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Designing a Knowledge Management System – A Case Study of a Global Telecommunications Company

Tonia San Nicolas-Rocca
Claremont Graduate University, tonia.sannicolas@cgu.edu

David Rhee
Claremont Graduate University, david.rhee@cgu.edu

Lorne Olfman
Claremont Graduate University, lorne.olfman@cgu.edu

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Tonia San Nicolas-Rocca
Claremont Graduate University
Tonia.sannicolas@cgu.edu

David Rhee
Claremont Graduate University
David.rhee@cgu.edu

Lorne Olfman, Ph.D.
Claremont Graduate University
Lorne.olfman@cgu.edu

ABSTRACT

This paper focuses on the challenges a global telecommunication company faces in managing their existing knowledge management (KM) systems and planning for a new enterprise-wide knowledge management system (KMS). Data was collected from six user roles using three disparate knowledge repositories. The design requirements for a new enterprise-wide knowledge management system are presented. This paper offers a contribution to the study of information science by providing empirical evidence to the design requirements of an enterprise-wide KMS.

KEYWORDS

Knowledge, Knowledge Management System, Design, Role Conflict

INTRODUCTION

The study of KM has become a pervasive subject in the field of Information Science. In practice, many organizations have come to realize that KMS may be a strategic necessity to compete globally. As such, there has been considerable research in the study of KM. However, there has been little attention to the technical challenges a global organization may face in planning for an enterprise-wide KMS. This research will provide a list of technology-based factors that are related to the quality and usefulness of information systems applied to KM initiatives (Alavi and Leidner, 2001), and offer a list of design requirements for an enterprise-wide KMS.

The purpose of this research is to discuss the challenges and recommendations in designing and implementing an enterprise-wide KMS within a global telecommunication company. This report is organized in four sections. The first section provides for a literature review of knowledge management, the extent to which KMS have been designed and/or implemented, and role conflict. The second section describes the research method in which the design requirements are generated. The third section provides the results of the study and the design requirements for an enterprise-wide KMS. The fourth section offers a discussion and conclusion of the study.

LITERATURE REVIEW

Knowledge

In the knowledge-based view of the firm, knowledge is the foundation of a firm's competitive advantage, and ultimately, the primary driver of a firm's value (Bock et al, 2005). Knowledge resides within individuals (Nonaka and Konno, 1998) and, more specifically, in the employees who create, recognize, archive, access, and apply knowledge in carrying out their tasks (Bock et al, 2005). Knowledge takes two forms: explicit and tacit. Explicit knowledge is knowledge that can be codified, stored in a system and disseminated to others. Tacit knowledge is knowledge that cannot be codified and, hence, difficult to convey in writing.

Knowledge may be viewed from several perspectives, 1) a state of mind, 2) an object, 3) a process, 4) a condition of having access to information, or 5) a capability (Alavi and Leider, 2001). Knowledge has been described as a "state or fact of knowing" with knowing being a condition of "understanding gained through experience or study; the sum or range of what has been perceived, discovered, or learned" (Schubert et al, 1998). A second view defines knowledge as an object (McQueen, 1998 and Alavi and Leider, 2001). This perspective posits that knowledge can be viewed as a thing to be stored and manipulated. Alternatively, knowledge can be viewed as a process of simultaneously knowing and acting by applying expertise (McQueen, 1998). In addition, knowledge can be considered a condition of having access to information (Alavi & Leider, 2001). Finally, knowledge can be viewed as a capability to use information for purposes of decision making.

Knowledge management

Knowledge can be perceived and used differently by organizations. As such, how knowledge is captured, stored, and disseminated within the boundaries of an organization will be based on the organizations perception of the economic capital of their knowledge resources. KM can be viewed as identifying and leveraging the collective knowledge in an organization to strategically compete (Von Krogh, 1998). According to Jennex (2005), KM is the practice of selectively applying knowledge from previous experiences of decision making to current and future decision making activities with the express purpose of improving the organization's effectiveness. KM can also generate synergistic value by increasing innovativeness and responsiveness (Hackbarth, 1998). If organizations view KM as a necessity to increase innovativeness and responsiveness to strategically compete, it is imperative that they adopt a system that offers a fit between its technological and social systems (Bhatt, 2001) in which to exploit their knowledge resources.

