SMARTVision: a knowledge-management methodology

Bonnie Rubenstein-Montano
Jay Liebowitz
Judah Buchwalter
Doug McCaw
Butler Newman and
Ken Rebeck

The authors

Bonnie Rubenstein-Montano is at The McDonough School of Business, Georgetown University, Washington, DC, USA.
Jay Liebowitz, Judah Buchwalter and **Doug McCaw** are all at the Department of Information Systems, University of Maryland Baltimore County, Baltimore, Maryland, USA.
Butler Newman and **Ken Rebeck** are both at RWD Technologies Inc., Columbia, Maryland, USA.

Abstract

A myriad of researchers have presented methodologies and frameworks for implementing knowledge-management. However, frameworks do not provide sufficient detail for executing knowledge-management initiatives, and existing methods do not adequately address all of the requirements for effective knowledge management. The field of knowledge management has been slow in formulating a universally accepted methodology. This paper reviews the status quo of knowledge-management methodologies and presents a detailed, comprehensive methodology that addresses existing shortcomings. The presented method, SMARTVision, extends previous research on frameworks by taking a more micro-view of knowledge management – a specific methodology.

Introduction

Knowledge management (KM) is an emerging field that has commanded attention and support from much of the industrial community. Many organizations are now engaging in KM in order to leverage knowledge both within their organization and externally to their shareholders and customers. KM deals with the process of creating value from an organization's intangible assets. These assets, or knowledge, can be classified as either tacit or explicit. Explicit knowledge is that which has been codified and expressed in formal language (Nonaka, 1991, 1994). It can be represented, stored, shared and effectively applied. Tacit knowledge is knowledge that is difficult to express, represent and communicate (Nonaka, 1991, 1994). The distinction between types of knowledge is relevant because each type must be managed differently.

Alavi and Liedner (1999) indicate that many organizations are developing information systems designed specifically to facilitate the sharing and integration of knowledge. However, KM encompasses much more than technologies for facilitating knowledge sharing. In fact, practitioners are beginning to realize that people, and the culture within which they work, are the driving factors that ultimately determine the success or failure of KM initiatives (Bobbitt, 1999; Saint-Onge, 1999).

KM is a young discipline for which neither a codified, universally accepted framework (Rubenstein-Montano *et al.*, 2001) nor methodology (Beckman, 1998) has been established. Despite this fact, numerous approaches to KM have been implemented across a variety of organizations. Unfortunately, these approaches do not adequately fulfil the KM needs of organizations. This paper seeks to address this lack of a widely accepted methodology by reviewing the status quo of KM methods and presenting a comprehensive methodology that addresses shortcomings of the existing methods.

Rubenstein-Montano *et al.* (2001) present a systems thinking framework for KM. This work extends that research through its micro-view of KM – a specific methodology – that is consistent with the framework

formerly proposed. The contribution of this work is the detailed methodology that is presented. We define a methodology as a set of procedures that can be followed for achieving an objective. In the case of this paper, the objective is to successfully "do" KM.

In the next section, this paper reviews the KM methodologies that have been reported in the literature, and it discusses important insights gained from analyzing the current state of the art. Details for a comprehensive methodology for KM are provided in the a comprehensive methodology section, and a summary of the research is provided in the summary.

Status quo of knowledge-management methodologies

Both frameworks and methodologies are relevant for the discussion of developing a KM methodology. They provide guidance and direction for how KM should be done. However, methodologies are more specific than frameworks, detailing how actually to carry out KM in a manner consistent with a particular framework. KM frameworks are mentioned for their role as overseer (or provider of guidance) for the discipline. Thus, methodologies ought to be developed within the context of some acceptable framework. The KM frameworks in the literature tend to emphasize different aspects of KM. Holsapple and Joshi (1997, 1998) of the Kentucky Initiative for Knowledge Management, have presented several KM frameworks. For example, they have developed a descriptive framework that, similar to the Theseus Institute (1999), provides a number of building blocks which can be sampled from in order to build prescriptive approaches (Holsapple and Joshi, 1998).

