTRACT

Computer-based knowledge management systems provide sustainable management of organisational knowledge. The adoption of computer-based knowledge management systems assists organisations in harmonizing critical knowledge pertaining to their business procedures, and processes to effectively collaborate, reuse, and coordinate their efforts. However, available studies show that the implementation of computer-based knowledge management systems is problematic across a multitude of organisations, especially those in the healthcare sector. In this study, a framework and assessment tool were developed to enable healthcare organisations implement computer-based knowledge management systems successfully. The framework and assessment tool developed were tested as a proof of concept and the evaluation was done by two healthcare knowledge management executives and two industry experts. The framework provides implementation teams with a holistic approach, guidance, and conduct of good practice towards implementing a computer-based knowledge management system, which increases chances of success.

KEYWORDS

Computer-Based Knowledge Management Systems, Electronic Health, Healthcare Knowledge Systems, Implementing Knowledge Systems, Knowledge Management Frameworks

INTRODUCTION

Organizations that embrace knowledge management (KM) can resolve most of their business difficulties and increase their benefits and profit margins with improved service delivery and products (Chen, 2013; Hermann, Pentek, & Otto, 2016). These results can be achieved by making informed decisions, retrieving and sharing knowledge quickly, using authenticated knowledge, following best practices, and working smarter by reusing knowledge (Hermann et al., 2016; Maramba & Smuts, 2020; Pawlowski & Bick, 2012). Computer-based knowledge management systems (CBKMSes) enable organizations to quickly make informed decisions, reuse experience to solve known problems,

DOI: 10.4018/IJKM.313640 *Corresponding Author

stimulate innovation, retain tacit knowledge, enforce proper content governance, and increase focus on outcomes (Chen, 2013; Hermann et al., 2016; Maramba & Smuts, 2020). Furthermore, CBKMSes help organizations to harmonize all their available knowledge into a single repository that will make it readily available and easy to retrieve when required (Maramba & Smuts, 2020).

The use of a CBKMS is fast becoming a prerequisite for many organizations, particularly in healthcare, as countries' populations continue to increase and demand for better healthcare standards rises (Chen, 2013). The healthcare sector plays a vital role in all societies; therefore, knowledge and information about disease patterns, trends, and treatments need to be shared and distributed to where they are required to serve human lives (Ghalavand, Panahi, & Sedghi, 2020).

The implementation of a CBKMS in healthcare organizations has been challenging (Ericsson, 2014; Liyanage & Rupasinghe, 2014; Maramba, Coleman, & Ntawanga, 2020). The KM implementation challenges encountered in healthcare organizations differ from other sectors on aspects such as cultural change, change management, work overload, funding, content presentation requirements, information security, knowledge sharing and collaboration, knowledge retention, and human capital management (Adenuga, Kekwaletswe, & Coleman, 2015; Chen, 2013; Maramba et al., 2020).

The implementation of KM principles and concepts in healthcare has been sluggish (Chen, 2013). Healthcare organization setup and structures are complex due to many different stakeholders, including medical doctors, surgeons, nurses, psychologists, radiologists, healthcare insurance companies, medical aids, drug manufacturing companies, ministries of health, and health research communities (El Morr & Subercaze, 2010). The multilayered divisions in healthcare organizations make it unique and challenging as KM project teams underestimate the complexity therein (Bloice & Burnett, 2016; Jennex & Olfman, 2005; Maramba et al., 2020). This complexity requires a well-defined approach to implement a CBKMS successfully in healthcare organizations. Therefore, the aim of this paper is to consider a framework and assessment tool for implementing a CBKMS in healthcare organizations. The guiding research question for this paper is, What are the elements of a framework that will contribute to the successful implementation of a CBKMS in the healthcare sector?

The paper is structured as follows: the background, KM enablement concepts, methodology, discussion of the results, application of the CBKMS framework, the assessment tool, and the conclusion.

BACKGROUND

The need for a coherent and practical framework for KM was first raised over 20 years ago (Wiig, 1993). KM frameworks are essential to organizations because they enable managers to explore and use knowledge aspects to better their services and products (Chen, 2013; Pawlowski & Bick, 2012). In addition, if practical guidelines such as knowledge frameworks existed, more KM practices would be adopted (Maramba & Smuts, 2020; Pawlowski & Bick, 2012; Smuts, Kotzé, Van der Merwe, & Loock, 2017), and more organizational resources would be allocated to KM (Ali & Avdic, 2015).

Without proper guidance and informed execution plans, organizations will continue to fail to implement a CBKMS, thus wasting resources (Frost, 2014; Lenz, Peleg, & Reichert, 2012). CBKMS specialists lack fundamental healthcare knowledge, while medical practitioners in turn do not have extensive knowledge of KM aspects (Lenz et al., 2012). In addition, the sensitivity and confidentiality of medical information make it challenging as some medical practitioners are skeptical and do not believe that the electronic world provides adequate security and protection to private and confidential patient information (Bloice & Burnett, 2016; Coleman, 2014). Medical practitioners consider all information about their patients to be confidential and private data that cannot be shared (Bloice & Burnett, 2016). However, concerns over privacy and confidentiality are misconstrued as a risk of implementing a CBKMS in healthcare organizations (Lech, 2014) and used as justification for shunning CBKMS projects.

KM implementation frameworks are not readily available as ascertained by a study conducted by Heisig (2009), who reviewed 160 KM frameworks and showed that 73% were designed to manage knowledge and not to implement it. Studies by Adenuga et al. (2015); Botha, Botha, and Herselman (2014); Coleman (2014); Du Plessis (2007); Finestone and Snyman (2005); Ghalavand et al. (2020); King, Kruger, and Pretorius (2007); Kruger and Johnson (2010); Maramba et al. (2020); Papa, Mital, Pisano, and Del Giudice (2020); and Smuts, Van Der Merwe, Loock, and Kotzé (2009) acknowledged that more challenges are encountered when implementing a CBKMS in developing countries.

The studies conducted in healthcare organizations on KM and Information Systems (ISes) uncovered some of the following challenges: lack of data quality measurements, ambiguity of roles on data use and governance, inappropriate information technology infrastructure, and the lack of defined knowledge exchange channels and procedures (Adenuga et al., 2015; Badimo & Buckley, 2014). Furthermore, Du Plessis (2007) discovered the absence of defined roles and accountability to support KM projects—as well as inadequate funding to carry out KM projects to completion—as a prevalent hindrance.

A lack of medical practitioner's commitment, failure to transform medical information into systematic knowledge, and the lack of formal channels of sharing knowledge also came to the fore as obstacles (Pawlowski & Bick, 2012). Available literature identifies the following as fundamental causes of challenges encountered when implementing a CBKMS in healthcare organizations: absence of evidence of its value and benefits, effects on the doctor and patient relationship, and a disconnect between system designers and medical teams (Chen, 2013; Mengiste, 2010). Furthermore, Pawlowski & Bick (2012) and Smuts et al. (2009) discovered that from a strategic management perspective, the absence of proper alignment of KM with a business strategy, KM implementation being managed as a separate entity from the business it is meant to service, insufficient funding, disregard of the human factor, poor prioritization from top management, and no proper implementation plan are challenges.

There is a growing amount of literature on knowledge management systems (KMSes); however, most of the available literature focuses on knowledge management cycles (CEN, 2004) and on how to manage and maintain a KM (Heisig, 2009). A substantial number of studies have called on researchers to produce more CBKMS frameworks (Heisig, 2015; Lech, 2014; Shongwe, 2016). An analysis of CBKMS studies by CEN (2004), Heisig (2009), and Heisig (2015) shows that most of the studies focused on KM cycles and management, highlighting the need for CBKMS implementation frameworks.

KM Enablement Concepts

Technology is a key enabler of KM as it proliferates industry and enhances the speed, efficiency, and collaboration of knowledge transfer (Adeyemi, Uzamot, & Temim, 2022; Dalkir, 2017; Milton & Lambe, 2016). Technology permits individual knowledge or team knowledge to be synergized, codified, structured, and distributed across respective knowledge domains (Milton & Lambe, 2016). KM technology is a broad concept that enables organizations to use a wide variety of modern technologies to systematically administer and improve knowledge (Grover & Davenport, 2001; Lech, 2014).