Knowledge management system

A KMS is referred to as an IT-based system developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application (Alavi & Leidner, 2001). Although not all KM initiatives (i.e. storytelling, observation) rely on IT-based systems, information technology can offer an organization an effective way in which to share knowledge when knowledge is dispersed throughout an organization where time and geography constrain face-to-face knowledge sharing.

A KMS generally includes three common applications: 1) the coding and sharing of best practices, 2) the creation of corporate knowledge directories, and 3) the creation of knowledge networks (Alavi & Leider, 2001). Organizations can share knowledge gained during the successful completion of a task or tasks, or best practice. This knowledge can be shared by capturing the knowledge, codifying it, and storing it in an IT-based system. Additionally, organizations can create knowledge directories that point people to knowledge, or to the people who have the knowledge. Furthermore, organizations can develop knowledge networks in which to create a knowledge market where workers can exchange their experience and expertise.

Information technology can be used to support KM initiatives. According to Tanriverdi (2005), information technology may impact firm performance through the mediation of KM capability. These technologies can be used to support the transfer of explicit and/or tacit knowledge within and between organizations. A list of these technologies are provided in table 1.

A-I based	*Conventional*
Case-based reasoning	Bulletin boards
Data mining	Computer-supported co-operative work
Expert systems	Databases
Genetic algorithms	Data warehousing
Intelligent agents	Decision support systems
Knowledge-based systems	Discussion forums
Multi-agent systems	Document management
Neural networks	Electronic publishing
"Push" technology	E-mail
	Executive information systems
	Groupware
	Information retrieval
	Intranets
	Multimedia/hypermedia
	Natural language processing
	People finder/"Yellow Pages"
	Search engines
	Workflow management

Table 1. Information Technology to Support Knowledge Management (Edwards et al, 2005)

IT Factors that influence knowledge management systems

Knowledge management systems can store a vast amount of information generated from a number of resources including websites, databases, PowerPoint presentations, PDF documents, email, etc (see table 1). The process in which this knowledge is codified, stored, disseminated, and retrieved throughout the organization can lead to a number of challenges faced by many organizations. According to Poston and Speier (2005), sifting through the myriad of content available through KMS can be challenging, and employees may be overwhelmed when trying to locate the content most relevant for completing a new task. Unfortunately, this often leads to falsely informed or poor decision making, and even ineffective performance.

According to Alavi and Leidner (2001), a KMS must be designed such that knowledge workers can readily find high-quality content without feeling overwhelmed. With the use of content ratings schemes, if applied and evaluated properly (Wathen and Burkell, 2002), knowledge workers can improve subsequent search results leading to more effective decision making (Poston and Speier, 2005). McAndrew et al (2004) suggest a shared database combining an uncomplicated, familiar interface with a powerful search engine and rich content is arguably one of the most useful KM tools.

The study of knowledge management systems has focused on areas surrounding the social-behavior of individuals and the collection of individuals within an organization, and the operational processes embedded within everyday business initiatives. If the combination of knowledge assets, including people, processes, and technology, create a competitive advantage, we need to enhance our understanding of this amalgamation by gaining a better understanding of all factors that contribute to the successful design of KMS that have evolved into an integral part of the business value chain, and thus part of the daily tasks of individuals. Without diluting the social-behavior and organizational challenges of KMS, our area of focus in this research

are the technical factors that contribute to the design of KMS from the perspective of a user community of knowledge workers within a global telecommunications company.

Role Conflict

User participation in the development of IS has been recognized as improving systems quality (Ives and Olson, 1984). However IS, including KMS, are susceptible to role conflict that could arise during development. Role conflict can be defined as the interference by an individual or group in the attempts by another individual or group to achieve a goal (Schmidt and Kochan, 1972). Conflict in systems development is generally a special case of interdepartmental or lateral conflict in organizations, where departments with different subgoals may intentionally or unintentionally interfere with one another's attempts to achieve subgoals (Robey, 1989).

RESEARCH METHOD

Research Site

This study was conducted at a global telecommunications company we call Telco. Telco was selected for two reasons. First, one of the authors had a three-year employment relationship with the company. Due to this relationship, we were able to communicate with the vice president directly in charge of knowledge management and organizational learning. Second, Telco had a strong need for improving their knowledge management practices and were seeking the guidance of external consultants.

Telco

Telco is one of the largest telecommunications companies in the United States and considered one of the largest in the world. Telco provides services to millions of customers around the globe including multi-national, national, midsize, regional, government, and residential consumers. Telco employs over 300,000 employees worldwide. Within the last few years Telco has merged with and has acquired other organizations. These business initiatives have given Telco a strategic advantage in the telecommunications industry.