Additionally, Teleos has developed a framework of eight "knowledge-management dimensions" which identify organizations that recognize knowledge as the key for competitive success (Chase, 2000). The eight dimensions are:

(1) success in establishing an enterprise knowledge culture;
(2) top management support for managing knowledge;
(3) ability to develop and deliver knowledge-based goods/services;
(4) success in maximizing the value of the enterprise's intellectual capital;
(5) effectiveness in creating an environment of knowledge sharing;
(6) success in establishing a culture of continuous learning;
(7) effectiveness of managing customer knowledge to increase loyalty/value; and
(8) ability to manage knowledge to generate shareholder value.

This is a comprehensive framework in which each dimension is comprised of myriad processes and subprocesses. Unfortunately, there is no codified, generally accepted framework for KM as a discipline (Rubenstein-Montano et al., 2001). Beckman (1999) and Rubenstein-Montano et al. (2001) review existing frameworks.

Survey of existing methodologies

Most of the emphasis in the literature thus far has been on KM frameworks, although, as mentioned above, a unified approach has yet to emerge in the discipline. However, there are several KM methodologies that have been presented in the literature as well.

We present some of the methodologies, but do not claim to be exhaustive. Rather, we are trying to make some general points regarding KM methodologies from which the methodology presented in this paper builds.

The three key limitations of current methodologies, as discussed in the "Analysis of existing knowledge-management methodologies" section, are their:

(1) lack of detail;
(2) lack of an overseeing framework; or
(3) failure to address the entire KM process.

The "entire KM process" mentioned in the third limitation includes consideration of strategy, organizational culture, learning, and distinction between tacit and explicit knowledge, and knowledge tasks. The cursory information given in some papers could lead to debate over whether the methods are truly methodologies or simply outlines of methodologies, more in line with frameworks.

Wiig (1999) lists "major KM building blocks", including:

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(1) Obtain management buy-in.
(2) Survey and map the knowledge landscape.
(3) Plan the knowledge strategy.
(4) Create and define knowledge-related alternatives and potential initiatives.
(5) Portray benefit expectations for knowledge-management initiatives.
(6) Set knowledge-management priorities.
(7) Determine key knowledge requirements.
(8) Acquire key knowledge.
(9) Create integrated knowledge transfer programs.
(10) Transform, distribute and apply knowledge assets.
(11) Establish and update knowledge-management infrastructure.
(12) Manage knowledge assets.
(13) Construct incentive programs.
(14) Coordinate knowledge-management activities and functions enterprise-wide.
(15) Facilitate knowledge-focused management.
(16) Monitor knowledge management.

The building blocks will not necessarily all be implemented at any one time, but rather should be used as appropriate for a particular situation. Wiig (1999), while not explicitly presenting the building blocks as a methodology, further details what is meant by each component such that they can be carried out according to our definition of what constitutes a methodology.

Wiig et al. (1997) discuss specific methods and techniques for doing parts of KM. The term "parts" of KM is used because the methodology emphasizes knowledge flows (and bottlenecks) rather than the entire KM process. Their discussion is within the context of the review, conceptualize, reflect and act framework:

(1) *Review* – monitor organizational performance internally and against external benchmarks. Lessons learned can be a useful tool.
(2) *Conceptualize* – organize the different levels of knowledge in the organization. Identify knowledge assets and link them to business processes that use them (a list of survey techniques are provided). Analyze strong and weak points in the knowledge inventory. A set of knowledge "bottlenecks" should be identified in this phase.

(3) *Reflect* – establish a plan to address and mitigate the knowledge bottlenecks. Prioritize the parts of the improvement plan.
(4) *Act* – implement the improvement plan. Different parts of the organization may be responsible for enacting different parts of the plan.

