International Journal of Case Method Research & Application (2008) XX, 3
 ISSN 1554-7752

KNOWLEDGE *MEASUREMENT* ACROSS THE ENTERPRISE: A CASE STUDY HIGHLIGHTING THE ASSESSMENT PROCESS

Kathleen Y. Terry
TEEG Ventures, L.L.C.
ALPHARETTA GEORGIA, U.S.A.
Robert DeMichiell
Robert DeMichiell & Associates
POMPANO BEACH, FLORIDA, U.S.A.

Abstract

In the late 1990s, knowledge management (KM) gained importance for organizations. Many educators and practitioners recognize knowledge as a capital asset of economic value for productivity enhancement and a stability factor in an unstable and dynamic competitive environment. Using a KM framework derived from studies in software development and telecommunications, this study uses a case-study approach to test KM models to understand how practitioners use a stage-by-stage evolutionary process to measure KM maturity and gain a more secure foothold in the marketplace. Practical case-study approaches are described to highlight teaching this assessment process in undergraduate, graduate, and training environments.

KEYWORDS: Knowledge Management Maturity (KMM), Capability Maturity Model Integrated (CMMI), Knowledge Management (KM), Knowledge Audit, Technology Support (TS)

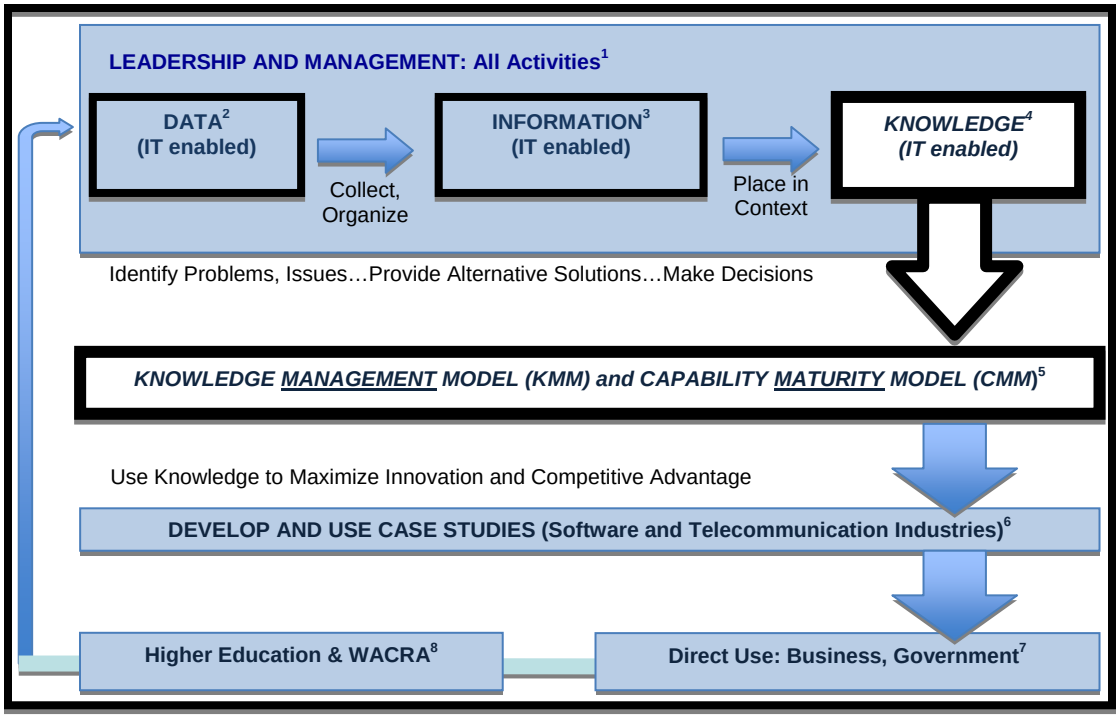
KNOWLEDGE AND KNOWLEDGE MODELS

In a hypercompetitive environment, organizations are bound to perform internally. Knowledge-based theory demonstrates that the possession of knowledge and its efficient use provide a sustainable competitive advantage. Ramanujan and Kesh [2004] found that knowledge and its application are the main sources of competitive advantage. Innovation, the source of sustained advantage for most organizations, depends upon the individual and collective expertise of employees. Dayan and Evans [2006] point out that a major part of knowledge refers to defined and documented processes in the company's various competence centers (some of them technological and others procedural). Other tacit knowledge exists as the experience of the organization's people, in stored memory or at the tip of their electronic finders.

Organizations cannot be ahead of customers; they can only anticipate the next move. This research uses a case-study approach to test knowledge management models and integration to understand how knowledge management (KM) practitioners methodologically go through a stage-by-stage evolutionary process to measure maturity level for a more secure foothold in the marketplace. It is believed that even though KM models and Capability Management Models (CMM) are different approaches for attaining sustained competitive advantage, there is a symbiotic relationship between the two. This article is derived from a few case studies to map knowledge-stage levels.

This new century of instant communication through cell phones and the Internet, of instant results and impatience, and of heightened competitive worldwide activity requires that all players deepen their awareness of the meaning of the differences among data, information, and knowledge. Leadership and management styles will adapt to this new paradigm so that knowledge will be maximized for competitive advantage (see Figure 1).