A KMS is a system that is used to implement KM principles (Milton & Lambe, 2016). However, a KMS is not necessarily a computer system (Gorelick et al., 2004), even though the use of the word *system* has been typically associated with the use of computers. Nonaka (1994) defines a system as a set of coordinated activities working together toward a common goal. Lenz et al. (2012) state that a KMS enables an organization to define business process and procedures, create a corporate culture of knowledge sharing, change management strategies on KM adoption, and outline scopes and objectives of KM initiatives.

A KMS can be implemented with or without technology or via a hybrid of the two. A traditional KMS entails the use of knowledge sharing and distribution using socialization, training programs, seminars, workshops, and educational programs (Coleman, 2014; Gorelick, Milton, & April, 2004). A traditional KMS requires participants to be able to identify and recall the sources and references of

the knowledge. In addition, traditional knowledge sharing sessions assume that all participants will understand and follow the discussions, but people learn differently and collaborate better socially or in their own environments (Nonaka, Toyama, & Konno, 2000). The concept of a KMS has been deliberated to integrate it to technology. The next section discusses the concept of computer-based KMSes.

Computer-Based Knowledge Management Systems

A computer-based knowledge management system (CBKMS) refers to the use of computer applications or electronic media to perform KM processes and activities (Chen, 2013; Maramba & Smuts, 2020). A CBKMS is a socio-technological system that comprises the knowledge itself—that is, the intellectual capital of the organization; intangible organizational attributes, such as culture, policies, and procedures; and some form of electronic storage and retrieval systems (Maramba & Smuts, 2020).

A CBKMS enables organizations to combine informed practices and methodologies to harness intellectual capital, business processes, and technological solutions to deliver adequate services timeously (Lenz et al., 2012). Chen (2013) further states that a CBKMS presents an organization with an opportunity to harness new methods of managing knowledge to offer improved service delivery and a quick turnaround. In a healthcare context, Chen (2013) reiterates the need for various types of knowledge repositories in healthcare organizations specifically. These repositories are vital for future generations to learn from previous and current disease patterns and devise better advanced, innovative solutions.

The difference between a KMS and a CBKMS is that a KMS can adopt any form of knowledge management (non-technology and technology related) and that a CBKMS is a subset of a KMS (Frost, 2014). A CBKMS is a specific type of a KMS that uses computers or technological devices. This study identifies a CBKMS as a subset of a KMS, and the term is not interchangeably used.

Knowledge Management Framework

CEN (2004) defines a KM framework as the most essential components of a KM and their relationship with one another. Heisig (2009) identifies three types of KM frameworks; namely, prescriptive, descriptive, and hybrid. Prescriptive frameworks provide direction on how activities can be done, descriptive frameworks characterize KM identifying attributes that are important and have a positive influence on the successes of KM initiatives, and hybrid frameworks are a combination of prescriptive and descriptive frameworks (Heisig, 2009).

KM frameworks are created to enable organizations to achieve a common understanding in the domain (Bhagat, Kedia, Harveston, & Triandis, 2002; CEN, 2004; Maier, 2005) to structure approaches and practices (Grover & Davenport, 2001) and to identify research gaps (Alavi & Leidner, 2001). A KM framework ensures that all necessary KM aspects are present and complete; this framework also ensures that these aspects correlate correctly (Maramba & Smuts, 2020; Milton & Lambe, 2016). In addition, a KM framework ensures that the system is free from breaches and that it enables knowledge to permeate all required areas of an organization (Milton & Lambe, 2016). As stated by Milton and Lambe (2016), the elements of a KM framework need to work together with existing structures, systems, technologies, and infrastructure in the organization. The outcome of a KM framework enhances knowledge gathering, sharing, retention, and application within an organization (Maramba & Smuts, 2020; Salzano et al., 2016). The next section discusses the methodology that was adopted to guide this study.

METHODOLOGY

The aim of this paper is to present a comprehensive framework and assessment tool for implementing a CBKMS in healthcare organizations. To build the envisioned framework, four iterations were employed to collect data and enhance the framework cumulatively with each iteration.

Iteration 1: A systematic literature review was conducted in which 20 published frameworks were reviewed. The objective of the first iteration was to identify the essential elements that would ensure a successful implementation of a CBKMS to formulate the basis on which this study's framework was built.

The authors used the journal search engine of their higher education institution's library to search for the relevant studies. The following keywords were used to select the most relevant studies containing CBKMS frameworks: knowledge management frameworks, knowledge management models, or knowledge management cycles and knowledge management systems or knowledge management system implementation. The search returned 585 studies, and the frameworks were identified as CBKMS cycles, models, processes, and frameworks. The abstracts of these papers were browsed, and 150 relevant papers were selected. The list of 150 papers was narrowed down to 50 by selecting research contributions that focused on design, implementation, and management of CBKMSes. The selection of 50 papers was further narrowed down to 20, considering aspects such as elements considered in the framework, the ease of adoption, and the industry where it was applied or tested. The final selection is shown in Table 1, where 3 columns are depicted as follows: the source of the study, considered framework counts of 50, and the reviewed papers count of 20 CBKMS studies that were reviewed.

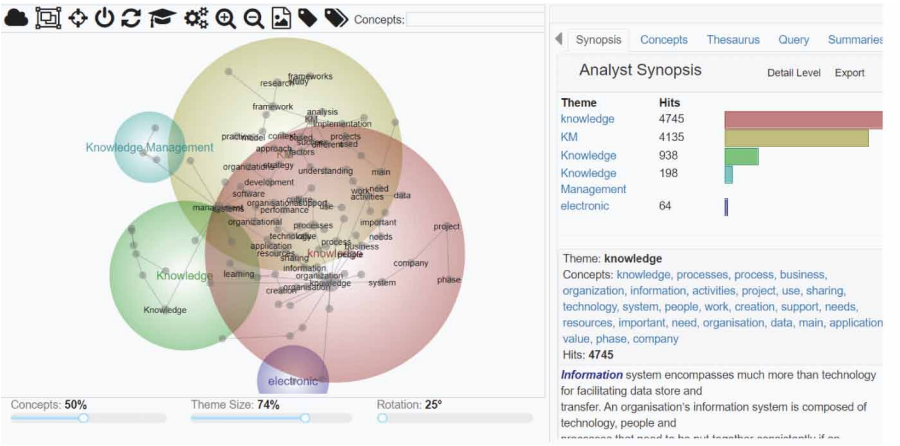
The final 20 studies were loaded into software called Leximancer, a text analytics tool that is used to analyze the content of collections of textual documents (https://www.leximancer.com). Figure 1 depicts the initial text analysis used to generate the concepts and themes.

Iteration 2: The objective of this iteration was to bring the medical doctors' contribution into the framework that would ensure the inclusion of the business case and that the relevant participants are part of the CBKMS project. The questions on the online questionnaire were derived from

Table 1. CBKMS Frameworks Reviewed

Source	Considered frameworks	Reviewed studies
International Journal of Social, Behavioural, Educational, Economic, Business and Industrial Engineering	1	1
European Committee for Standardization (CEN)	1	1
Springer International Publishing	2	1
International Conference on Intellectual Capital, Knowledge Management, and Organizational Learning	1	1
The Electronic Journal of Knowledge Management	24	6
Fountain publishers (Academia.edu)	1	1
International Journal of Knowledge Management	6	1
International Journal of Science and Research	1	1
Journal of Knowledge Management	5	2
Kogan Page Publishers	1	1
International Journal of Production Research	1	1
Therapeutic Innovation & Regulatory Science	1	1
Rivers Publishers Denmark	1	1
Council for Scientific and Industrial Research South Africa	2	1
Total	50	20

Figure 1. Leximancer Concept Map and Themes



the essential elements identified in the first iteration. The medical doctors from Johannesburg, South Africa, were chosen according to the profile shown in Table 2.

The snowball sampling technique was used as medical doctors were not easily accessible due to busy schedules and the nature of their work. The researchers sent a WhatsApp message to the medical doctors they knew, inviting them to participate in the study and requested them to forward the message to their colleagues. The online questionnaire remained open for two weeks. The researchers reviewed the 16 submitted questionnaires for completeness, data quality, and integrity. Only one questionnaire was excluded, making the final accepted questionnaires 15 in total. The participants needed to have gleaned at least three years' working experience and have used a CBKMS for more than a year to provide valuable feedback and contributions to this study. Table 3 presents the composition of the medical doctors and specialists who responded to the questionnaire.