Monsanto built its approach to KM on existing literature (Junnarkar, 1999). The five processes include:
(1) Connecting people with other knowledgeable people.
(2) Connecting people with information.
(3) Enabling the conversion of information to knowledge.
(4) Encapsulating knowledge, to make it easier to transfer.
(5) Disseminating knowledge around the firm.

Dataware Technologies, Inc. (1998) provided a fairly detailed methodology for KM:
(1) Identify the business problem.
(2) Prepare for change – obtain executive support and make the shift to a sharing culture.
(3) Create the team (of people responsible for leading knowledge management).
(4) Perform a knowledge audit – identify what knowledge is missing and organize the knowledge.
(5) Define key features required for the technological infrastructure.
(6) Phase in knowledge management activities in seven steps:
   · Improve the return on investment on existing knowledge assets.
   · Enhance the process of locating applicable knowledge.
   · Increase the accuracy and speed of classifying knowledge.
   · Provide substantially enhanced functionality, security and performance for the growing knowledge-management activity in the organization.
   · Start capturing valuable "tacit knowledge" that was previously lost to attrition.
   · Enable faster access to critical knowledge.
   · Quickly find people in the organization who have specific knowledge.

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(7) Link people to knowledge – knowledge directory and content management.

Xerox Corporation (1999) has developed the X5 methodology, which emphasizes the linkage of knowledge management to business goals. The five steps are as follows:
(1) *Discovery* – identify business goals, challenges and opportunities.
(2) *Definition* – determine key requirements and scope of the project.
(3) *Start-up* – detailed project plan is developed.
(4) *Delivery* – implement the plan.
(5) *Evaluation* – ensure results meet expectations and facilitate knowledge transfer.

Liebowitz (2000) and Liebowitz and Beckman (1998) present their work as methodologies. Listed below, the steps of each method dictate particular tasks, but detailed procedures for accomplishing each task are not provided.

Liebowitz (2000) discusses a nine-step approach to KM:
(1) Transform information into knowledge.
(2) Identify and verify knowledge.
(3) Capture and secure knowledge.
(4) Organize knowledge.
(5) Retrieve and apply knowledge.
(6) Combine knowledge.
(7) Create knowledge.
(8) Learn knowledge.
(9) Distribute/sell knowledge.

Liebowitz and Beckman (1998) discuss an eight-step approach for KM:
(1) Identify knowledge.
(2) Capture knowledge.
(3) Select knowledge.
(4) Store knowledge.
(5) Share knowledge.
(6) Apply knowledge.
(7) Create knowledge.
(8) Sell knowledge.

Table I summarizes the strengths of existing methodologies. Checkmarks indicate the aspects included in each methodology.

In addition to the KM methodologies presented above, methodologies for specific or tangential parts of KM have also been discussed in the literature. For example, a number of organizations such as Skandia, NCI Research and Merck have developed

methodologies for measuring intellectual capital (Liebowitz and Beckman, 1998). Daudelin and Hall (1999) present a process for learning, and Myers and Swanborg (1998) have a method for packaging knowledge so it is "insightful, relevant, and useful". Furthermore, the Canadian Imperial Bank of Commerce has developed a methodology just for managing tacit knowledge (Saint-Onge, 1996), NASA and Stanford worked jointly to develop methods and tools aimed at capturing design knowledge (O'Leary, 1997), and Hayes-Roth *et al.* (1983) proposed a method for acquiring knowledge. The Delphi Group (2000) has a KM methodology, KM2, for conducting the knowledge audit part of KM, and it integrates both tacit and explicit knowledge.

There are also several broadly scoped endeavors that, while not methodologies, inform the development of new KM approaches. For example, the Theseus Institute has developed a taxonomy for KM which provides an overall picture of existing KM tools and approaches from which organizations can develop their KM initiatives (Despres and Chauvel, 1999). Furthermore, the Esprit IT Learning and Training in Industry (LTI) program of the European Commission has co-funded 16 projects that deal with the adoption of knowledge-management strategies and the need to develop a learning-organization culture within an increasingly knowledge-based, European industrial infrastructure (Kalif, 2001). Some of the projects include: ENRICH (Enriching Representations of Work to Support Organizational Learning), ETOILE (Environment for Team, Organizational and Individual Learning in Emergencies), KLEE&CO (Knowledge and Learning Environments for European and Creative Organizations), KNOW-WEB (Web in Support of Knowledge Management In-Company), and KNOWNET (Knowledge Management with Intranet Technologies).