FIGURE 1
INFORMATION TECHNOLOGY (IT) ENABLEMENT, KNOWLEDGE, AND KNOWLEDGE MODE



LEADERSHIP AND MANAGEMENT[1]

The superscripts used in Figure 1 are carried through to these sections so the reader can follow the chart more easily. Truly successful managers and leaders of the 21st century are characterized not by how they can access information, but by how they can access the most relevant information and differentiate it from the exponentially multiplying masses of irrelevant information. Consider that there has been more information produced in the last 30 years than during the previous 5,000 years and that the information supply available to us approximately doubles every 5 years. The truly successful managers and leaders of the 21st century are determined not by what they know, but by how fast they can learn. They will excel not only by possessing traditional skills and tools, but also by demonstrating a high degree of flexibility and adaptability in dealing with both technology and people and by being able to stay meaningfully connected to others in the ever-changing world [Nevins and Stumpf, 1999].

Alternative Teaching and Learning Methods—To address the leadership challenges of the this era of global business, traditional degree-granting programs and professional schools as well as traditional methods (for example, books, lectures, discussions, and case studies), will continue to be necessary, but increasingly will not be sufficient to meet learning demand. To develop successful professionals in an environment of strong market forces, changing people issues, and shifting leadership competencies, a new educational model will have to be forged. Traditional models fall short because they are unable to link the knowledge, skills, and concepts covered to the practice of leadership within actual work organizations [Nevins and Stumpf, 1999].

For the 21st century, learning methods must be enhanced with the ability to practice leadership to meet the needs for organizations to succeed in the marketplace [Nevins and Stumpf, 1999]:

- They need to be more people sensitive and time sensitive (critical attributes in many performance-oriented professions).
- They need to create better practice fields (as in competitive sports) or practice sessions (as in music training) for skill development.
- They should include lifelike situations, including crises, for learning under pressure (similar to state-of-the-art flight simulators for pilots).
- They must permit problem finding and issue diagnosis as a central part of the experience (the learning method used in most professional service firms).
- They should use master–apprentice relationships in the learning process (as is done in dentistry and medicine as well as in craft trades) so as to guide an effective ongoing development process.
- They need to create mentor–protégé relationships to facilitate continuous learning beyond the formal educational process (like methods used to develop mastery in sports as well as the performing and visual arts).
- They should threaten trainees' egos and job security by placing them on the firing line to prosper or fail based on their decisions and actions (consider survival training for the military or difficult developmental assignments for multinational executives).

DATA (IT ENABLED)[2]

Data represent observations of facts out of context and usually have no direct meaning [Ramanujan and Kesh, 2004]. *Data* are a collection of facts, measurements, and statistics, while *information* is organized or processed data that have been transformed into content relevant to the situation [Laudon and Laudon, 1999; McFadden, Hoffer, and Prescott, 1999]. Data are streams of raw facts representing events occurring in organizations or their physical environment before they have been organized and arranged into a form that people can understand and use.

Research has shown that most organizations that have been successful in introducing IT-enabled business innovations have not formalized the management of the innovation process [Moody, 2008]. Corporate entrepreneurship frameworks and models are an appropriate guide to successful IT-enabled business innovations. The concept of IT-Enablement is seen to have a very close relation to the notion of IT-enabled business innovation. IT-Enablement relates to the ability of an organization to effectively create new business processes, services, and perhaps even products using IT. The current top IT-enabled lists reference enterprise resource planning (ERP) and web-based business capabilities [Moody, 2008]. As we move into this century, database management systems (DBMS) are being replaced with enterprise data models. Organizations are finding that DBMS have numerous reliability and security issues.

Interestingly, while IT-Enablement may be a desired benefit or outcome of IT-Alignment, it is generally not a stated objective at the outset. Many executives seem to believe that alignment will automatically lead to the benefits of enablement, but that notion assumes a giant leap of faith. Traditional IT-Alignment processes in no way guarantee enablement types of outcomes and, in fact, overly restrictive alignment practices can almost guarantee against it. In summary, Moody [2008] states that

- IT-Alignment relates to efficiency while IT-Enablement relates to effectiveness.
- IT-Alignment results from IT and business having consistent business objectives and metrics.
- IT-Enablement may benefit from some IT-Alignment, but results from a cultural match between IT and business in an entrepreneurial enterprise.

INFORMATION (IT ENABLED)[3] AND KNOWLEDGE (IT-ENABLED)[4]

Information is a flow of messages, while knowledge is created and organized from the flow of information, anchored on the commitment and beliefs of its holder. This understanding emphasizes an essential aspect of knowledge that relates to human action [Nonaka, 1994].

Knowledge is neither data nor information, though it is related to both, and the differences between these terms are often a matter of degree. According to Nonaka [1994], the traditional epistemology of

knowledge is a *justified truth belief*. He stated that knowledge focuses on truthfulness as the essential attribute of knowledge. Nonaka [1994] also emphasized the importance of knowledge justification.

Knowledge, according to Davenport and Prusak [1998], is a fluid mix of experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded, not only in documents or repositories, but also in organizational routines, processes, practices, and norms. Knowledge is that which we come to believe and value based on the meaningful organized collection of information (messages) through experience and communication. It can be viewed as a thing to be stored and manipulated and as a process of simultaneously knowing and acting—that is, applying expertise [Ramanujan and Kesh, 2004].