KM is currently being practiced at Telco in many different areas, but to date, there has not been a central coordinating group to actively manage the diverse and disparate KM initiatives. Telco has three existing knowledge bases in use that we call: Standardized Business Process (SBP), Business Knowledge Management System (BKMS), and Standardized Customer Care Operations (SCCO). Each knowledge base contains a combination of websites, PDF documents, PowerPoint presentations, etc., and has its own template guidelines and user communities.

At the initial stage of this project, Telco was interested in amalgamating the three existing knowledge bases currently in use into a single knowledge base repository with multiple views for various user communities. The requirement for the new platform was that it be capable of scaling to absorb other existing or planned knowledge bases in addition to the three core aforementioned systems.

Data Collection

The purpose of this study was to understand the requirements for each of the user communities using each of the knowledge bases in use and to recommend a single commercialized product that will meet the needs of all user communities and to support the KM requirements for the organization. The sources of data included interviews with all user communities and senior-level managers, and multiple screen shots of the each of the knowledge bases. Most interviews were conducted by at least two of the authors.

A list of sixty-nine users of the three repositories was compiled. Each of the sixty-nine persons on this list received a description of the project and was asked to participate in the study by providing information on one or three of the repositories, and to offer any recommendations or requirements for the new system. From the list, only twenty-seven responded. Of the twenty-seven respondents, twenty-four were interviewed. We were unable to schedule interviews with the remaining three respondents during the timeframe allotted for this phase of the research project. Of the twenty-four interviewed, six identified themselves as end users, six identified themselves as authors, four identified themselves as system

administrators, and three identified themselves as third-party representatives. The remaining five individuals either did not identify themselves with one of these groups, or identified themselves with multiple groups.

Respondents were asked to assess SBP, BKMS, and/or SCCO and provide insights based on their experience. Their responses regarding the overall functionality and usefulness of the system(s) was captured by asking how satisfied they were with the system's usefulness in completing tasks, and what features not found in the current systems could help to increase the effectiveness of distributing information and/or knowledge throughout the organization.

In addition to the interviews, we received multiple screen shots from each of the knowledge repositories. These screen shots provided us with an understanding of the user interface/view, availability and detail of content, structure and/or format of the application. We were unable to work with each of the content repositories as a result of technological and other security constraints. This, however, did not affect our ability to understand each of the systems or compromise the purpose of our study.

Data Analysis

The sources of data included interviews with all user communities and senior-level managers, and multiple screen shots of the each of the knowledge bases. We categorized interview notes based on user roles and responsibilities and included all requirements in this report.

RESULTS AND DESIGN REQUIREMENTS

This section discusses the various requirements of the different user communities: *Authors*, who write documents to be included in the knowledge base; *End Users*, who search for, retrieve, and ultimately make use of the knowledge they extract from the system; *Publishers*, who validate the content, consistency, and style of each document before arranging it for distribution and access; *Editors*, a subset of the current publishing role that ought to separate the content validation tasks from distribution functions; and finally, *Third Party Representatives*, who have shared insights into other existing and future systems, suggesting compatibility concerns to consider to make future integration less difficult and more rewarding.

Authors

Authors want to be able to create documents with a variety of customizable elements, incorporating where they see fit the creative use of fonts and color, graphical elements such as screen shots, and possibly more sophisticated elements such as Visio process flowcharts, sound and video clips, or links to outside documents. They wish to be able to publish their documents with a minimum level of standardization, which they feel often strips out certain useful and novel elements of their documents in the name of conformity to a standard which may be outdated.

Specific Author Requirements

Individual authors have various needs, and varying levels of abilities and resources to create documents for their intended audiences. While one individual may be interested in writing nothing more than simple instructions in plain text, another may be interested in using Microsoft Front Page to write very elaborate HTML code for an interactive web page, complete with screen shots, Shockwave or Flash animation, and a sound file or demo video clip, though not all user client platforms may support these features.

Authors also find a different balance may be appropriate for different types of documents for different purposes. While an entirely new process document may need every step of every sub-process spelled out in great detail, an update to an old process may require only a short paragraph of text detailing the change to a single step, really not much more than appending an "alert" to the end of the existing file. How much information to include in a document is variable, and will depend on whether the intent is to train a new user from scratch, or merely to update a veteran user on a few recent subtle changes.