Some of these projects are developing knowledge-management methodologies and strategies. In order to facilitate knowledge exchange between these projects, KALIF (run by Kenniscentrum CIBIT in The Netherlands and the European Consortium for the Learning Organization) was created to optimize knowledge sharing

Table I A sampling of existing methodologies

Methodology	Framework	Detail	Strategy	Culture	Entire process		Tasks
					Learning	Explicit vs tacit	
Wiig (1999)		✓	✓	✓			✓
Wiig *et al.* (1997)	✓						✓
Dataware Technologies, Inc. (1998)		✓		✓		✓	✓
Liebowitz (2000)					✓		✓
Liebowitz and Beckman (1998)							✓
Junnarker (1999)						✓	✓
Xerox Corporation (1999)			✓		✓		

and lessons learned between these projects (ECLO, 1999).

Analysis of existing knowledge-management methodologies

As illustrated in the "Survey of existing methodologies" section, a number of individuals and organizations have developed methodologies for KM. The key limitations of current methodologies include their:

- lack of detail;
- lack of an overseeing framework; or
- failure to address the entire KM process.

This third limitation refers to the failure of the methodologies to address all relevant aspects of KM, and instead focuses on one or several parts.

Finding 1
The level of detail in the Liebowitz (2000) and Liebowitz and Beckman (1998) methodologies suggests they might be more appropriately termed frameworks. The two methodologies provide only high-level guidance for KM: combine and create knowledge for example. Based on our definition of a methodology, the lack of specifics means these are really frameworks rather than methodologies.

Finding 2
The Wiig *et al.* (1997) methodology is the only one explicitly discussed in terms of an overseeing framework: review, conceptualize, reflect and act. The purpose of a framework is to direct work in a discipline. Thus, it seems necessary for methods to be based on some framework to provide theoretical underpinnings and a basis for the methodology. It is outside the scope of this paper to prove which framework ought to be used as the driver behind methodologies. Instead, we claim there should be some framework, and we select a systems-thinking framework for our methodology (Rubenstein-Montano *et al.*, 2001). We select the systems-thinking framework because it not only provides overseeing guidance for KM, but also addresses the limitation regarding the entire KM process.

The Rubenstein-Montano *et al.* (2001) framework addresses KM from a systems perspective. It is both prescriptive and descriptive in nature in an attempt to consider the entire knowledge cycle. The framework is prescriptive in that is prescribes specific KM procedures (or tasks), and it is descriptive in that it identifies attributes of KM that influence its success or failure – organizational culture, learning, strategy, knowledge classifications. Figure 1 depicts the Rubenstein-Montano *et al.* (2001) framework.

Finding 3
None of the existing methodologies address the entire KM process, although each addresses important parts of the KM process (e.g. Wiig (1999) incorporates strategy, Dataware Technologies, Inc. (1998) incorporates culture and the distinction between tacit and explicit knowledge and Liebowitz (2000) incorporates learning). While the tasks covered in most of the methodologies are essential for KM (see the last column of Table I), they paint an incomplete picture of what is needed for KM initiatives. This is because KM should address the entire knowledge cycle. This finding is related to Finding 2 in that organizational culture, organizational strategy, learning and recognition of the