Tacit knowledge is highly personal. It is hard to formalize and therefore difficult to communicate to others. In the words of the philosopher Michael Polanyi, "we can know more than we can tell." Tacit knowledge is diffused, unstructured, without tangible form, and difficult to codify, and therefore difficult to put into words [Polanyi, 1966]. Tacit knowledge is also deeply rooted in action and in an individual's commitment to a specific context [Nonaka, 1998]. This knowledge consists partly of technical informal skills, those hard to clearly define skills captured in the term "know-how." An important cognitive dimension, it consists of mental models, beliefs, and perspectives so ingrained that we take them for granted and therefore cannot easily articulate them. Implicit models profoundly shape how we perceive the world around us [Nonaka, 1998]. Tacit or *embedded* knowledge [Madhaven and Grover, 1998] is the cumulative store of the experiences, mental maps, insights, acumen, expertise, know-how, trade secrets, skill sets, understanding, and learning that an organization has, as well as the organizational culture embedded in the past and present experiences of the organization's people, processes, and values.

When formal training or knowledge transfer is the objective, the interaction tends to be primarily between instructor and student (or expert and novice) and structured around a discrete problem, assignment, or lesson plan [Zack, 1999]. This is referred to as distributed learning [Zack, 1999]. Borghoff and Pareschi [1998] expressed the same idea in a similar way: *Explicit* knowledge is formal knowledge that can be packaged as information and can be found in the documents of an organization: reports, articles, manuals, patents, pictures, images, video, sound, software, etc. Tacit knowledge is personal knowledge embedded in individual experience and is shared and exchanged through direct contact. Thus, tacit knowledge transfer needs people to be working together for a period of time. These two types of knowledge are two parts of the same entity and are equally relevant for the overall knowledge of an organization. The other great discovery of the knowledge movement lies in the following simple observation: knowledge that does not flow, does not grow, and eventually it ages and becomes obsolete and useless—just as money saved without being invested eventually loses value until it becomes worthless [Borghoff and Pareschi, 1998].

Knowledge Management is an emerging set of principles that govern organizational and business process design, as well as specific processes, applications, and technologies that help knowledge workers dramatically leverage their creativity and ability to deliver business value [Gurteen, 1998]. It is the knowledge that people carry around in their minds that needs to be defined and managed. An organization's greatest assets may not lie in the products or services it produces, but in the knowledge of the people maintaining those products and services. If knowledge is used correctly within an organization, it will ultimately lead to effective and efficient problem solving and decision-making. For data, information, and knowledge, organizational success and failure can often depend on knowing which of them you need, which you have, and what you can and cannot do with each entity. Understanding these three things, information, data, and knowledge is essential in doing knowledge work successfully [Davenport and Prusak, 1998]. In order for an organization to be able to handle its data, there must be a process for collection.

KNOWLEDGE MANAGEMENT MODEL (KMM) AND CAPABILITY MATURITY MODEL (CMM)[5]

Knowledge Management (KM) is an important capability in an organization, but it has one of the least scientific approaches with an absence of proper methodologies for assessment, application, or implementation [Natarajan, 2005]. As an emerging discipline, KM promises to capitalize on organizations' intellectual capital. The concept of taming knowledge and putting it to work is not new; phrases containing the word knowledge, such as knowledge bases and knowledge engineering existed before KM became

popular. Software engineers have engaged in KM related activities aimed at learning, capturing, and reusing experience, even though they were not using the phrase “knowledge management.” KM is unique because it focuses on the individual as an expert and as a bearer of important knowledge that he or she systematically shares with an organization. KM supports the know-how of the company, but also the know-where, know-who, know-when, and know-why [Ramanujan and Kesh, 2004].

The Knowledge Maturity Model (KMM) uses some of the framework and key components of an integrated capability maturity model (CMMI) and will accelerate the evolution from knowledge to enablement for strengthening the organization. Natarajan [2005] noted several reasons organizations implement KMM:

- Go beyond data processing and information management and develop the ability to harness and manage both explicit and tacit knowledge, and put it to use building future products, services, and capabilities.
- Develop stage-by-stage models for organizations to measure their status and plan for improvement across the KM continuum.
- Enable organizations to plan specific actions toward KMM and identify key factors.

KMM can serve as an enabler for common understanding. A staged model provides an implementation platform for KM functions. It is an application of the structured approach to the implementation of KM [Natarajan, 2005].

The Software Engineering Institute (SEI) was established by the United States Government in 1984 to address the Department of Defense’s (DoD) needs for improved standards for software development [Ramanujan and Kesh, 2004]. The Capability Maturity Model (CMM) is a five-level model that attempts to quantify a software organization’s capability to produce consistent and predictable high-quality software products. Each level of maturity signifies an organization’s software process capability. The key process areas (KPAs) are identified as the maturity levels. Overall, CMM focuses on software process, which can affect people’s effectiveness and effective technology adoption. This, in turn, will help the organization attain its business objective.

WHY INTEGRATION OF KMM AND CMMI IS NECESSARY

Applying KM to a CMMI framework brings enormous tangible and intangible benefits. They come from two different areas of study, have different scopes in nature, but have similar methodologies such as maturity models and evolution through processes [Ramanujan and Kesh, 2004]. Both models have problem-solving capabilities. CMMI provides a conceptual structure for improving the management and development of software products in a disciplined and consistent way, while KM provides a broader view of knowledge use and its power. When KM is used with CMMI, the organization becomes more efficient and effective in the development of the projects they are used on. The organization is able to maintain better documentation and management of this information for use whenever needed. KM can save the organization hundreds of hours through its ability to collect and organize knowledge resources and make these resources accessible with relative ease and speed [Ramanujan and Kesh, 2004].

This section demonstrates how the KMM/CMMI models are integrated. Dayan and Evans [2006] identify KM as a discipline that maximizes innovation and competitive advantage to organizations that integrate into their operational and business processes knowledge capture, documentation, retrieval, reuse, creation, and transfer, and the sharing of their knowledge assets in a measurable way. Organizational knowledge is the key asset. The competitive advantage comes from having and effectively using that knowledge. Potential examples of the use of these models include law offices, accounting firms, marketing firms, software companies, most government agencies, universities, the military, and significant parts of most manufacturing companies, regardless of their product.