Quantitative data analysis was applied on data collected using the online questionnaire. In this study, mode, frequency, and percentage were used. Mode identifies the most common value among a data set, and a percentage is used to express how a group of values relates to a larger group, where frequency refers to the number of times a value is present in the data set.

Iteration 3: Semi-structured interviews were employed to collect data for this iteration from KM experts in the healthcare sector. The aim of this section was to engage with KM experts to provide an expert and industry contribution in this study. KM experts were considered as the healthcare industry specialists with business knowledge architects, procedural specialists, and

Table 2. Medical Doctor Required Profile

Criteria	Rationale	Ideal participant profile
Medical Doctor	Attain their CBKMS experience and contribution	Practicing in the private healthcare sector
	Obtain the essential elements that should be considered	Knowledge of a CBKMS
	Get the aspects the doctors consider to be the critical success factors when implementing a CBKMS	Participated in a CBKMS implementation or uses a CBKMS

Table 3. Composition of the Participants

Occupation category	Number of participants	% of participants
Aestheticians	1	7
Clinicians	2	13
General practitioners	5	34
Gynaecologists	2	13
Histopathologists	1	7
Neurosurgeons	2	13
Paediatricians	2	13
Total	15	100

technical specialists on how to implement and manage a CBKMS in the healthcare sector. The researchers sent emails to the knowledge section managers of the two international organizations that have successfully implemented a CBKMS requesting their participation in this study. The participating KM experts were selected by their managers and connected to the researchers (two from each organization were connected). Semi-structured interviews were scheduled and conducted telephonically, as the researchers reside in South Africa. The expert's profiles are shown in Table 4.

The interviews were recorded with the permission of the participants. The recorded interviews were transcribed using the Otter mobile application. The transcribing was close to 100% voice to text, but the researchers made a few adjustments. The transcriptions were then thematically analyzed. No software was used because there were only four KM experts, and the researchers did the analysis. The KM expert contribution was to enable the researchers to align this study to current industry practice.

Iteration 4: The assessment tool was developed to assist organizations in determining their preparedness for implementing the CBKMS. It serves to highlight if the organization has missed important essential aspects before embarking on implementing a CBKMS. The semi-structured interviews were conducted via Skype and Zoom applications to perform a user evaluation to gauge if the built artifacts were aligned to the expectations of the users.

The essential elements were rephrased to formulate questions for the assessment tool questionnaire, and all essential elements were incorporated into the development of the assessment tool. Three participants included a KM manager in a healthcare organization, a company executive director, and a medical doctor as detailed in Table 5. In this table E denotes evaluator, and a number refers to the number of the participant.

Table 4. KM Experts Knowledge Roles

Participant code (P#)	Role
P1	Knowledge management manager
P2	Knowledge engineer
P3	Knowledge management system designer
P4	Knowledge analyst

Table 5. Evaluators Profiles

Participant	Industry
KM manager (E1)	Healthcare
Executive director (E2)	Insurance
Medical doctor (E3)	Healthcare

The evaluators from the healthcare sector were to validate if the framework and assessment tool were relevant and applicable in the healthcare organizations. The evaluator from the insurance industry was to determine if the framework could be used in industries other than the healthcare sector where this study was conducted. The researchers contacted the participants telephonically before the evaluation process began to explain the purpose and objectives of the study and the assessment tool. The participants were asked the questions presented in Appendix B.

DISCUSSION OF RESULTS

The development of the CBKMS framework was accomplished through three iterations. The first iteration sought to determine the essential elements that formulated the base of the framework from a scientific perspective. The essential elements were gathered through the application of a systematic literature review.

Systematic literature review (iteration 1): The essential elements from the 20 reviewed frameworks were tabulated and presented in Appendix C (Table 19). The essential elements were then put together based on their themes and clustered into four exclusive clusters depicted in Table 6. The table columns include a cluster, which refers to the grouping of the frameworks; CBKMS essential elements, which are the actual essential elements required to accomplish the implementation of CBKMSes; and brief summary, which describes the identified element.

The identified essential elements in Table 6 were clustered into four categories; namely, strategic, socio-technological, organizational, and operational:

- **Strategic:** Strategic management gives the organization direction; therefore, the identified essential elements need to be managed by organizational leadership to spearhead the project. The elements identified as strategic components include strategic development, CBKMS progress evaluation, preparation, development, implementation plan and strategy, knowledge validation, and review sessions and processes.
- **Socio-technology:** The application of correct and adequate technology awareness contributes positively to the success rate of the CBKMS application (Frost, 2014). Socio-technology is crucial for any CBKMS: people, culture, interface, content, infrastructure, and management fashions the link between human resources and technology tools.
- **Organizational:** Organizations need to enforce and manage these elements: CBKMS performance, employee accountability, required resources, technological changes and updates, CBKMS metrics, market liberalization or business community, risk and threat, proper enforcement of governance of knowledge in the CBKMS, economies of scale, and its customers.
- **Operational:** Operational activities constitute the day-to-day activities that need to be accomplished in creating accurate, appropriate, and relevant knowledge in a CBKMS. Elements identified as operational in nature include the following: knowledge processes, knowledge creation, organization, transformation, storage, sharing, validation, application, evaluation, transfer and distribution channels, and continuous improvement.

Table 6. CBKMS Implementation Framework Elements

Cluster	CBKMS essential elements	Brief summary
Operational	Create	Build and set up knowledge creation tasks
	Organize	Prepare artifacts that define the arrangement of knowledge
	Transform	Develop tools to perform knowledge conversion (tacit, explicit, and implicit)
	Storage	Set up a platform where knowledge will be stored or archived
	Share	Construct an interface and visuals that enable knowledge sharing and exchange
	Validate	Authentication and verification of KMS content
	Apply	The use of knowledge as an end product to run business operations
	Evaluate	To establish if the knowledge is effective and improving the area applied
	Transfer	The ability to distribute knowledge to other areas where it is required
	Improvement	Update, continuous KMS enhancement for value addition
Strategic	Strategizing	CBKMS strategizing, setting up direction, goals, objectives and values
	Evaluation	CBKMS review, update, realign, and apply continuous improvement
	Preparation	Identify all resources required for pre- and post-implementation
	Development	Set up checks to manage the development of the CBKMS
	Implementation	Defining an implementation plan and strategy
	Validation	Identify the process that will be applied to validate knowledge in the CBKMS
	Review	Access the difference made by the CBKMS
Socio-technology	People	Human resources task allocation, roles and accountability, assign best-skilled resources for the right tasks
	Culture	Implementation of CBKMS culture and change management process
	Interface	Selection of suitable infrastructure for the CBKMS
	Content	Content contribution and authentication
	Infrastructure	Knowledge visualization, interface design, and infrastructure setup
	Management	CBKMS management and sustainability
Organizational	Performance	Quick turnaround times to customers' needs
	Accountability	Align human capital to CBKMS roles and reporting structure
	Resources	Making CBKMS resources available
	Technology update	CBKMS as key to industry innovation
	CBKMS metrics	The use and benefits derived from the CBKMS need to be measured and assessed periodically for continuous reviews
	Market liberalization	Growth, a CBKMS enables the organization to expand as a learning journey has been reduced
	Risk	Identify any potential business risk to the CBKMS implementation as well as the risk of not implementing the CBKMS
	Governance	The CBKMS project requires dedicated management; all processes and procedures must be documented and transparent
	Economic	Improve quality, boost efficiency, and reduce the cost of production, managing economies of scale
	Customers	Customers, stakeholders, and investors benefit from CBKMS implementation. Customers' needs are satisfied.

Medical doctors (iteration 2): The aim of this section was to engage with medical doctors to gather their considerations regarding the implementation of a CBKMS in healthcare organizations. The contribution from the medical doctors was critical as it provided the users' dimension to the framework. A major finding revealed a gap created by management's lack of participation in the implementation of a CBKMS and is shown in Table 7.

The lack of managerial (strategic) participation contributed to poor project team cohesion and lack of adequate allocation of resources of which 7 (46.6%) of the participants indicated dissatisfaction in both respects.