Figure 1 The systems thinking framework for knowledge management
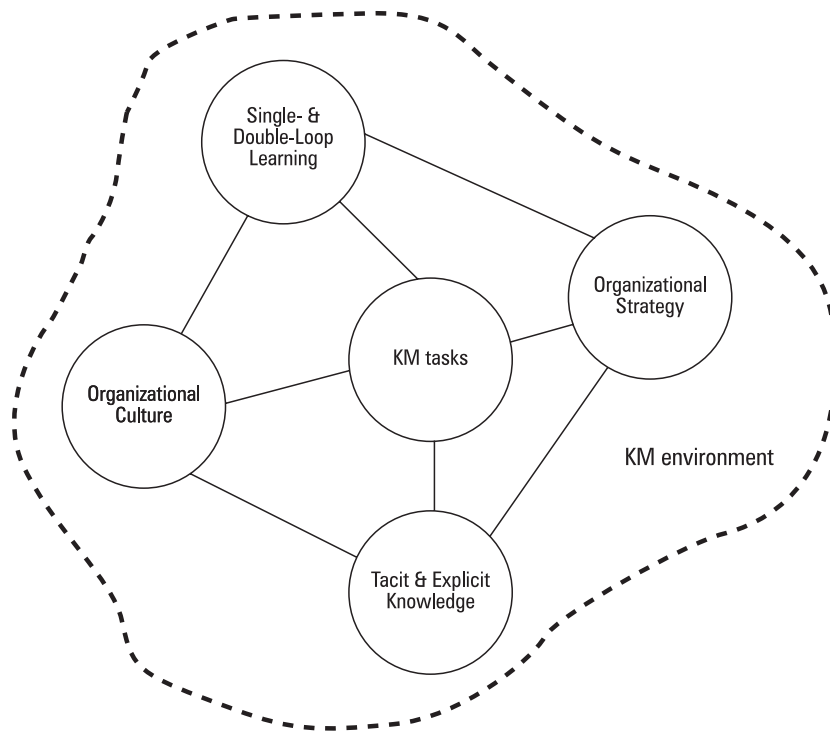
different types of knowledge allow for consideration of the entire knowledge process. An approach similar to that of the Theseus Institute might be useful in its sampling of different pieces of past approaches as appropriate (Theseus Institute, 1999).

Of course, not all of the methodologies possess all of these shortcomings. The purpose of this paper is simply to present a method that does not have any of these limitations. Dataware Technologies, Inc. (1998) addresses more than just knowledge tasks by listing the shift toward a sharing culture as one of the steps in doing KM. Cultural considerations have been shown to be a key organizational characteristic for successful KM (Beckman, 1999). Bob Buckman, CEO of Buckman Labs, has stated that the KM effort in his organization is 10 percent technology and 90 percent cultural. Similarly, Larry Bobbitt, of Andersen Consulting, cites their efforts as 20 percent technology and 80 percent cultural (Bobbitt, 1999). These figures suggest that KM is much more than technological infrastructure.

Cultural attributes will impact how knowledge is shared, stored, distributed and used. For example, in organizations where the culture continues to advocate the motto

"knowledge is power", individuals may not want to distribute or share their knowledge for fear of losing their edge over other colleagues. Also, is the culture formal or informal in the sense that knowledge sharing, use, etc., in that it already occurs informally during friendly discussions or formally at regularly scheduled staff meetings? The importance of linking KM with an organization's strategic goals has been discussed by Davenport (1999) and Holsapple and Joshi (1998) and is emphasized in the Xerox methodology (Xerox Corporation, 1999).

Furthermore, Liebowitz (1999, 2000) considers learning knowledge (again providing a more complete view of the knowledge process. Single-loop learning has already been addressed by a number of KM frameworks if not specific methodologies (e.g. Holsapple and Joshi, 1997; O'Dell, 1996; Ruggles, 1997; van der Spek and Spijkervet, 1997; van Heijst *et al.*, 1997; Wiig, 1998). However, the recommendation here is for the incorporation of both single-loop and double-loop learning into the KM methodology so that varying degrees of learning can occur (Argyris and Schön, 1978; Rubenstein-Montano *et al.*, 2001).