The integrated Capability Maturity Model (CMMI) deals with standards that the organization must follow in order to maintain well-documented processes, which must have well-defined stages. Because of this assumption in mature organizations, it is possible to measure and relate the quality of the process and the quality of the product. CMMI is a framework that describes the key elements of an effective process. It describes an improvement path from the ad hoc, immature process to a mature, disciplined process. CMMI does not tell you how to achieve process maturity, but it does tell you what you need to do and defines requirements for each maturity level. It enables organizations to have a predefined improvement path.

A KM Maturity \Model helps an organization assess its relative progress in KM implementation at a more detailed level than a KM framework does. The main difference between a KM framework and a KM Maturity Model is that the framework simply sets out a desirable set of standards for the components that need to be in play for KM to be successful. The KM maturity model deepens this understanding by describing identifiable stages on the way to KM maturity and it widens the perspective by bringing good practice KM activities and processes into consideration as well. Each of the components in the framework has a descriptor that provides measurable indicators that link to KM effectiveness; this is used to inform the KM evaluation and measurement framework. If a KM Maturity Model is being developed for an organization, the components in the KM framework are also used to feed into the KM Maturity Model.

The maturity levels we use follow the standard CMM originally developed by the Software Engineering Institute for the U.S. Air Force in 1989:

- Initial beginnings
- Repeatable efforts in some quarters
- Defined and scoped
- Managed in a systematic way
- Optimized for learning, feedback, and improvements [Straits, 2008].

Appendix A shows how the two models are mapped together and depict the levels of maturity in the case study.

CASE STUDY: BACKGROUND AND METHODOLOGY

BACKGROUND FOR CASE STUDY

A KMM/CMMI approach is expensive to implement and maintain. Therefore, senior leaders and sponsors must be convinced of its benefits in the early stages of planning. Activities include: collection of data, editing of these data, categorizing of the data, developing infrastructures and applications for the distribution of the data, and training and education on the collection and use of the data [Ramanujan and Kesh, 2004]. John Holt's book, *How Children Learn*, sums up the issues: we think we can transpose our knowledge from one person to another by traditional methods of teaching and explanation. These methods do have a role, but they are not nearly as effective as we might imagine. Adults, like children, learn most effectively through play and through experience [Gurteen, 1998]. Using case studies and other forms of nontraditional teaching will ensure that students can learn and analyze real-world experiences. The case researcher's purpose is to learn about organizational practices and processes, and this learning often evolves into a case write-up. A case study developed for classroom use attempts to describe an issue, unit, or problem in sufficient detail so that the case can be considered holistically in a realistic context [Patton, 1987 and DeMichiell, et. al., 2005]. The case study offers learning opportunities for analysis and perhaps decision-making situations or exercises for students. This teaching approach is followed in the development of this case and in classroom implementation.

Leveraging existing knowledge and creating new knowledge are critical to creating a sustainable and competitive advantage in today's knowledge economy. "To do this, organizations need to develop an 'absorptive capacity,' which is the ability to use prior knowledge to recognize the value of new info, assimilate it, and apply it to create new knowledge and capabilities [Gold, Malhotra & Segars, 2001]." By becoming knowledge centric, Company A Technical Support (TS) changes its path from transactions to interactions. Company A is a software development firm with a large number of engineers across all science disciplines, some of whom have important managerial responsibilities at all levels of the enterprise. This group includes a large core of information technology professionals with managerial responsibilities as well. Although this concentrated mix of professionals in the technical area may seem to be an advantage, this case highlights the need for managerial control of information (and knowledge) at all levels of the enterprise.

Customer data are essential to understanding and driving customer needs and to the quality of the data, knowledge, and information to be captured. By leveraging both external customers and cross-functional internal customers and partner information, both Company A and its customers can benefit from the availability of shared knowledge. The result would be more timely, have meaningful information exchange, and increase customer satisfaction by decreasing search time. The long-term vision of the business is to reduce support calls and improve responsiveness of Company A's managerial (engineering) staff by providing current and relevant information in a timely manner.

For this exploratory study, each interview conveys pertinent support content that is used to ultimately support the customer at Company A. Company A continues to acquire knowledge for "support content." Students research these "definitions" and discuss them as each one pertains to the assigned tasks. The assigned tasks are described in a later section, Teaching Notes. Below are the findings and recommendations from the qualitative data collected from these interviews for Company A.

This case-study report looks closely at Company A's Technical Support (TS) division to conduct an analysis and research effort from the bottom up to high level key personnel to map the process flows of support and to identify levels of "capability maturity." While reviewing current levels of maturity following a specific structure developed and used by consultants, the CMMI findings and recommendations are made on the process of how to advance from lower to higher levels of maturity. The appendices present a description of the CMMI (Appendix A), definitions of the maturity levels (Appendix B), and the method used to measure knowledge content across the enterprise (Appendix C). This information is summarized here for the reader's convenience. Students using this case study would not only receive the full model described in the appendices, but would also be required to research these topics further.

The CMMI assesses Company A's current state of maturity and provides strategic insight into its current initiatives. By using a Knowledge Measurement Model to highlight the current process flow by the TS across the enterprise, information was identified for each level of the CMMI. Thus far, only documentation avenues of information discovery were used.