The most common 10 essential elements identified in the first version of the framework (Table 6) were evaluated by participants and presented in Table 8. The participants responded to the following question:

Q11. Based on your experience in computer-based knowledge management systems, rate the importance of the elements below on a scale of 1–5; 1 being least important and 5 very important.

Keeping a CBKMS aligned to business goals and objectives is key to successful implementation and post-implementation. Eleven (73%) of the participants indicated that this was a significant component, whereas two (13%) indicated it as average, and two (13%) considered it as not important.

Eight (53.3%) of the participants identified governance as crucial for implementing a CBKMS, one (6.7%) rated it as important, four (26.7%) indicated it as average, and two (13%) indicated it as least important. Implementing a CBKMS without proper governance makes it challenging to support post-implementation, that is why 60% of the participants indicated it as important.

It is important to measure a CBKMS success in the organization so that the impact of knowledge can be determined: two (13%) identified this element as the least important, five (33%) rated it as average, five (33%) indicated it as important, and the remaining three (20%) indicated that it was very important. This element was rated by eight (53%) of the participants as important.

The participants recognized the need for a change management strategy and plan as important. Seven (47%) identified it as very important, three (20%) indicated it as important, and three (20%) indicated it as average. The remaining two (13%) identified it as the least important. Overall, 10 (67%) of the participants identified it as important when implementing CBKMS in healthcare organizations.

Correctly defining roles and responsibilities aligned to a CBKMS increases the chances of success; however, two (13%) participants found this to be the least important and not important, while two (13%) indicated it as average. Four (26.7%) indicated this element as important, and five (33%) identified it as very important.

Table 7. Management Participation and Team Cohesion on CBKMS Implementation

Aspect to be evaluated	Strongly dissatisfied		Dissatisfied		Neutral		Satisfied		Strongly satisfied	
Participation of top management	1	6.7%	3	20%	5	33.3%	1	6.7%	5	33.3%
Participation of middle management	2	13.15%	2	13.15%	7	47%	1	6.7%	3	20%
Participation of operational management	2	13.3%	3	20%	3	20%	4	26.7%	3	20%
Project team cohesion	2	13.3%	3	20%	3	20%	5	33.4%	2	13.3%
Dedicated project resources	1	6.7%	4	26.6%	3	20%	4	26.7%	3	20%

Table 8. Essential Elements of a CBKMS

Implementation aspects	Least important		Not important		Average		Important		Very important	
Keep the computer-based knowledge management system project aligned to business goals and objectives	1	6.7%	1	6.7%	2	13.3%	6	40%	5	33.3%
Governance, the need to manage computer-based knowledge management system content and resources	2	13.3%	0	0%	4	26.7%	1	6.7%	8	53.3%
Measurement to assess computer-based knowledge management system impact	2	13%	0	0%	5	33%	5	33%	3	21%
Change management strategy and plan	2	13%	0	0%	3	20%	3	20%	7	47%
Defining staff roles and responsibilities aligned to the computer-based knowledge management system	2	13.3%	2	13.3%	2	13.3%	4	26.8%	5	33.3%
Improved business processes	1	6.7%	0	0%	4	26.7%	6	40%	4	26.6%
Integration of procedures, processes, and technology into knowledge library	1	6.7%	0	0%	2	13%	5	33.3%	7	47%
Technological changes to manage external, internal aspects that impact computer-based knowledge management system adoption	2	13.3%	0	0%	5	33.3%	4	26.7%	4	26.7%
Technology infrastructure, appropriate software, and technology aspects	1	6.7%	0	0%	3	20%	5	33.3%	6	40%
Business and computer-based knowledge management system alignment strategy	1	6.7%	0	0%	3	20%	5	33.3%	6	40%

Improved business process was identified by four (26.7%) of the participants as very important, six (40%) of the participants indicated it as important, and one (6.7%) found it to be the least important. The four (26.7%) remaining participants rated it as average. Most of the participants (10–67%) indicated that the implementation of CBKMS would improve their business processes.

The integration of procedures, processes, and technology into a knowledge library was found to be important and very important by 12 (80%) of the participants, respectively. One (6.7%) participant indicated it as the least important, and the remaining two (13%) indicated it as average.

Four of the participants (26.7%) indicated that technological changes that enable management of external and internal components in the adoption of a CBKMS were very important. Five (33%) participants considered this element as average, while two (13%) indicated it as the least important.

The adoption of correct technology and software is critical when implementing a CBKMS. Six (40%) of the participants indicated that this element is very important, five (33%) rated it as important, and one (6.7%) rated it as the least important. The remaining participants (three–20%) indicated it as average.

The correct alignment of business and CBKMS strategy enables easier assimilation of the CBKMS into business processes and procedures: Six (40%) of the participants identified this element as very important, five (33%) indicated it as important, and one (6.7%) rated it as the least important. The remaining three (20%) participants rated this element as average.

The feedback from the medical doctors was used to enrich the CBKMS framework in Table 6 (first version) to the second version. The contents of the first version were merged with the feedback from the medical doctors resulting in the second version of the framework. The second version of the framework is presented in Table 9, which illustrates the cluster and essential element.

Table 9. CBKMS Framework Version 2

Cluster	Essential element
Strategic	Strategizing
	Evaluation
	Preparation
	Development
	Implementation
	Validation
	Review
	Set up organization structure to support CBKMS
	CBKMS knowledge awareness sessions
	Prepare a post-implementation process
	Continuous reviews, realignment
	Perform CBKMS progress evaluation
	CBKMS management and sustainability
Infrastructure (Socio-technology)	People
	Culture
	Content
	Create knowledge creation and sharing sessions to attain user involvement.
	Technology that is secure to protect private and confidential information
	System auto recoveries
Organizational	Innovation
	Organizational growth
	Staff engagement
	Task allocations
	Incentives and staff motivation
	Knowledge experts
	CBKMS performance
	CBKMS metrics
	Risk
	Economic
	Manage changes that affect human resources
	System and technology training sessions
	Governance
Operational	Knowledge creation
	Knowledge organization
	Knowledge transformation
	Knowledge storage
	Knowledge sharing
	Knowledge transfer
	Knowledge validation
	Knowledge improvement

The strategic cluster of the updated framework (Table 9) has been improved and now contains 13 essential elements and critical success factors that enforce the participation and contribution of all levels of organizational management. The lack of managerial participation (Table 7) contributed to poor project team cohesion and a lack of adequate allocation of resources of which five (33%) of the participants indicated dissatisfaction in both respects.

The socio-technology cluster has been renamed as infrastructure in the second version. The infrastructure cluster contains the technological aspects of the CBKMS and has been updated using feedback from the participants. Six essential elements formulate the infrastructure cluster: people, culture, content, knowledge sharing sessions, protect private and confidential information, and system auto-recovery.

The organizational section includes 13 essential elements: innovation, organizational growth, staff engagement, task allocation, incentives and staff motivation, knowledge experts, CBKMS performance, CBKMS metrics, risk, economic, manage changes that affect human resources, system training sessions, and governance. The organization needs to manage all these factors to maintain staff morale and keep the team focused and motivated. The findings indicated that 53% of the participants expressed the need for adequate training, support material, and continuous system review and improvements. The achievement of CBKMS implementation lies in the attitude and commitment of the employees; furthermore, adequate resource allocation indicates the commitment of the organization to the project.

The updated and enriched essential elements of the operational cluster include knowledge creation, knowledge organization, knowledge transformation, knowledge storage, knowledge sharing, knowledge transfer, knowledge validation, and knowledge improvement.

KM experts (iteration 3): This section aimed to engage with KM experts to provide an expert and industry contribution to this study. The KM expert contribution enabled the researchers to align this study to current industry practice. The findings of this section were used to enrich the second version of the framework resulting into the final version of the framework. The KM experts' feedback was obtained through semi-structured interviews.

The interview recordings were transcribed from voice into text using the Otter mobile application. The researchers performed thematic analysis on the transcripts. Thematic analysis was applied to identify patterns and common aspects,. Each of the identified themes was mapped to the respective clusters and summarized. These themes were extrapolated and are listed in Table 10, which details the associated cluster and essential element.

The presented essential elements drawn from the KM expert's feedback presented in Table 10, were merged with the second version of the framework (Table 9). Some of the items from Table 10 were rephrased in the refining process in order for them to align and have a flow.