In double-loop learning, new knowledge is synthesized from the existing knowledge by

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combining it in new and innovative ways. This learning may result in changing or evolving parts of the KM initiative being undertaken within the framework (Argyris and Schön, 1978). Iterative feedback loops within and between steps in the KM process are necessary elements to achieve double-loop learning and to have a learning organization. Learning and feedback loops are also important for maintaining both the relevance and currency of knowledge, which is important for robust KM systems and activities.

Moreover, a KM methodology should address the different types of knowledge to be complete in its treatment of the knowledge cycle. The distinction between tacit and explicit is important because each type of knowledge must be managed differently. Explicit knowledge lends itself to the tasks identified by Wiig (1999) (acquire, create, distribute, etc.), Liebowitz (2000) (identify, verify, capture, organize, etc.) and Liebowitz and Beckman (1998) (identify, capture, store, share, etc.). However, the intangible nature of tacit knowledge does not easily lend itself to such activities. In contrast, tacit knowledge is more personal – steeped in experience and intuition and influenced by individual ideals, values and emotions (Nonaka and Konno, 1998). Thus, tacit knowledge cannot be treated in the same way explicit knowledge is treated. In fact, tacit knowledge can be located, but it cannot be captured the way explicit knowledge is captured because it resided in the minds of people. Tacit knowledge emerges from discussions, conversations and storytelling. A directory of expertise or community of practice may be relevant for tacit knowledge, whereas a repository of best practices may be relevant for explicit knowledge. As such, the two types of knowledge must be evaluated and integrated into the organizational memory differently. If tacit knowledge can be articulated formally, it can be transformed into explicit knowledge. After such transformation, it is then subject to the same processes and methods as explicit knowledge. Dataware Technologies, Inc. (1998) is the only methodology that explicitly differentiates between knowledge types by acknowledging tacit knowledge. However, Monsanto (Junnarker, 1999) alludes to the distinction between knowledge types by distinguishing between connecting people with other people (tacit) versus connecting people with information (explicit).

A comprehensive methodology

Recommended directions

The recommendations for a KM methodology derive directly from the three key findings discussed in the preceding section. First, a framework provides a set of guiding principles for a discipline, and a methodology can be thought of as a specific, detailed description of how to carry out the ideas and objectives set forth by a framework. Thus, a methodology must be developed within the context of some framework – adopting its ideals and principles.

Second, in an effort to address the entire KM process, the methodology should be consistent with the notion of systems thinking. Systems thinking is important for KM because it encourages consideration of the entire knowledge process and facilitates the linkage between KM initiatives and the strategic goals and objectives of an organization. This is accomplished via the overall view of the organization that emerges when a systems approach is adopted, and it helps to maintain a clear vision of what is being done and why it is being done.

The KM methodology presented in this paper is developed within the KM framework presented by Rubenstein-Montano et al. (2001) in an effort to address the first two findings. The entire KM process, as defined in this paper and by the Rubenstein-Montano et al. (2001) framework, includes learning, organizational culture, strategy, tacit versus explicit knowledge, and KM tasks.

Third, the method must contain sufficient detail to be implementable. Thus, the methodology presented below is described in detail. General KM phases are given, along with detailed steps of how to carry out KM expected outputs. The general phases are strategize, model, act, revise and transfer; hence the name SMARTVision.

The proposed methodology

A methodology based on the recommendations listed above has been developed. Figure 2 shows a high-level view of the method, and Table II lists the specific phases, procedures and outputs for the

Figure 2 The SMARTVision knowledge management methodology
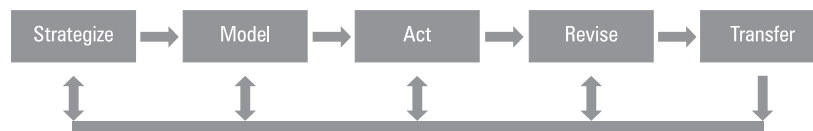
methodology. The highlight of the methodology is that it is consistent with both the framework proposed by Rubenstein-Montano et al. (2001) and systems thinking, and it addresses the three key limitations of existing methodologies, as discussed earlier in the paper – it has been developed within the context of a framework, it addresses the entire KM process and it is sufficiently detailed to explain how to actually "do" KM.

