

Association for Information Systems
AIS Electronic Library (AISeL)

ACIS 2013 Proceedings

Australasian (ACIS)

2013

Organizational Knowledge Management Framework: The COMFENALCO Case

Jairo Gutierrez

Auckland University of Technology, jairo.gutierrez@rocketmail.com

Yesenia Castellon

Comfenalco, ycastellon@comfenalco.com

Follow this and additional works at: <https://aisel.aisnet.org/acis2013>

Recommended Citation

Gutierrez, Jairo and Castellon, Yesenia, "Organizational Knowledge Management Framework: The COMFENALCO Case" (2013). *ACIS 2013 Proceedings*. 36.

<https://aisel.aisnet.org/acis2013/36>

This material is brought to you by the Australasian (ACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ACIS 2013 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.



ACIS 2013
RMIT MELBOURNE

Information Systems: Transforming the Future

**24th Australasian Conference on Information
Systems, 4-6 December 2013, Melbourne**

Proudly sponsored by



ACIS 2013 Principal Sponsor



Advancing ICT through Education and Research



Organizational Knowledge Management Framework: The COMFENALCO Case

Yesenia Castellón
COMFENALCO
Cartagena, Colombia
Email: ycastellon@comfenalco.com

Jairo A. Gutiérrez
School of Computing & Mathematical Sciences
Auckland University of Technology
Auckland, New Zealand
Email: jairo.gutierrez@aut.ac.nz

Abstract

Modern organizations generate a great amount of information that stays dispersed throughout the different operating units. This makes it difficult for management to identify useful relationships among the disparate pieces of information. In an attempt to address that issue organizations implement document management systems that only resolve half of the problem: the half that deals with structuring and organizing the information linked to projects and processes carried out in the organization so that it is available and can be consulted. However, that solution does not address the issue of capturing all the information associated with the experience, tacit and explicit, associated with the processes and the people who participated in those activities and the information thus produced. The goal is that in the future users in the organization could query the knowledge management system and find out the history of the projects and processes carried out, the relationship between the different parts of the process, the role and responsibilities of the different participants and in general the lessons learned. With that in mind this paper presents a framework which serves as a guide for successful implementation of an organizational knowledge management system based on a case study of a large regional public organization in the state of Bolívar, Colombia.

Keywords: Knowledge management, Information Systems, Knowledge Acquisition, Organizational Knowledge.

INTRODUCTION

Organizations are constantly striving to improve their processes and one of the key aspects is to capture and manage the information produced in each of the tasks associated with the many processes. This problem is of increasing significance due to the amount of information being generated and the variety of projects associated with that information: security, information management and policy projects among others.

However, when knowledge management is involved, we are getting into a territory in which organizations are recognizing the importance of the adequate handling of information in a globalized world where organizations are being transformed, merged and restructured in order to remain competitive. From that awareness comes a drive to consolidate the knowledge created within the organization and promote a culture of sharing and exploiting that accumulated knowledge (Marin, 2005).

Within the Colombian legal framework it is important to highlight the legislative agreement No. 07 of 1994 which promoted the concept of document management for government organizations and the law No. 594 of 2000 (Ley General de Archivo, Title V, Article 21) which mandated the use of those systems for public entities. These mandated document management systems included the digitalization of documents, the inclusion of metadata and the storage of files in a number of different formats to facilitate the access and consolidation of information. The next step necessarily leads to the capture, structuring and readiness-for-access of information associated with the experience gained during the execution of the different processes and projects. This is the missing module in many systems and where many hours are being wasted in procuring the information needed at the right time.

The construction of frameworks has been identified as one of the most successful design techniques and its key selling point is the reuse of code (Fayad & Schmidt, 1997). Basically, a framework is a reusable design of a complete system which is represented by a set of classes and often based on an object oriented language. A framework describes the usual behaviour of its components within a particular application domain breaking the components into objects and interactions among those objects.

The paper is organized as follows: the next section presents the conceptual framework for this research, then the methodology used is discussed, a section on the development of the framework and its analysis follows and finally the paper closes with conclusions and recommendations.