Feedback on how to make their documents more useful is generally welcomed by authors, as long as the suggested modifications serve a clear purpose, and are not merely to enforce an arbitrary presentation style. Tracking metrics would also be useful, telling authors which documents are most accessed, in terms of rating the importance or utility of certain documents over others. For example, more effort might be spent keeping the most frequently accessed documents up-to-date than those accessed only very seldom.

End Users

End users wish to find information easily with an intuitive menu or search interface that yields relevant documents whose accuracy and timeliness can be trusted. They wish to have all the information about a given topic easily at hand, rather than having to click through multiple links or sub-documents, or search multiple systems in order to complete the task they set out to accomplish. Further, when they find a document whose contents may be suspect; they want to be able to easily verify the information in question with a person who can authoritatively address the issue at hand.

Specific End User Requirements

From the end user perspective, finding the right balance in the detail level of a given document is more difficult, as the same individual will progress from rank novice to expert over time, and so will access the same document multiple times, but with a different purpose and intent.

Ideally, each document will be collapsible or expandable, allowing a novice user to fully explore links to all sub-steps and detours, taking tangential paths in a nearly random exploration, until they grasp how interconnected the various systems and procedures might be. Similarly, the veteran user can collapse all but the latest links, skipping over the portions they use daily, and reading only the exceptions they need this one time.

Some users may want the same information at the same level of detail, but with different presentations on different occasions. While streaming video demos may be appropriate for a user at their powerful desktop computer with a high-bandwidth connection to the corporate network, strictly limited text and basic HTML may be the most a user can handle with an older laptop on a dialup connection from a remote site. Users will on occasion want to copy entire documents, or selected portions of documents, into a Microsoft Office document, perhaps to forward as an email attachment.

Users seek information in various ways. As a practical example, some users prefer clicking through hierarchical menus, while others who are less certain of how to find what they want may prefer a "site map" display of all the document categories available at a single glance. A methodical, organized search might begin with a logical expansion of a menu tree, looking for information according to a strict hierarchy of products or procedures. Of course, one person's logical menu tree may make no sense to another, and while there are many ways to organize knowledge, there is no single correct or best way for the entire organization.

Conversely, if one is looking for ideas, such as solutions to a poorly defined problem, a search of keywords might turn up serendipitous links, or pointers to knowledge that would not otherwise have been considered. Search engines that allow permissive queries, Boolean operations, wildcard pattern matching, natural language queries, and results ranking options could all improve user effectiveness. One would like to be able to search embedded text within a non-HTML file, such as a Visio, Word, Excel, or PDF file, as well as keywords from a sound file or video clip.

Data quality is also a primary user concern. The information should be current, complete, and accurate. If the information source is suspect, users will take additional time to check with a colleague or other authority to verify the procedures they are about to follow are in fact the ones which will result in the desired outcomes, or that the figures and information they have found and are about to include in a presentation to a client are still authorized for release and still up to date.

Most users are reluctant to install additional "thick" client software on their computers, especially since hardware standards for any given group change constantly, and would prefer being able to use nothing more than a browser they are already familiar with. Although client software may allow other features to be utilized, memory and other hardware constraints, besides keeping all users current with the same software version and release level, often lead to further administrative and troubleshooting difficulties and frustrations.

System Publishers

System "publishers" have inherited a three-fold role, perhaps as much by accident as by design. First, they are generally responsible for system robustness and uptime, and clearly, a simpler hardware and software system is easier to maintain in a production environment. Second, they serve as distributors for the content, ensuring that end users are able to access the documents they need with as little difficulty as possible. Usually, this means creating the menu trees or search engine keyword indexes needed to locate documents within the repository. Finally, they have assumed the function of editor, one

who validates documents before they are made available, ensuring standards have been met and appropriate common terminology has been used.

Specific System Publisher Requirements

System quality issues are paramount to any production hardware and software environment, and maintaining 24 x 7 x 365 uptime for a global organization can be a daunting task if the components are too heavily "customized", out of date, or unsupportable for various other reasons.

As content distributors, publishers must identify which audiences they serve, and create the appropriate access methods for each audience. This may entail publishing a single document in multiple formats, or searchable by different keywords, or accessible through several different end-user views. Menu trees need to be customized for different audiences, and off-the-shelf search engines need to be trained and tuned to respond to specialized vocabularies and contexts in the ways most useful to the ultimate users.