The methodology is cyclic, with multiple feedback loops. Thus, while the strategize phase provides a logical place to begin discussion of the methodology, this is not a requirement of the methodology and is more for presentation purposes. The cyclic, iterative nature of the methodology is illustrated by the looping in Figure 2. There are no real beginning or ending points, and an organization should continually cycle through the various stages of KM.

The diagram in Figure 2 is detailed in Table II. Specific procedures (and subprocedures) are given for each general KM phase. The outputs provide direction regarding what should actually be completed during each phase. The entire first phase, strategize, addresses the requirement that KM be linked to strategic objectives. Furthermore, organizational culture is handled in the strategize phase, and learning is handled in the act phase. Tasks are outlined in the procedures and subprocedures section of each phase (e.g. capture and secure knowledge, collect and verify knowledge, evaluate knowledge). The distinction between tacit and explicit knowledge is not directly discussed, but it is inferred from such aspects of the methodology as the knowledge audit document from the model phase and the design document from the act phase.

Summary

The findings and recommendations from our research possess two key themes:

(1) methods should be based on frameworks; and

(2) methods should be comprehensive (i.e. consistent with systems thinking).

They also need sufficient detail to be useful. Our primary finding is that current KM methodologies are neither typically linked to a more general framework for the discipline nor consistent with systems thinking. There are a number of offshoots from this concept: integration of people and technology; pre-planning, thinking and conceptualizing to get the whole picture; and double-loop learning to emphasize relationships and linkages within the system. This paper presents a specific methodology, SMARTVision, which addresses the findings of this research.

Developing a KM methodology is a critical step for organizations that are serious about conducting KM activities. The methodology should originate from a strategic perspective and be integrated within the strategic mission and vision of the organization. Performing KM in a separate department or group within the organization is a piecemeal, sub-optimal approach for improving the organization as a whole that is inconsistent with systems thinking. To realize fully the benefits from KM, it needs to be integrated from the top down across the organization and developed within the context of systems thinking. Only then will the true, ultimate value of KM be realized.

That said, additional research is still needed in the area of KM methodologies. While the methodology presented in this paper enhances past work, it still possesses limitations. For example, the distinction between tacit and explicit knowledge is made, but it is not adequately addressed. Perhaps different methodologies should be developed for each type of knowledge, tacit and explicit. This work provides a foundation from which future work can build.

Table II Details of the SMARTVision methodology

Phase	Procedure(s)	Subprocedure(s)	Outputs
Strategize	1. Perform strategic planning	(a) Determine key knowledge requirements (i.e. core competencies) (b) Set knowledge-management priorities	• Business needs analysis document: this reviews the current IT infrastructure and documents the metrics to be used for measuring success of the knowledge-management procedure
	2. Perform business needs analysis	(a) ID business problem(s) (b) Establish metrics for success	• Cultural assessment and incentives document: this reviews the current culture of the organization and outlines approaches for encouraging knowledge sharing within the organization
	3. Conduct cultural assessment and establish a motivation and reward structure to encourage knowledge sharing		

Model	1. Performance conceptual modelling	(a) Conduct a knowledge audit
		  i. Identify types and sources of knowledge (i.e. knowledge assets)
		  ii. Determine competencies and weaknesses
		  iii. Perform knowledge mapping to identify the organization and flow of knowledge
		  iv. Perform gap analysis
		  v. Provide recommendations
			• Knowledge audit document: survey the status of knowledge in the organization. Emphasis is on identifying core competencies and weaknesses
			• Visual prototype: knowledge map showing taxonomy and flow of knowledge

		(b) Do knowledge planning
		  i. Plan knowledge-management strategy
		  ii. Build a supportive, knowledge-sharing culture
		  iii. Create and define knowledge-management initiatives
		  iv. Develop a cost-benefit analysis
			• Knowledge-management program plan: document specifying the initiatives and programs that will be used to meet knowledge-management goals