CONCEPTUAL FRAMEWORK

In this section we discuss the theoretical aspects relevant to the development of the knowledge management framework. This work is based on theories which consider knowledge as one of the most important strategic resources for organizations. Knowledge is hard to imitate, it is socially complex, and it is based on heterogeneous data sources and therefore determines to a great degree the competitive and sustainable advantages and the superior performance associated with a particular organization.

That complex organizational knowledge is distributed (dispersed) among different components and actors and it takes into account different aspects such as the culture of the organization, its identity, the policies, procedures, documents, systems and the organization's employees.

The theory of organizational-based knowledge goes one step further since it recognizes the special nature of knowledge and it differentiates it from any other "generic" resource. There is also a prominent role for information technology since it can be used to synthesize, improve and facilitate the scalable use of knowledge management within organizations (Alavi and Leidner, 1999).

Knowledge and Knowledge Management

The quest to define knowledge has a long history and it has engaged the minds of philosophers such as Socrates, Plato, Aristotle and Kant among many others. Each on its own way expressed the idea that knowledge is the higher stage of the thinking process and that knowledge has resulted from data which has been acquired and interpreted by a person via experience or throughout an educational process and that so acquired knowledge allows that person to act and make informed decisions (Valhondo, 2003).

According to Nonaka & Takeuchi (1995), knowledge is a set of information acquired by means of experience or learning (a posteriori), or by means of introspection (a priori). In the widest possible interpretation of the term it refers to the possession of multiple interlinked data which on their own are less valuable from a qualitative point of view. The process of acquiring knowledge involves four elements: subject, object, operation and internal representation (the cognitive process). The authors propose that tacit and explicit knowledge can be acquired in four different ways: by sharing experiences and information with colleagues using dialogue and observation, by structuring information so that it can be easily imparted to other people (instruction, training), by on-the-task learning where participants assimilate the knowledge by being active in the process, and, finally, by a combination of the previous techniques so the knowledge can be exploited in the best possible way by the largest number of people in the organization (Nonaka & Takeuchi, 1999).

Authors such as Senge and Nonaka have reviewed knowledge theories throughout history in order to identify the fundamental questions regarding the acquisition of knowledge. Prominent examples include those of Peter Drucker and his "Knowledge Worker" concept or Peter Senge's "Learning Organization". These concepts are valuable resources for organizations which should be aware and capitalize on all of its knowledge assets (Nonaka & Takeuchi, 1995; Davenport & Prusak, 1998).

Knowledge Management (KM) can be analysed from different perspectives according to the level of importance given to the process of acquiring that knowledge. Among those perspectives we can find:

An eastern perspective proposed by Nonaka & Takeuchi (1999) and which gives more importance to knowledge creation as a decisive competitive asset when participating in a specific market. They state that knowledge is generated by a process of transformation and that transformation takes tacit knowledge and makes it explicit or vice versa. With tacit knowledge the human, even group, aspects take precedence while with explicit knowledge the information handled by the system is more important. This perspective is to be contrasted with a western take in which organizations seek to extract knowledge from people in the organization to be able to use it as support in the process of decision making.

We can thus define knowledge management as the activity that allows us to define the conditions and parameters under which knowledge is created. In other words, good knowledge management creates the environment (rules,

policies) to ensure that the knowledge generated and accumulated is put to use towards supporting decision making and towards supporting the regular operating processes within the organization. Knowledge management comprises four basic phases: information generation, information organization, information storage and information use or application thus becoming a key asset for any organization.

Knowledge Elements

Several authors have worked on the required elements for the generation of knowledge but for the purposes of our study we found Bernal & Briceño's (2010) argument the most convincing with key elements which include the context, the identification of knowledge, the transmission of that knowledge, the media and technology used, decision making, organizational culture and competition.