In this case-study process, interviews were conducted with all key staff. Several findings were uncovered for Company A to review, as the higher levels of management continue with strategic and operational initiatives to better understand their customer's needs and the quality of the data, knowledge, and information yet to be captured. The net result of this extensive process is the documentation of all levels of maturity, highlighting the issues and problem areas for each level, the analysis of that knowledge base, the projection of its impact on the enterprise, and the identification of actions for those findings. Without the comprehensive picture the CMMI process reveals, it would be impossible to have strategies and operations in concert for overall benefit to that enterprise. In this case study, the use of this model with its level-by-level reporting procedure precludes micromanaging each function without an impact statement on the whole process. Although Company A is a large worldwide company with many partners, this model is equally applicable to small businesses, government, and educational institutions. Here are some general comments on the model-implementation process:

- *Support Content*—Within each TS group, the support content is accurate and up to date, but when resolving cases, sometimes content is out of date on the sites where support content is stored. Different repositories are used to store and retrieve data and support content.
- *Collaboration*—Collaboration within Company A still needs improvement in some areas of the organization. The structural boundaries are still impeding efficient collaboration and interaction. Each group expressed a weakness in collaboration with other teams.
- *Communication*–Technology is in place, but the structure and culture to collaborate are not as efficient as they should be. Unified communication signifies a new paradigm in business communications and supports real-time accessibility across communication channels. Company A continues to have silos of communication channels through the organization where information and knowledge remain static.
- *Capturing and Storing*—Process flows of support content among the different groups are too decentralized. Each team interviewed described in detail how they resolved cases, captured support content, and stored it on their own home pages. Sharing information is possible but not easily accessible.
-

SCOPE AND AUDIT OF CMMI METHODOLOGY

This section is provided for the reader (future teachers of this case and students) to gain a perspective of the comprehensive and time-consuming nature of using this methodology. The purpose is to measure knowledge for later management of it. One cannot manage resources effectively unless the knowledge base is uncovered and highlighted for change.

An interview process (information gathering) was conducted in four areas within the Technical Support (TS) group. A total of 27 interview participants were selected by Company A management. Each interview participant was contacted for a 30-minute interview. Questions were centered on support content, as follows:

- Origin of the support content .
- How do they acquire the content.
- How do they handle the content once they receive it.
- What is done with the support content once it is reconfigured for usage by internal and external customers.

Qualitative data results were then analyzed. Themes and patterns were identified. Process flows were developed to describe how the support content flows. Internal tools were also identified for each group interviewed. This case study was conducted to obtain information that is required to address the needs and value of information, both explicit (theoretical) knowledge and implicit (practical) knowledge within the TS division of Company A. Knowing how to use information in any given context requires wisdom. In order to effectively manage knowledge one has to understand the organization. By conducting interviews and mapping the support content, Company A can now focus on key areas of TS to further enhance their CMMI initiatives.

TEACHING NOTES

A teaching manual is also available from WACRA for instructors of this case study. For organizational purposes, one way that this case study could be used effectively in the classroom (or training room) would be to divide it into two separate, but related, parts:

Part I: Role-Playing Exercise

Learn the meaning of knowledge and all it implies in a modern enterprise (business, governmental, or educational); and, examine a case study (Company A) for the way in which it addressed the use of capability modeling (CMMI) in looking for the proper strategic and operational initiatives.

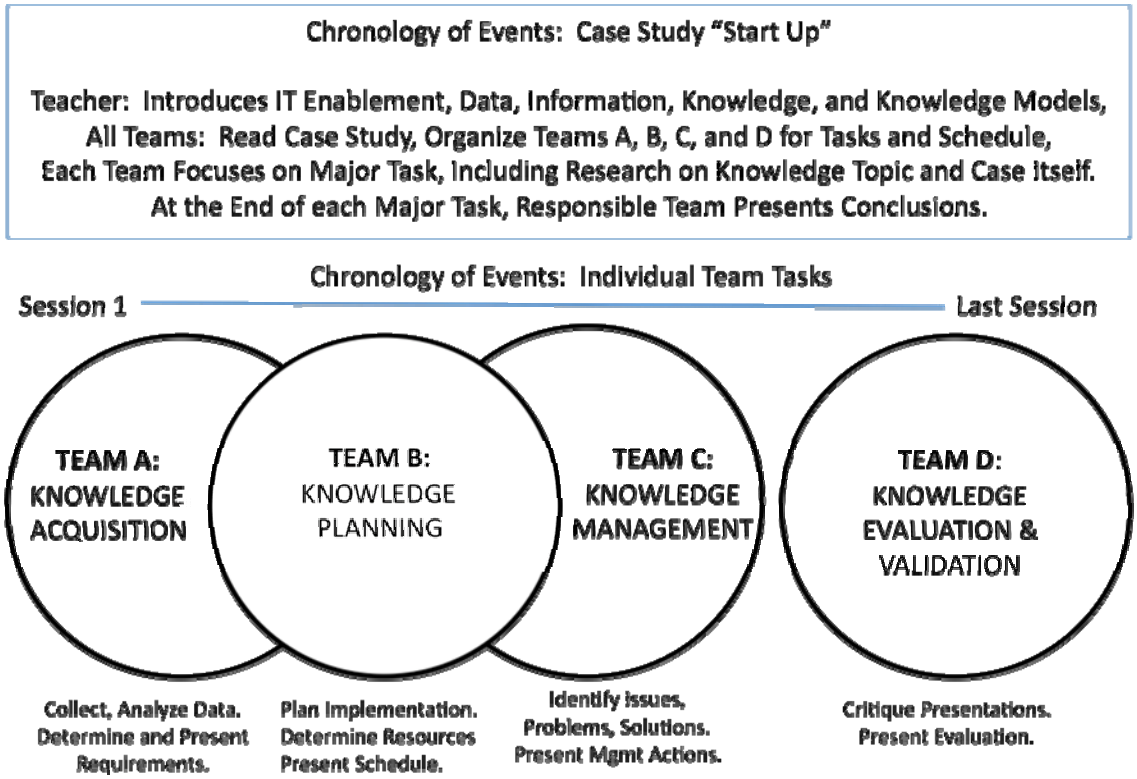
Part II: Students as Consultants for Actual Experience