Proposed Framework for Implementing a CBKMS in Healthcare Organizations

To develop a practical CBKMS implementation framework that would be a valid solution to the current implementation challenges that healthcare organizations are experiencing, it was prudent to combine scientific contributions, medical practitioners' considerations, and KM experts' experiences and contributions. The inputs from these three dimensions were used to formulate a comprehensive CBKMS implementation framework that provides the essential elements needed to guide the implementation of the CBKMS. Therefore, the final framework was informed by the findings of the systematic literature reviews, medical doctors' key considerations, and the KM experts' contributions.

The final version of the framework is made up of four clusters: strategic, organizational, infrastructure, and operational. The strategic aspect identifies all elements that business leaders need to manage to keep all stakeholders informed: strategic planning, stabilizing the organization, and providing direction. The organizational cluster possesses three distinct aspects that should be addressed: human resources, CBKMS support, and social aspects. Infrastructure and technology are critical tools that provide the platform and environment that will host the created knowledge. The operational cluster addresses the processes and procedures needed for creating knowledge and its subsequent activities.

Table 10. KM Experts' Feedback Summary

Cluster	Essential element
Strategic	Identify all relevant knowledge sources
Strategic	Establish knowledge contributors and audiences
Strategic	Conceptualize communication channels
Infrastructure	Conceptualize knowledge delivery and distribution channels
Infrastructure	Conceptualize navigation and search tools
Infrastructure	Envision user experience
Infrastructure	Conceptualize knowledge hierarchy and taxonomy of knowledge content
Organizational	Align CBKMS to business requirements
Strategic	Setting up goals and objectives
Organizational	Create a resource matrix to keep the organisation informed and stable
Strategic	Set up adequate funding dedicated toward CBKMS
Strategic	Identify all compliance and regulatory requirements
Organizational	Artifact's performance that serves the intended purpose
Infrastructure	Invest in flexible and dynamic technology
Infrastructure	Auto-recovery and failover cluster system
Infrastructure	Design appropriate knowledge visualization
Organizational	Conceptualize interactive interface design
Organizational	Engage in technological awareness for users
Organizational	Content contribution and authentication
Organizational	Procure correct and appropriate technology
Operational	Knowledge feedback loop for users to provide feedback on the content
Operational	Knowledge access tracking to measure its usage
Operational	Always availability capacity
Operational	Licensing and access rights where required
Operational	Knowledge use
Organizational	Change management
Organizational	Knowledge sharing culture
Strategic	Customer's satisfaction
Strategic	Stakeholders' satisfaction
Strategic	Economic value
Organizational	Resource allocation

The essential elements were rephrased, rearranged, and regrouped, where after the strategic cluster resulted in 14 distinct themes. The organizational cluster had three subsections, each consisting of six themes. The infrastructure cluster concluded with nine themes, and the operational cluster had 11 themes. Each theme was reworded to formulate an essential framework element, where some elements were moved across clusters to present a more meaningful framework. The CBKMS framework is presented in Table 11 in a formalized format as the final version.

Table 11. The Proposed and Final CBKMS Framework

Computer-based knowledge management system framework	
Cluster	**Essential element**
Strategic	Identify critical areas where knowledge is required
	Identify knowledge requirements
	Identify knowledge sources
	Identify knowledge contributors and audiences
	Identify all compliance and regulatory requirements
	Set up goals, objectives, and values of the CBKMS
	Prepare the CBKMS implementation strategy
	Draw the CBKMS implementation plan
	Set up a resource matrix for the CBKMS project
	Set up a progress and evaluation measurement matrix
	Conduct reviews, updates, realignment, and continuous improvement plan
	Prepare a post-implementation/maintenance plan
	Avail adequate funding and budget for the CBKMS project
	Set up CBKMS communication and feedback channels
Infrastructure	Set up correct and appropriate technological tools
	Acquire technology that is secure to protect private and confidential information
	Set up flexible and dynamic technology
	Provide auto-recovery and failover cluster system
	Conceptualize interactive interface design, navigation, and adequate search tools
	Conceptualize knowledge delivery, distribution, and communication channels
	Engage in technological awareness sessions for users
	Knowledge creation and sharing sessions to promote user involvement
	Conceptualize an effective interface for content contribution
Organizational	Customer requirements and satisfaction
	Stakeholders' requirement and satisfaction
	Conceptualize and envision user experience
	Economic value; reduce the cost of production
	The CBKMS as key to industry innovation
	Knowledge retention and learning organization
	CBKMS training and learning
	Roles and reporting structure to support the CBKMS
	Organizational culture
	Staff engagement plans
	CBKMS task and activities allocation
	Incentives
	Engage knowledge experts
	Measure CBKMS performance
	Continuous assessment and evaluation of knowledge use
	Promote knowledge sharing culture
	Knowledge governance
	Conceptualize knowledge as always available

continued on following page

Table 11. Continued

Computer-based knowledge management system framework	
Cluster	**Essential element**
Operational	Knowledge creation; build and set up knowledge creation tasks
	Knowledge organization; prepare artifacts that define the arrangement of knowledge
	Knowledge transformation; develop tools to perform knowledge conversion
	Knowledge storage; set up a platform where knowledge will be stored or archived
	Knowledge sharing; construct interfaces that enable knowledge sharing and exchange
	Knowledge transfer; build artifacts and processes that enable knowledge transfer
	Knowledge validation, authentication, and verification of KMS content
	Knowledge improvement; update, continuous KMS enhancement for value addition
	Knowledge feedback loop for users to provide feedback on the content
	Knowledge access tracking to measure its usage, coverage, and impact
	Knowledge access rights and license where required

The Assessment Tool

The assessment tool was developed to validate the CBKMS implementation framework and assist the organization to measure and determine its preparedness. The organization needs to determine and evaluate its preparedness before embarking on implementing the CBKMS. It has been established that many organizations prepare adequate documentation, such as strategies and execution plans, but still fail the implementation (Dominquez, J. (2009). The assessment tool serves to determine if the organization has missed important essential aspects that are required for implementing a CBKMS. The assessment tool was built based on the final version of the CBKMS implementation framework (Table 11).

The assessment tool enables the organizations to identify the following aspects:

- Enable the organization to evaluate its preparedness through a self-assessment tool that included essential elements, knowledge requirements, required resources, and a complete CBKMS project team.
- Produce an assessment report based on responses provided to the assessment tool that highlights the gaps or missed items by the organization, makes recommendations to the organization based on best practices, and presents the organizational assessment results.
- Produce the four clusters separately and in detail to guide the organization.

The essential elements were transformed into questionnaire questions, and the main clusters of the framework were rephrased forming the questionnaire sections as shown in Table 12.

Table 12. CBKMS Framework Clusters Conversion to Assessment Question Sections

CBKMS cluster	Assessment section
Strategic	Organizational strategic readiness
Organization	Organization's preparedness
Infrastructure	Organization's infrastructure preparedness
Operational	Organization's operational readiness

The strategic readiness section contains questions that require the reviewer to provide answers that will determine leadership readiness to embark on implementing a CBKMS. The organizational section requires the organization to determine if it has addressed all essential elements from the main three sections of social, human resources, and CBKMS support to keep the organization operational while the CBKMS is being implemented. The infrastructure section requires the organization to answer questions about technology, hosting platforms and environment, accessibility, security, and stability. The acquisition of correct, relevant, and performing technology affects the outcome of the implementation of the CBKMS. Operational readiness entails the management and creation of knowledge at a lower level where the question surrounding the action plan and implementation must be answered.

The assessment tool scoring was structured according to essential elements and clusters as shown in Table 13, which details the clusters and scores. The score is the maximum percentage that can be obtained per cluster or sub-section in the case of the organizational cluster.

To automate the evaluation of the organization's preparedness, the assessment tool was presented in Microsoft Excel, as this program can be linked to other applications, and furthermore, Excel facilitates well-refined graphic presentations, thus enabling organizations to run the assessment tool easily as most employees would already have Excel installed on their computers. In the automated assessment tool, the Yes is translated into a 1 and a No into a 0. The assessment is conducted by completing a questionnaire. The questionnaire is presented at the end of this study as Appendix A.