Knowledge Management Systems

During the early 90s several consulting firms started internal projects dealing with knowledge management and several leading organizations in the US, Europe and Japan had their own KM programs. The term itself (KM) gained currency among business people with the publication in *FORTUNE* magazine of "The Knowledge-Creating Company: How Japanese companies create the dynamics of innovation" by Nonaka & Takeuchi (1995). During the mid-90s some of those KM initiatives were flourishing, thanks in great part to the Internet. A number of related conferences and seminars were created and this period also saw the beginning of a number of professional organizations promoting the management of information resources in organizations. The International Knowledge Management Network (IKMN) published in 1994 a study about KM in European companies and the European Community started allocating research funds linked to KM via the ESPRIT project in 1995.

Knowledge Management, which appeared as a desirable alternative to Business Process Reengineering, has become a good revenue line for international consulting firms such as Accenture, Booz-Allen & Hamilton, Cap Gemini-Ernst & Young, and KPMG. Several professional organizations working with associated areas of endeavour are also increasingly interested in the role of KM within their own disciplines. That includes firms dealing with risk assessment, benchmarking, best practices, and change management among others. This latter category includes organizations such as the American Productivity and Quality Council (APQC) and the American Society for Information Science (ASIS, Valhondo, 2003).

Modern information management systems range in functionality from Management Information Systems (MIS), via Decision Support Systems (DSS) to Knowledge Management Systems (KMS) which allow the compilation and reuse of information generated by the different processes carried out in a particular company or business. Knowledge Management Systems' main focus is the capture, organization and diffusion of information generated within an organization and the presentation, to users, of that information in such a way that it can be exploited successfully for the benefit of the organization (Choo, 1996; Davenport & Prusak, 1998; Alavi & Leidner, 1999; Jennex & Olfman, 2005; Ortega, 2009). Modern KMS are focused on controlling and facilitating the access of relevant information using digital formats. It is of particular importance that the information generated by the different systems during the execution of the day-to-day operations (processes) of the organisation can be searched and retrieved easily. Additionally, the KMS must be able to manage a wide range of different types of records and documents generated by each one of the organisations processes. This functionality makes these types of systems an important source of information and the base to transform that information into knowledge and intellectual capital for the organisation.

RESEARCH METHODOLOGY

Nunamaker, Chen, and Purdin (1990) have developed a multi-methodological research approach as an attempt to integrate a number of separate approaches in recognition that not one methodological approach should be deemed pre-eminent, while accommodating design science through a systems development approach. Since this research integrates theory building (conceptual frameworks), systems development (prototyping), and observations (case study), the authors considered this a suitable applied science methodology in which the development of an artifact serves as a proof of concept and helps inform a theory-building phase.

Additionally, there is an Action Research component to the mix since one of the co-authors works as part of the team implementing a knowledge management system for the study's target organization. The work then aims to contribute by addressing very real needs coming out of the organization while at the same time fulfilling the study's research goals.

The research was carried out in three phases: a first cut at theory building by adapting a number of conceptual frameworks from the literature and by deriving a draft knowledge management framework for the organization with a set of characteristics and functionality. The main research steps were the collection of information based

on, mostly, internal documentation and the use of in-depth interviews with personnel from five different functional areas of the organization.

Next we had the system development phase which consisted of an initial design and then the development and implementation of a prototype integrated with the organization's information systems.

Finally, we had the observation's phase in which the prototype was instantiated with the information collected from the organization using a combination of case study and action research techniques. This phase also included a validation exercise with the main stakeholders of the knowledge management framework (KMF). It was essential to assure ourselves that the proposed system did indeed address the issues raised by the target ("coal face") users and that the KMF also contributed to solve the (more structural) problems identified at the beginning of the project.

The target organization is COMFENALCO CARTAGENA, a 50-year old non-profit organization which provides services for affiliates' employees (other companies and organizations). Those services include educational facilities (primary, secondary and tertiary), social (clubs, hotels), financial (mortgages, credit facilities) sports, discounts, etc. The five functional areas selected for this study are relevant to several of the companies operating under the COMFENALCO umbrella and for that reason were chosen for this project. Those divisions are: Corporate Strategy and Planning, Human Resources, Financial Services, Legal Services, Contributions and Subsidiaries (key area: main revenue source. Most services are funded from affiliated members' contributions).