Use this case-study experience as a way to assess a company's knowledge maturity; by using those techniques, identify a real company of any size and actually conduct the interviews, make the presentations on findings (much like those conducted in Part I), and turn a role-playing exercise into a real consulting activity (under the direction of the teacher, of course).

Part I is outlined in Figure 2. Before role-playing sessions are conducted, teacher and students meet to discuss the case study (Company A). Four teams are organized at the outset and given assignments to act as role-players for each of the activities described on the chart. Role-playing by the teams would occur after some general research of the "knowledge" topic by students, and a presentation of the general concepts of the CMMI approach by the teacher. Once the role-playing sessions commence, the teacher becomes more of a monitor and facilitator rather than leader of the process. As the case progresses to its end of Part I, the teams should know the content of "knowledge" and how to acquire it for a real case, if given one.

Part II would follow the same procedure, except in this situation the students actually conduct the interviews for a real company and apply the CMMI model accordingly. Presentations are made for each of the phases of the chronology. The authors have used this approach for many years and it can work nicely even though it is more work for the teacher and students [DeMichiell, 1997].

FIGURE 2: CASE-STUDY TEAM ORGANIZATION, PROJECT WORK, AND PRESENTATIONS



CONCLUDING COMMENTS ON ARTICLE

Any general topic such as knowledge is difficult to teach. It helps if you have some framework and then move the theoretical domain into reality. The topic of knowledge is getting more press in this technology-laden world of instant everything. Here, we have uncovered one way to place meaning behind the word, "knowledge," with a methodology for measuring it and then managing it. All enterprises should be interested in this activity and should take the time needed to discover their course in a contemplated way and then to pursue that course with prudent use of resources.

This case study brings the topic into the classroom and should provide an interesting adventure, not only in learning the importance of knowledge in organizations today and tomorrow, but also in applying the concepts to real life situations. In those teaching experiences when we have used this case-study approach for understanding difficult topics, the results have been very rewarding. Students may not like the role-playing idea, or presenting formally so much, but in the end they appreciate the opportunity to do so when the stakes are not quite so high.

In conclusion, the reward system for team and individual case-study projects such as this one, must accommodate overall performance and not just results. Such an approach will require more preparation for the teacher at the outset, but will decrease to the role of facilitator as the case study unfolds. Students become active participants rather than passive listeners. Real data are substituted for provided case material and student accountability is heightened. In our experience, according to students, learning was fun and enhanced.