The questionnaire is completed in sequential order beginning with the strategic cluster, followed by infrastructure, then organizational, and finally the operational. Each cluster is assessed individually first, and then the scores are aggregated to provide an overall rating. Once the questionnaire has been completed, the user must click the Click here to view the Report button, which will run the algorithm to perform the assessment based on the scores presented in Table 13. After the user clicks the Click here to view the Report button, the report is created in the CBKMS folder on the desktop as shown in Figure 2.

A CBKMS folder will be created on the desktop in which the assessment report will be created and saved as a Portable Document Format (PDF) document. Upon completion, a summary assessment report will then be displayed depicting the scoring based on the selected answers by the user assessing the organization's preparedness. The report's recommendation section is based on the total scores and comments presented in Table 14.

The assessment report can be a single page or more, depending on the answers selected by the user. The assessment report is shown in Figure 3.

The assessment report consists of five sections: comment, scores, recommendation, aspects to improve, and output/deliverables. The comment section provides a general course of action the organization must take, and the scores section presents the breakdown of the score indicating the organization's preparedness rating per each cluster. The recommendation section presents a summary

Table 13. Assessment Tool Scoring

Cluster	Score
Strategic	20%
Organizational Social Human resources CBKMS support	 10% 15% 10%
Operational	20%
Infrastructure	25%
Total	100%

Figure 2. Assessment Report Confirmation Message

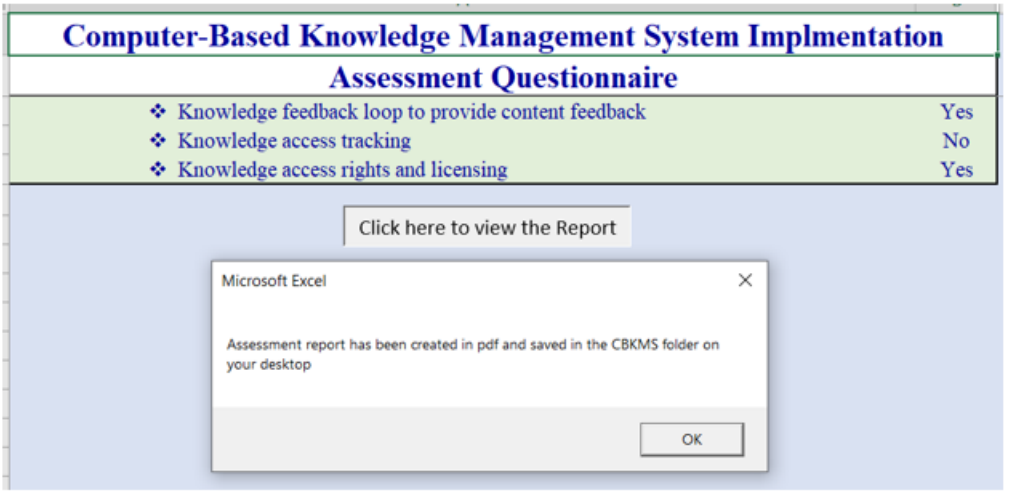


Table 14. Summary Assessment Report Recommendations

Total score	Recommendation
0%–60%	The organization is not ready to implement a CBKMS. There is a need to restart the process, conduct a comprehensive feasibility analysis and planning, and use the framework to secure guidance. The organization must redo the process and rerun the assessment evaluation to determine areas that require improvement, until the organization is ready.
61%–70%	Some critical aspects are missing; the organization needs to perform a comprehensive review of the areas highlighted in the detailed report. The organization must rerun the assessment evaluation; if there is a need for rework, then it must be done accordingly as suggested by the summary report.
71%–80%	Some important aspects need to be improved upon; refer to the sections with low scoring and highlighted sections. It is not ideal to proceed as there are some risks on the implementation strategy or plan.
81%–90%	The organization is ready; perform a review of the areas with low scores as they will add more value to the implementation plan.
91%–100%	The organization is ready; implementation of a CBKMS may proceed.

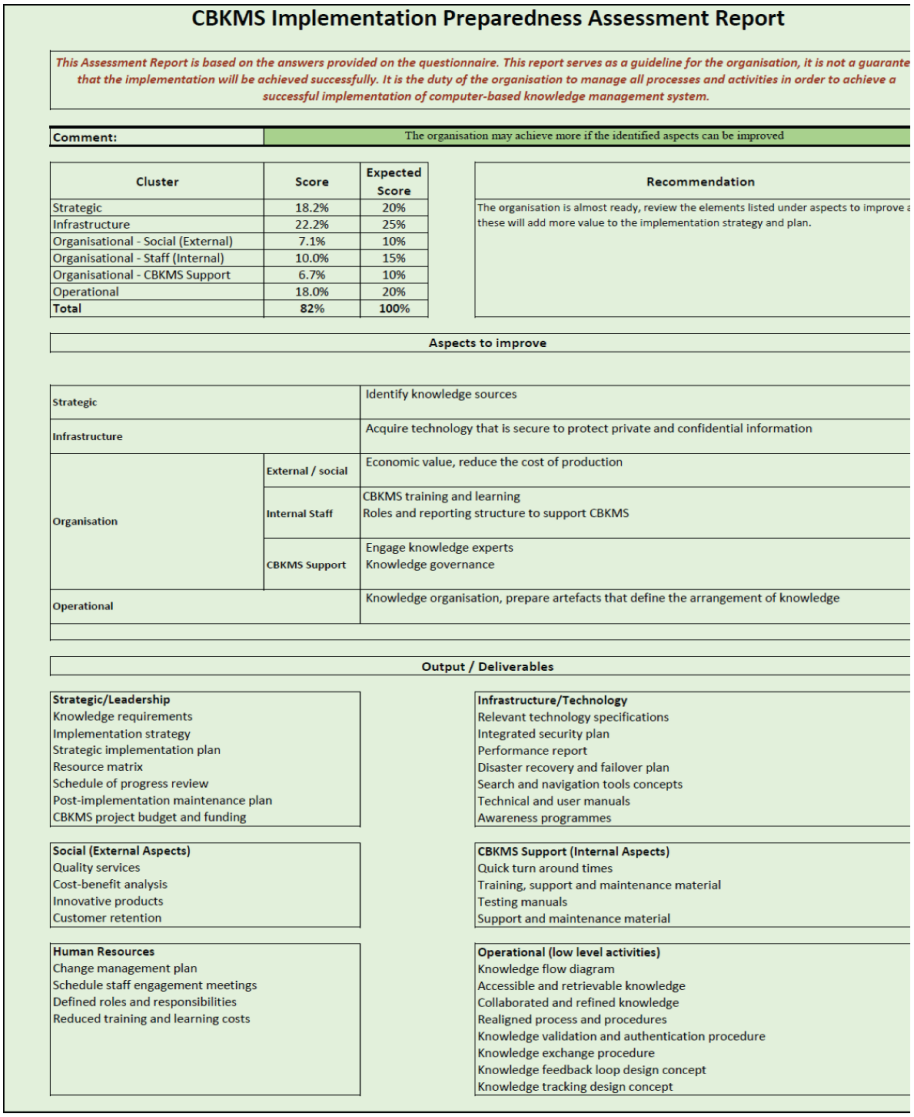
Scoring is divided into five categories: 0–60% (lowest), 61–70%, 71–80%, 81–90%, and 91–100%.

of what should be done based on the obtained score, and the aspects to improve section identifies areas that require some rework. The output/deliverables section presents expected outputs per each cluster should the organization adopt the framework as the guideline.

An illustration of the assessment readiness overview is presented in Figure 4. Section A of Figure 4 is the expected level of preparedness the organization should reach before embarking on implementing a CBKMS. Section B presents the actual readiness of the organization. The values used are derived from the sectional questions and ratings as shown in Table 13.

Figure 4 presents a comparison of what the evaluated organization (Section B) attained versus what was expected (Section A). The expected level is 100% where the organization received 81%; therefore, the organization is required to review the section where it did not do well, which will be

Figure 3. CBKMS Implementation Assessment Report



CBKMS Implementation Preparedness Assessment Report

This Assessment Report is based on the answers provided on the questionnaire. This report serves as a guideline for the organisation, it is not a guarante that the implementation will be achieved successfully. It is the duty of the organisation to manage all processes and activities in order to achieve a successful implementation of computer-based knowledge management system.