KNOWLEDGE MANAGEMENT FRAMEWORK

This section discusses the characteristics, features and functionalities designed into the framework and then it presents its development based on the requirements collected from COMFENALCO's functional areas.

Framework Characteristics

Alavi and Leidner (1999) present five perspectives of what "organizational knowledge" means. They argue that it can be understood as a state of mind, an object, a process, a condition or a capability. Knowledge as a state of the mind establishes that this knowledge is acquired by different means such as experience, study, learning, perception, or by discovery. The individual can then apply that knowledge to address organizational needs. If knowledge is defined as an object then it can be seen as something tangible (a thing) and it can be stored, accessed and manipulated. This perspective focuses on the application of that knowledge.

In the perspective of knowledge as a condition of access to information, organizational knowledge must be structured (organized) to facilitate access and retrieval. This can be considered as an extension to the perspective of knowledge as an object with a special emphasis on ease of access. In the perspective where knowledge is seen as a capability the key is its role as a factor of influence when making decisions. The organization has learned something valuable and it is able to interpret the results of that experience to support new business decisions.

When trying to generalize those aspects with our goal in mind, the formulation of the knowledge management framework, we found that all of those perspectives were present in COMFENALCO. The telling aspect for each perspective's application was the point of view employed in the corresponding analysis.

Based on our case data we selected the fundamentals aspects for the design of the KMF keeping in mind that the overriding requirement was the transversal nature of the information being handled (Smuts et al, 2009, Calabrese and Orlando, 2006). The five functional areas selected touch on all organizational processes and have an impact over the entire enterprise. After verifying, analysing and structuring the in-depth interviews data we summarized the framework characteristics as shown in Table 1.

Information Integrity	Defined as the property which seeks to maintain data free of unauthorized modifications.
Ease of access	This is a key characteristic since the main objective is to be able to obtain the relevant information, for the situation at hand, in the easiest possible way.
Information Availability	The system must be operating continuously with up-to-date information which will be reachable when it is needed.
Information Organization and Structure	The system deals with information, gained from experience, which in many cases is unstructured. For that information to be useful it is essential that it is organized and structured otherwise there is a clear risk of missing on relevant information at the time of consultation.
Information Confidentiality and Hierarchy	Confidentiality as the property that prevents access from unauthorized users or systems and hierarchy so that access rights can be organized according to the level required by authenticated users.
Information Security and Contingency Planning	Security policies which determine authorized use of the information and contingency planning to assure service continuity, including backups and hot/warm alternate sites, in case of temporal or permanent lost of information.
Process Knowledge Integration	This characteristic is directly linked to the system's objective which is to generate knowledge and in that way support decision making and support the creation of new ideas to help maintain the competitiveness of the organization. Therefore, the system must allow processes to have access to the information produced and reported by other processes thus learning from the experience gained while carrying out other, relevant activities, in the organization.
Organizational Knowledge Transfer	This characteristic aims to make the knowledge acquired easily assimilated by the organization's users. For the users to accept, use, assimilate and be satisfied with the information it must be accessible in a user-friendly way but that is not enough. It is key that the same ease will be there for users to contribute to the system with information from the experience gained while participating in their own organizational processes.
Information Access Response Time	This characteristic seeks to reduce the knowledge base search time in order to make this resource an attractive source of decision making knowledge.
Organizational Experience Consolidation and Management	Many information systems are capable of structuring and cataloguing information but often fail at consolidating ALL the information. For example: the tacit knowledge, gained from the experiences in the day-to-day operations and processes or projects completed by the organization. This results on teams repeating time after time the same steps without the benefit of experience due to the lack of consolidation of the knowledge acquired and thus resulting on a lack of awareness of relevant knowledge for a particular process and the inability to reconstruct that knowledge from fragmented data.
New Knowledge Generation and Innovation	The capability to produce new ideas and to put them into practice in order to strengthen the organization by generating new products and services and by optimizing the use of information resources with the ultimate goal of maintaining a competitive advantage.