	2. Perform physical modelling	(c) Develop the physical architecture
		  i. Develop the framework for access, input/update, storage and eventual distribution and use
		  ii. Develop a high level meta-data design
		  iii. Construct a visual prototype
			• Requirements specifications document: document identifying the technological requirements for the knowledge-management system (i.e. hardware and software)

Act	1. Capture and secure knowledge	(a) Collect and verify knowledge (b) Evaluate the knowledge	• Knowledge-acquisition document: this document contains the methods and presumptions used in the process of acquiring knowledge for the knowledge-management system based on the findings in the knowledge audit and the knowledge-management program plan
	2. Represent knowledge	(a) Formalize how the knowledge is represented (b) Classify the knowledge (c) Encode the knowledge	
	3. Organize and store knowledge in the knowledge-management system		• Design document: this document contains the knowledge classification and encoding system as well as high-level knowledge mapping into a computer system (i.e. file structures)
	4. Combine knowledge	(a) Retrieve and integrate knowledge from the entire organization	
	5. Create knowledge	(a) Have open discussion with customers and interested parties, both internal and external to the organization (b) Perform exploration and discovery (c) Conduct experimentation (i.e. trial and error)	• Visual and technical knowledge-management system prototypes: presentation of screen-mockups and technical design of the knowledge-management system
	6. Share knowledge	(a) Distribute knowledge	

(continued)

Table II

Phase	Procedure(s)	Subprocedure(s)	Outputs
		(b) Make knowledge easily accessible	
	7. Learn knowledge and loop back to step 1 of this phase		
Revise	1. Pilot operational use of the knowledge-management system		• Evaluation methodology and results document: general evaluation and review of the KM system. This document will evaluate the fitness of the developed KM system for implementation in the transfer phase. Critical analysis of the completed KM system, which includes the determination of whether the program is ready for transfer and will be completed, and recommendations to continue development will be evaluated. The documentation of the evaluation methodologies used for the review and the documented results of the review are required

	2. Conduct knowledge review	(a) Perform quality control
		  i. Review knowledge for validity and accuracy
		  ii. Update knowledge
		(b) Perform relevance review
		  i. Prune knowledge and retain what is relevant, timely and accurate and proven useful	

	3. Perform knowledge-management system review	(a) Test and evaluate achieved results (b) Revalidate/test against metrics	• Knowledge-management system prototype II: a pre-production, fully functional release of the KM system • User's guide for knowledge-management system: the methods and procedures developed for the KM system are compiled into a guide for use as a training document and the coordination of standard practices. The guide should describe both internal system processes and how the system interacts with the environment
Transfer	1. Publish knowledge		• Maintenance document for KM system: following the completion of the final version of the KM system, documentation describing the general maintenance and change process for the system are created
	2. Coordinate knowledge-management activities and functions	(a) Create integrated knowledge-transfer programs (b) Notify where knowledge is located and lessons learned (c) Perform serious anecdote management (i.e. publicize testimonials of the benefits of the KMS)	• Fully functional KM system: the final delivered and installed KM system
	3. Use knowledge to create value for the enterprise	(a) Sell (e.g. package knowledge bases for sale) (b) Apply (e.g. knowledge-management consulting services, apply methodology) (c) Use (e.g. improve customer satisfaction, employee support and training)	• Post-audit document: following the completed transfer of the KM system a follow-up audit of the entire process is completed. This will include all lessons learned, user experiences, best/worst practices and proposed changes to the methodology and/or KM system. The post-audit will also include proposals for new initiatives and enhancements for the system
	4. Monitor knowledge-management activities via metrics 5. Conduct post-audit 6. Expand knowledge-management initiatives 7. Continue to learn and loop back through the phases		• Lessons learned document: lessons learned and other appropriate learning functions will be formatted and loaded into the appropriate corporate memory location for dissemination throughout the organization

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