APPENDIX A: TABLE 1: RELATIONSHIP BETWEEN CMM AND KM

TABLE 1. Relationship between CMM/CMMI and KM

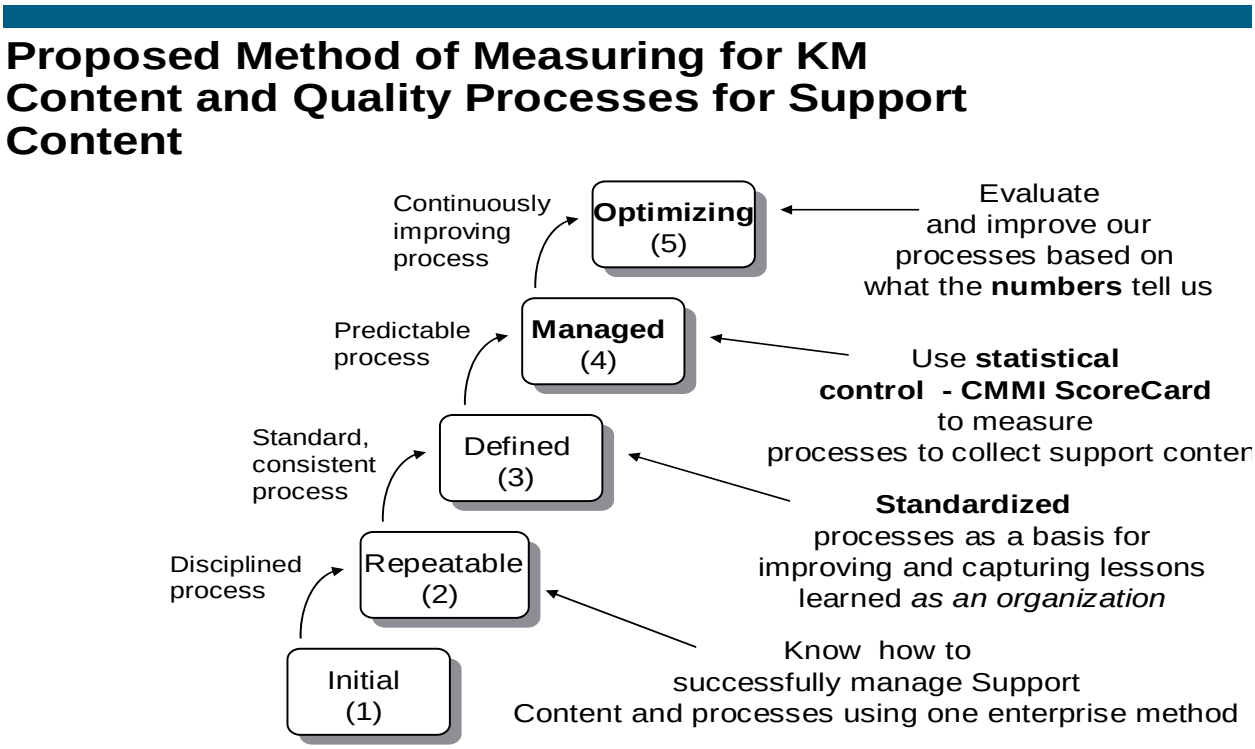
CMM/CMMI Levels	CMM/CMMI's effect on KM	KM's effect on CMM/CMMI
Level 2: • Requirements Mgt • Software Project Planning • SW Project Tracking & Oversight • SW Subcontract Mgt • SW Quality Assurance • Software Configuration Mgt. • *Measurement & Analysis*	**KM Impeded by CMM** • This is still a learning process for the organization and is likely there is no established routine or process for the collection of information at this time. • Justification of expenditures on KM initiates. • The structure of the organization can greatly impede the use of KM in that there is no buy-in from upper mgt. • Organizational culture not likely set up for information sharing. **KM Enhanced by CMM** • KM could be enhanced by CMM at this level due to the documentation that is required by CMM. That knowledge should be collected anyway. With KM that knowledge would then be organized for later use.	**CMM/CMMI Impeded by KM** • Still no systematic way to approach KM • Avoid over-evaluation of new ideas • An organization attempting to incorporate CMM is still in the learning phase and may feel overwhelmed trying to integrate KM also. **CMM/CMMI Enhanced by KM** • Find lowest maturity areas and apply KM to them.. It is at this level you are looking for repeatability. With good documentation and use of resources, KM can enhance the CMM/CMMI effort. • Project Planning includes developing estimates: If KM had been used; previous experience with similar projects can be tapped into in order to develop a more realistic estimate. It also helps in developing a schedule and assess in risk through access of knowledge of others with previous, similar experiences.
Level 3 • Organization Process Focus • Org. Process Definition • Training Program • Integrated SW Mgt. • SW Product Engineering • Intergroup Coordination • Peer Reviews • *Risk Mgt* • *Validation* • *Technical Solution* • *Requirements Dev.* • *Product Integration* • *Decision Analysis & Resolution*	**KM Impeded by CMM** • The Organization is to provide the resources and long-term commitment for CMM. It still may not be clear to the decision makers the importance of KM and therefore, the budget may not include the resources necessary for implementation. • The skills and knowledge of the people are still in the development phase. **KM Enhanced by CMM** • At this level also, CMM requires meticulous documentation. The collection and distribution of knowledge at this level by KM would greatly enhance the CMM effort. This is considered the DEFINED level in CMM. • An activity in Integrated SW Mgt is using the organization's historical data. This information could already be available if used in conjunction with KM.	**CMM/CMMI Impeded by KM** • Avoid over-evaluation of new ideas. • Over documentation. As more documentation is required, it may become tiresome for employees and less likely to be done. **CMM/CMMI Enhanced by KM** • Standardized processes for sharing knowledge. • Find lowest Maturity Levels and apply KM to them. • The development of common tools through the use of KM to assist in knowledge collection and storage.
Level 4 • Quantitative Process Mgt. • SW Quality Mgt. • *Quantitative Process Mgt. & Org. Process Performance*	**KM Impeded by CMM** • The only obvious impediments at this point would be not allowing resources for the KM initiative or still not identifying the intangible benefits. **KM Enhanced by CMM** • The organization should be collecting process performance data at this level. This is a good time for the use of KM to organize the information for further use.	**CMM/CMMI Impeded by KM** • At this level of CMM/CMMI, the organization is MANAGED. You are able to 'expect' results. The only obvious impediment to this would be that misinformation was provided that is used to base new projects on. **CMM/CMMI Enhanced by KM** • Complete With Measurement & Metrics-DEFINED organizational processes are present and used in new projects. The information gained and organized through KM will help this process run more smoothly, and with less effort due to the information being accessed through an organized manner.
Level 5 • Defect Prevention • Technology Change Mgt. • Process Change Mgt. • *Organizational Innovation and Deployment*	**KM Enhanced by CMM** • A tool used by KM is Communities of Practice. It is at this stage in CMM/CMMI established relationships with community resources could be a boon for the use of KM. • Another tool used by KM is that of Knowledge Centers. This should be well established in a level 5 organization and could therefore transfer on over to KM. This includes connection people with each other as well with information in documents san databases. • Common causes of defects are identified and documented. Well-organized information harvested through KM will have this knowledge readily available.	• Not an explicit project anymore as KM should be deeply ingrained in the employees at this point.