Comment:	The organisation may achieve more if the identified aspects can be improved

Cluster	Score	Expected Score
Strategic	18.2%	20%
Infrastructure	22.2%	25%
Organisational - Social (External)	7.1%	10%
Organisational - Staff (Internal)	10.0%	15%
Organisational - CBKMS Support	6.7%	10%
Operational	18.0%	20%
Total	**82%**	**100%**

Recommendation

The organisation is almost ready, review the elements listed under aspects to improve a these will add more value to the implementation strategy and plan.

Aspects to improve

Strategic		Identify knowledge sources
Infrastructure		Acquire technology that is secure to protect private and confidential information
Organisation	External / social	Economic value, reduce the cost of production
	Internal Staff	CBKMS training and learning Roles and reporting structure to support CBKMS
	CBKMS Support	Engage knowledge experts Knowledge governance
Operational		Knowledge organisation, prepare artefacts that define the arrangement of knowledge

Output / Deliverables

Strategic/Leadership
Knowledge requirements
Implementation strategy
Strategic implementation plan
Resource matrix
Schedule of progress review
Post-implementation maintenance plan
CBKMS project budget and funding

Infrastructure/Technology
Relevant technology specifications
Integrated security plan
Performance report
Disaster recovery and failover plan
Search and navigation tools concepts
Technical and user manuals
Awareness programmes

Social (External Aspects)
Quality services
Cost-benefit analysis
Innovative products
Customer retention

CBKMS Support (Internal Aspects)
Quick turn around times
Training, support and maintenance material
Testing manuals
Support and maintenance material

Human Resources
Change management plan
Schedule staff engagement meetings
Defined roles and responsibilities
Reduced training and learning costs

Operational (low level activities)
Knowledge flow diagram
Accessible and retrievable knowledge
Collaborated and refined knowledge
Realigned process and procedures
Knowledge validation and authentication procedure
Knowledge exchange procedure
Knowledge feedback loop design concept
Knowledge tracking design concept

highlighted in a detailed assessment report (Figure 4). The assessment tool can be executed numerous times, and the history of every report is kept to enable progress review.

Evaluation of the CBKMS Framework

To evaluate the final version of the framework, industry experts were selected to participate. These experts were specialists in the subject of knowledge management in their respective industries. The mechanism to engage with the experts was via semi-structured interviews. The composition of the experts who took part in the evaluation is presented in Table 15, which details the industry, participant profile, rationale, and position or experience. The industry refers to where the expert was practicing, the participant profile is the participant's area of specialization, the rationale is the justification for why the participant was chosen, and position refers to the participant's current role.

Figure 4. Assessment Readiness Overview (Illustrative)

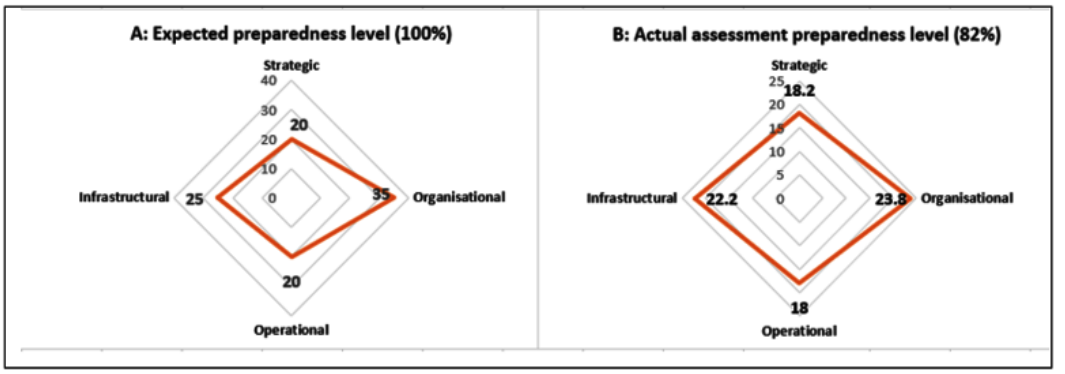


Table 15. Composition of the Assessment Participants

Industry	Participant profile	Rationale	Position/experience
Healthcare	Knowledge management team manager	This participant was chosen because of that person's role in KM administration and managing the KM human resources. The participant works for one of the best CBKMS in the UK. Therefore, the participant's view of the framework would focus on KM administration and KM human and non-human resources.	Manager (nine years)
Healthcare	Knowledge management senior collaborator	This participant works for the world's best CBKMS called ASKMAYOEXPERT (USA) as a knowledge collaborator. The participant's experience lies particularly in healthcare knowledge content, implementation, collaboration, distribution and application which were vital for this evaluation.	Senior (15 years)
Knowledge management consultancy	Knowledge expert	This participant possesses KM experience across various industries, including healthcare. The participant's experience in KM was adequate and would identify missing aspects compared to other industries.	Managing director (30 years)
Insurance	Insurance Risk Specialist	The framework was developed for healthcare; however, the purpose of this evaluation was to determine if the framework can work for other industries. Furthermore, risk management also functions similarly to KM, which can function across the entire organization. Insurance organization's setup is multidisciplinary, similar to healthcare organizations, which was ideal for understanding this aspect from its context.	Executive director (10 years)

The healthcare practitioners welcomed the CBKMS framework as a perfect and practical solution to the implementation of a CBKMS. The knowledge expert and insurance risk specialist agreed with the healthcare practitioners on the comprehensiveness of the framework. The knowledge expert and insurance risk specialist found the framework to be a business artifact that could be used in many industries including insurances and consultancy.

The aspects that the CBKMS was evaluated on are completeness and comprehensiveness; ease to follow as a business solution; applicability of the framework in the healthcare sector, insurance, and other organizations; and gaps or improvements. The evaluation feedback of the participants has been summarized in Table 16 illustrating the application of CBKMS and suggestions for enhancing the CBKMS.

The participants asserted that the CBKMS framework was an appropriate and relevant practical solution to assist in the implementation of CBKMS. The participants concurred that it met their expectations and would appreciate more studies of this nature going forward.

Contribution

The purpose of the CBKMS framework presented in this study is twofold:

- To guide organizations in planning and implementing a CBKMS to create a robust knowledge system.
- To provide organizations with a practical guide and validation on how to implement a knowledge management system.

The purpose of the assessment tool was to:

- Enable an organization to conduct a self-assessment to determine its preparedness when implementing a CBKMS.
- Provide the organizations with a detailed assessment report that will provide direction on what should be done.
- Illustrate the gap between the organization's current position and the ideal position of readiness.

Table 16. Summary of Evaluation Feedback

Application of CBKMS healthcare sector	Application of CBKMS knowledge management consultancy	Application of CBKMS insurance sector
Provides practical guidelines	Provides a holistic view of the organization	Present a perfect guideline for CBKMS implementation
Report is highly informative and a good evaluation for the organization.	This CBKMS framework increases the chances of success in implementing a CBKMS	Framework forces management to take part in the implementation of CBKMS
Comprehensive to address most of the critical aspects required for a successful implementation	Enforces the organization to adhere to set up guidelines	Ease to follow and implement has critical aspects: strategic, organizational, infrastructure, and operational
It is relevant in healthcare organizations	The framework can be adopted by any type of an organization implementing an IT project	The framework is relevant in the insurance sector and any other sector
Reduce project implementation time, a good foundation to start from when implementing a CBKMS	Framework is adaptable	The framework enables the organization to identify and manage the essential.

LIMITATIONS OF THE STUDY

The study was focused on healthcare organizations, where the 15 participating medical doctors were recruited from Johannesburg, South Africa, and the KM experts were from two healthcare organizations. Therefore, the feedback might not be exhaustive.

FUTURE RESEARCH

It may be necessary to conduct this type of study on a broader scale to generalize the framework and widen the essential elements of the framework. The study identified the need for more studies to be conducted to develop CBKMS frameworks, particularly for healthcare organizations. It is therefore prudent to conduct more studies of this nature.

CONCLUSION

The implementation of a CBKMS is a complex, exhaustive process that requires meticulous planning and adequate resources, as well as a framework that serves as a guideline to enforce the organization to follow tried and tested approaches. Knowledge is an important asset in modern economies and to help organizations in accomplishing their objectives and business goals.