Keeping track of versions, allowing trial publishing, document rollbacks, and other such features such as tabulating usage metrics are all necessary to properly manage a production document publication system. Automated reports are also needed, to tell when document links are broken, and to tell when the responsible authority for a document has changed.

Interactive reporting is also needed to be accessible within different organizations, to tell when and who is appropriately using the system. As a practical example, a Sales Vice President may want to know which Account Executives are correctly exploiting system resources to most effectively process sales. Further, this Sales Vice President can determine if any errors are individual or process generated.

Preference clustering is another powerful technology which might be useful here, suggesting to users that, based on the three documents they have recently viewed, they might likely find two other documents to be of value, since other users also frequently viewed the same cluster of five documents.

If systems, or parts of a system, are to be made available to external business partners, then some clear security mechanism must be built into the underlying architecture from the start. This might take the form of a secure socket layer, or integration with a common security platform, which automatically handles user logins to multiple systems.

Editors

It is the final editorial function where there has historically been conflict, much like the conflicts in the world of print publications. Editors are required to adopt certain standards for the presentation of material to a certain audience, and end users often fall into various audiences desiring different presentations. The result is that few are happy with any one style, no matter how appropriate it may be for some audiences.

Specific Editor Requirements

The editorial function is perhaps the least well understood, and certainly the least appreciated of the roles currently played by most publishing groups. This includes creating, with input from various user communities, the standards for publishing documents in various systems.

While the task of determining standards usually falls along the continuum of "use the most powerful technology available" v. "use only the most commonly-supported technology accessible to the lowest-powered user in the organization," this is often not the most difficult problem to overcome -- as the technology changes rapidly anyway, it is a moving target, and adopting a policy of continuous change usually works best.

Rather, the difficulties the editors most often face is one of convincing document authors that editorial standards are necessary – even though the same individual who insists on flexibility as an author may insist on consistency as an end user. As no one likes having their work modified, it can be especially difficult to ask an author to take the document they have spent much time and effort preparing, and change its style and format to match a standard, particularly when that standard evolves regularly to keep up with changing organizational needs.

Some editorial tasks are straightforward, such as insisting that every time a term is used, the use is consistent with the most current organizational standards. This task will expose, however, differences in opinion on what a specific term really means – as it is somewhat unlikely that, for example, sales, marketing, and engineering will all agree, all of the time.

Another task of the editor is trying to divide knowledge into the most effective set of documents, optimizing modularity and granularity. In other words, if completing a specific process requires logging into two different systems, both of which are widely used by other processes, should the login instructions for each system be included in this process document? Or should they be in a separate document whose purpose is to instruct the user how to use those systems? This case is clear-cut: the process document ought to refer to the other system's login-training file. Otherwise, if the login procedure were to change, it would be a difficult task to track down and change those instructions in every file that referenced that system. By keeping common information in one place, only one document needs to be changed. Conversely, suppose the system to be logged into was new, and used only by this one process. Then it makes little sense to spend the effort to create a new and separate login instruction document, if it is only to be referenced by this one process.

Only a staff of consistently trained editors can accurately make these judgment calls on a case by case basis – trying to create or enforce some sort of rigid global standard or document template would consume far too much energy, yet not having any editor at all, or having separate, non-coordinated editors, would result in a multitude of unrelated, poorly-connected systems, much like the situation that exists within Telco.

Third Party Requirements

Besides accommodating the direct users of the system to be developed, there are other interoperability requirements that should be taken into consideration, driven by those who work with other systems that may later be integrated with the current project.

Interoperability will be key to any future systems integration projects. This means that the system to be implemented now must not rely exclusively on proprietary technologies, but instead have a publicly available open standard to interface with other functional modules, including those developed by other organizations.

DISCUSSION AND CONCLUSION

This paper provides for the design requirements from the knowledge worker perspective of a KMS within a large multinational telecommunications company. It is evident, based on the empirical findings presented, that the design requirements of an enterprise-wide KMS should not only be defined by one user group, but the entire user community. Each user group will have their own requirements for the design of a knowledge management system. However, it is a design that balances the needs of the entire user community with organizational goals that will offer a competitive tool in which to compete globally.

This paper offers a contribution to the study of information science by providing empirical evidence to the design requirements of an enterprise-wide KMS. Although the research presented in this paper is based on the study of one multinational organization, it offers a perspective in which we can further our knowledge in the design of KMS.

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