APPENDIX B: KMM MATURITY LEVELS

	KM Strategy	Leadership Behaviors	Networking	Learning before, during and after	Capturing knowledge
Level 5	Clearly identified Intellectual assets. KM strategy is embedded in the business strategy. Framework and tools enable learning before, during, and after.	Leaders recognize the link between KM and performance The right attitudes exist to share and use others' know-how. Leaders reinforce the right behavior and act as role models.	Clearly defined roles and responsibilities. Networks and CoPs have a clear purpose, some have clear deliverables other develop capability in the organization. Networks meet annually.	Prompts for learning built into business processes. People routinely find out who knows and talk with them. Common language, templates, and guidelines lead to effective sharing.	Knowledge is easy to get to, easy to retrieve. Relevant knowledge is pushed to you. It is constantly refreshed and distilled. Networks act as guardians of the knowledge.
Level 4	Discussions ongoing about organization's Intellectual assets. A KM strategy exists but is not linked to business results. A clear framework and set of tools for learning is widely communicated and understood.	KM is everyone's responsibility; a few jobs are dedicated to managing knowledge. "Knowledge sharing is power." Leaders set expectations by "asking the right questions," and rewarding the right behaviors.	Networks are organized around business needs. Networks have a clear governance document. Supportive technology is in place and is well used.	Learning before, during, and after is the way we do things around here. "Customers" and partners participate in review sessions.	Just-in-time-knowledge is current and easily accessible. One individual distils and refreshes it, though many contribute. That individual acts as the owner.
Level 3	There is no framework or articulated KM strategy. Some job descriptions include knowledge capture, sharing, and distillation. People are using a number of tools to help with learning and sharing.	KM is viewed as the responsibility of a specialist team. Some leaders talk the talk, but do not always walk the walk!	People are networking to get results. Networks are created	People can easily find out what the company knows. Examples of sharing and using are recognized. Peers are helping peers across organizational boundaries.	Networks take responsibility for the knowledge, collects their subjects knowledge in one place in a common format. Searching before doing is encouraged. Little or no distillation.
Level 2	Most people say sharing know-how is important to the organizations success. People are using some tools to help with learning and sharing	Some managers give people the time to share and learn, but there is little visible support from the top.	Ad hoc networking to help individuals who know each other.	People learn before doing and program review sessions. They capture what they learn for others to access. In practice few do access it.	Teams capture lessons learned after a project. Teams look for knowledge before starting a project. Access to lots of knowledge, though not summarized.
Level 1	A few people express that know-how is important to the organization. Isolated people with a passion for KM begin to talk and share how difficult it is.	KM viewed as a management fad. Leaders are skeptical as to the benefits. Leaders think networking leads to lack of accountability. "Knowledge is power"	Knowledge hoarders seem to get rewarded.	People are conscious of the need to learn from what they do but rarely get the time. Sharing is for the benefit of the team.	Some individuals take the time to capture their lessons in any number of cupboards and databases. They are rarely refreshed, few contribute, even fewer search.

http://www.straitsknowledge.com/consultancy

APPENDIX C: PROPOSED METHOD OF MEASURE FOR KM



REFERENCES

Berry, Gregory and M. Taylor, "Service Learning as an Instructional Tool for University Educators: The Case Method on Steroids, International," Journal of Case Method Research and Application WACRA 18 (2006) pp. 179–192.

Davenport, T. H. and L. Prusak, Working Knowledge: How Organizations Manage What They Know (Harvard Business School Press, 1998).

Dayan, R. and S. Evans, "KM Your Way to CMMI," Journal of Knowledge Management, 10(1) (2006), pp. 69–80.

DeMichiell, R. , Manning, R., Griffith, T., and Klein, A., "Engaging Students to Think Creatively: An Insight Exercise for Educators in the Information Age," International Journal of Case Research and Application, Volume XVII, Issue 2, 2005.

DeMichiell, R. "Student Accountability in Information Systems Projects with Business: Preparing for the Next Century, Journal of Computer Information Systems, 1997.

Gold, A., Malhotra, & Segars, A. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems*, 18(1), 185-214.

Gurteen, David, Knowledge, Creativity and Innovation, Journal of Knowledge Management, 2(1) (1998), pp. 1–12.

Laudon, K. C. and J. P. Laudon, Essentials of Management Information Systems (3rd ed.) (Prentice Hall, 1999).

Madhaven, R. and R. Grover, "From Embedded Knowledge to Embodied Knowledge: New Product Development as Knowledge Management," Journal of Marketing 62(4) (1998), pp. 1–12.

McFadden, F. R., J. A. Hoffer, and M. B. Prescott, Modern Database Management (Addison-Wesley, 1999).

Moody, Kavin W., New Meaning to IT Alignment, Retrieved March 19, 2008, pp. 1–11, http://www.babsoninsight.com/contentmgr/showdetails.php/id/585

Natarajan, Genish, "A KM Maturity Model for the Software Industry," Knowledge Management Review 8(1) (2005), pp. 20–24.

Nevins, Mark David and Stephen A. Stumpf, "21st-Century Leadership: Redefining Management Education," Strategy+Business (3rd Quarter, 1999), pp. 1–11.

Nonaka, I., "Dynamic Theory of Organizational Knowledge Creation," Organizational Science 5(1) (1994), pp. 14–37.

Nonaka, I., The knowing-creating company. (Harvard Business School Press, 1998).

Patton, P., How to Use Qualitative Methods in Evaluation, 5th Edition (Sage Publications, 1987).

Polanyi, M., Tacit dimension (Routledge & Kegal Paul, 1966).

Preziosi, R. C. (2007). *The Leadership Zone: A Report and Suggestions for Action*. Coral Springs, Florida: Llumina Press.

Ramanujan, S. and S. Kesh, "Comparison of Knowledge Management and CMM/CMMI Implementation," Journal of American Academy of Business, 4(1/2) (2004), pp. 271–277.

Straits Knowledge, Knowledge Consultancy, (2008). Retrieved January 21, 2008, from http://www.straitsknowledge.com/consultancy.

Zack, M. H., Managing codified knowledge. Sloan Management Review, 40(4) (1999), 45–58.