Table 1: Characteristics of the Knowledge Management Framework

Knowledge Management Framework Functionality

The functionality was derived from the data collected in the case, the literature review and the conceptual frameworks studied during the execution of the research project. The required functions are:

Topic of the day: Space suitable for collaborations in which issues are presented challenging the users to contribute towards a solution which in turn will enrich the organizational knowledge base.

Important News: To be shared with all members of the organization maintaining a permanent communications channel with all employees.

Active Projects: Current projects under way with key and up-to-date information associated with them. This functionality aims to keep the organization informed about all the projects within the different functional processes.

Processes' Registers: Daily register maintained per process in the organization. These registers keep track of issues, decisions and changes linked to processes and allow posterior consultation about what was done or decided given a specific situation.

Lessons Learned: Repository of best practices, errors, special procedures, things that could have been done differently and other key lessons learned during the execution of processes. This information will serve as input to decision makers facing similar circumstances in the future.

Suggestions Box ("Aporta tú idea" in Spanish): Space where users can offer suggestions to improve any product, service or process in the organization.

Document Search: With a link to the organization's existing document management system and the ability to combine searches of the consolidated processes' knowledge.

Important Documents: Repository of often-accessed documents which are relevant to many functional areas within the organization.

Virtual Meetings: Online meeting facility with resource sharing capabilities.

Several of the functionalities listed above require a process of addition, deletion and consultation which has been added to the prototype KMF.

Framework Development

The prototype was developed taking into consideration the existing information infrastructure and the document management system used by COMFENALCO. This system is DOCUWARE with a SQL 2008 database and a dedicated server configuration administered by staff from the document management department. The organization also uses DUPRAL which is a popular content management system written in PHP. Designing the framework using the same development environment facilitates its integration with the existing document management system. Besides, DUPRAL allows the development and adoption of customized configurations and allows the management of information using a generous range of formats.

DRUPAL enables the construction of a robust, well-tested and reliable web-based system that doesn't place any additional requirement on the client side which only needs a browser-capable device to access the system.

The observation phase was conducted by installing the framework modules developed in the dedicated server and by accessing it via the organization's intranet. Test data was added and the subjects who participated in the in-depth interviews were invited to participate in the exercise. Every one of the modules and functionality (features) were then presented to the participants drawing parallels with the new decision making facilities and the way those decisions were made during the recent past. A feedback session was opened and the participants had the opportunity to provide suggestions for enhancements, criticisms, and any other comments conducive to fine-tuning the system so that it better addresses their requirements and it is fit for its stated purpose. The observation phase included an evaluation of all the characteristics listed in Table 1 with an emphasis on the integration of the information consulted.

The overall objectives were achieved although there were a number of observations leading to improvements in the framework. There were suggestions to enhance the graphical interface of the portal and a suggestion was

made to change the name of the suggestion box to a more encouraging “Aporta tu Idea” (Contribute an idea rather than just “leave” an idea). COMFENALCO recommended the implementation of the prototype as a full-blown system and several of the managers consulted have high hopes that the “Knowledge Portal” will facilitate the knowledge reuse in cases such as union negotiations, board meetings, general assembly meetings, legal proceedings, labour related claims, internal projects, and in particular compliance processes and governance-related projects in which the organization has to report to several government stakeholders.

The proposed framework, see Figure 1, enables organizations to prioritize the functionalities of their Knowledge Management System highlighting the key modules required to start the arduous road to successfully capture and exploit the knowledge acquired during the operation of the organization. It is that know-how, now available, which will allow the business to retain its competitive advantage. This paper also seeks to generalize those aspects of the framework that should be present in any successful organizational knowledge management system. Those aspects are included in the general scheme shown in Figure 2 below.