Change management processes of the evolving knowledge sharing culture must be managed effectively, and the participation of users must be made mandatory as medical practitioners are too busy for optional activities. A CBKMS enables organizations to share and work with authenticated knowledge on disease patterns and trends, providing several ways of managing and eradicating them. A knowledge system enables the organization to react and act decisively when faced with pandemics. All countries in the world are experiencing population growth that requires expertise, updated medical knowledge, and clinical science to provide their populations with appropriate healthcare services. Today's governments, policymakers, regulatory bodies, medical practitioners, and technologists must keep up with the emerging technologies and align them to service the healthcare sector.

The framework and assessment tool developed in this study are business enablers that will increase the chances of successful implementation of a CBKMS so that the benefits of knowledge sharing, as well as collaboration, can be realized. There is a need to make sure that the adoption of a CBKMS is driven from a participatory perspective with users realizing the value it brings to their work environment. With the successful implementation of a CBKMS, organizations can create opportunities to be innovative, improve service delivery, and gain a competitive advantage.

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APPENDIX A

Assessment Questionnaire

The assessment tool relies on the input from the users. The questionnaire shown in Table 17 is to be completed.

Table 17. Assessment Questionnaire

Computer-based knowledge management system assessment questionnaire	
Organizational strategic readiness	**Answer**
1. Have you identified the critical areas where knowledge is required?	Yes / No
2. Have you identified the knowledge requirements?	Yes / No
3. Have you identified all the available knowledge sources?	Yes / No
4. Have the knowledge contributors and audiences been identified?	Yes / No
5. Do you have a compliance and regulation skilled resource for this project	Yes / No
6. Are the CBKMS objectives and goals aligned to the business strategy?	Yes / No
7. Has the CBKMS implementation strategy been approved?	Yes / No
8. Have you prepared a CBKMS implementation plan?	Yes / No
9. Have you identified all the resources required for CBKMS?	Yes / No
10. Have you identified progress and evaluation matrices?	Yes / No
11. Have you prepared a realignment and continuous improvement plan?	Yes / No
12. Has the post-implementation/maintenance plan been prepared?	Yes / No
13. Is there a separate budget for the CBKMS project?	Yes / No
14. Have you set up CBKMS communication and feedback channels?	Yes / No
15. Has the subject of CBKMS been communicated across the organizations?	Yes / No
16. Has the organization set up a steering committee to oversee the CBKMS project?	Yes / No
17. Indicate from the below social aspects which ones have been included in the implementation plan	
• Customer requirements and satisfaction	Yes / No
• Stakeholders' requirement and satisfaction	Yes / No
• Conceptualize and envision user experience	Yes / No
• Reduce costs (training, operational etc.)	Yes / No
• Innovativeness in services development	Yes / No
• Knowledge retention	Yes / No
• Learning organization	Yes / No
18. Indicate from the below human capital aspects that have been identified and included in the implementation plan	
• CBKMS training and learning	Yes / No
• Roles and reporting structure to support CBKMS	Yes / No
• Organizational culture (change management)	Yes / No
• Staff engagement plans	Yes / No
• CBKMS task and activities allocation	Yes / No
• Incentives	Yes / No

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Table 17. Continued

Computer-based knowledge management system assessment questionnaire	
Organizational strategic readiness	**Answer**
19. Indicate from the below computer-based knowledge management systems support aspects which ones have been included in the implementation plan	
• Engage knowledge experts	
• Measure CBKMS performance	
• Continuous assessment and evaluation of knowledge usage	
• Promote knowledge sharing culture	
• Knowledge governance	
• Conceptualize knowledge as always available	
20. Has the organization acquired the appropriate technology?	Yes / No
21. Does the technology provide appropriate security to confidential information?	Yes / No
22. Is the technology flexible, upgradable in future?	Yes / No
23. Does the technology provide autorecovery and cluster failover?	Yes / No
24. Have you conceptualized the interactive interface design and adequate search tools?	Yes / No
25. Have you conceptualized knowledge delivery and distribution channels?	Yes / No
26. Have you planned and set up technological awareness sessions been?	Yes / No
27. Have the plans for knowledge creation and sharing sessions been created?	Yes / No
28. Have the content contribution aspects been set up?	Yes / No
29. Is the technology compliant with data protection regulations?	Yes / No
30. Can the technology be integrated with other technologies?	Yes / No
31. Select from the below computer-based knowledge management system activities that the organization has included in the implementation plan.	
• Knowledge creation	Yes / No
• Knowledge organization and visualization	Yes / No
• Knowledge transformation	Yes / No
• Knowledge storage	Yes / No
• Knowledge transfer	Yes / No
• Knowledge validation, authentication, and verification	Yes / No
• Knowledge improvement and updates	Yes / No
• Knowledge feedback loop to provide content feedback	Yes / No
• Knowledge access tracking	Yes / No
• Knowledge access rights and licensing	Yes / No

APPENDIX B

Assessment Tool Evaluation Questions

The semi-structured questions were open-ended as detailed in Table 18. AT stands for assessment tool in the respective table.

Table 18. Assessment Tool Guiding Questions

AT-1. How well is the assessment tool aligned with the CBKMS implementation framework?
AT-2. Did you find the assessment tool as a practical solution?
AT-3. The assessment tool was designed to enable the organization to determine its preparedness in the implementation of CBKMS – Does this assessment tool serve this purpose according to your evaluation?
AT-4. Give your personal evaluation of the assessment tool
AT-5. Explain how you view the assessment report
AT-6. You can provide any other comments you may have.
Thank you

APPENDIX C

Table 19 lists the extracted essential elements from the reviewed 20 frameworks.

Table 19. Essential Elements from Existing Frameworks

Author	Create	Organize	Transform	Store	Share	Validate	Apply	Evaluate	Transfer	Improve	Strategize	Evaluate	Prepare	Develop	Implement	Validate	Review	People	Culture	Interface	Content	Infrastructure	Management	Performance	Accountability	Resources	Technology Update	KMS Metrics	Market Liberalization	Risk	Governance	Economic	Customers
Badimo and Buckley (2014)	✓	X	X	✓	✓	X	✓	X	X	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bolisani and Bratianu (2018)	✓	✓	✓	✓	✓	X	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CEN (2004)	✓	X	X	✓	✓	X	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Evans and Ali (2013)	✓	✓	X	✓	✓	X	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Evans et al. (2014)	✓	X	X	✓	✓	X	✓	✓	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Karemente et al. (2009)	✓	✓	X	✓	✓	X	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mostert and Snyman (2007)	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shongwe (2016)	✓	X	X	✓	✓	X	✓	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lech (2014)	X	X	X	X	X	X	X	X	X	X	✓	X	✓	X	✓	X	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Smuts et al. (2009)	X	X	X	X	X	X	X	X	X	X	✓	✓	X	✓	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Woodman and Zade (2012)	X	X	X	X	X	X	X	X	X	X	✓	✓	X	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Biloslavo and Zornada (2009)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	X	X	✓	X	X	X	X	X	X	X	X	X	X	X

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Table 19. Continued

Author	Create	Organize	Transform	Store	Share	Validate	Apply	Evaluate	Transfer	Improve	Strategize	Evaluate	Prepare	Develop	Implement	Validate	Review	People	Culture	Interface	Content	Infrastructure	Management	Performance	Accountability	Resources	Technology Update	KMS Metrics	Market Liberalization	Risk	Governance	Economic	Customers
Heisig (2009)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	X	X	✓	✓	X	X	X	X	X	X	X	X	X	X
Pawlowski and Bick (2012)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	X	X	✓	✓	X	X	X	X	X	X	X	X	X	X
Piorkowski et al. (2013)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	X	✓	✓	✓	✓	X	X	X	X	X	X	X	X	X	X
Salzano et al. (2016)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	X	✓	✓	✓	X	X	X	X	X	X	X	X	X	X
Carrillo, Robinson, Anumba, and Al-Ghassani (2003)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	X	✓	✓	✓	✓		✓	X
Al-Shammari (2008)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	X	✓	✓	✓	✓	X	X	✓
Ali and Avdic (2015)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	X	X	✓	✓	✓	✓	✓	✓	✓
Jennex and Olfman (2006)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	X	X	✓	X	X	✓	X	✓	X
Milton and Lambe (2016)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	✓	✓	X	X	✓	✓	✓	X

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