The knowledge management system is populated with information from different sources: data include hard-copy documents captured with Optical Character Recognition software to facilitate subsequent searchers. These are accompanied with the relevant metadata which enables structuring of the information. Other important data is the recording of employees’ experiences and knowledge involved in carrying out specific tasks. Key personnel can thus record how they went through specific experiences. When an experience-rich person leaves the company that institutional knowledge is not lost and there are no “gaps” in the key processes that person executed. In the future, people encountering the same circumstances within a particular process need no guess what the experienced employed would have decided to do in that case and can carry out their duties using the best practices documented in the KMS. Moreover, the proposed system becomes a laboratory of ideas and allows the organisation to make decisions relying on information generated and consolidated over time. This information is essential to determine new potential revenue streams or to enhance operational processes.

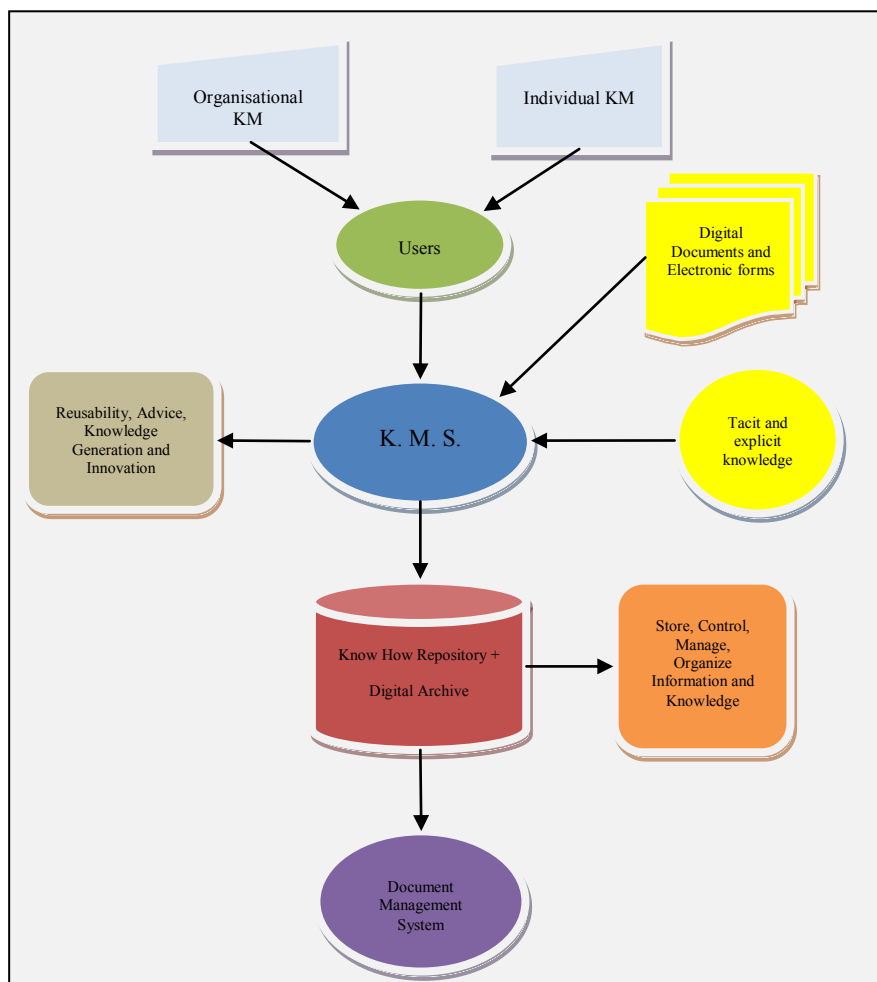


Figure 1: Proposed Knowledge Management Framework (“Knowledge Portal”)

The general scheme of the framework shows the different layers that made up the system and then defines which objects or parts are included in each level of the system based on the proposed framework. A fundamental component is a data repository or central place in which to consolidate all knowledge. The next layer has services to provide communication between the users and the repository. The top layer (Knowledge Creation and Presentation) includes the interface used to administer and manage the services through the second layer and eventually to reach the stored knowledge in the repository.

An important aspect of the proposed framework is the requirement to integrate the information generated by the document management system, linked to processes, with the tacit and explicit knowledge contributed by the organisation's staff. This aspect was developed and deployed in the tested prototype.

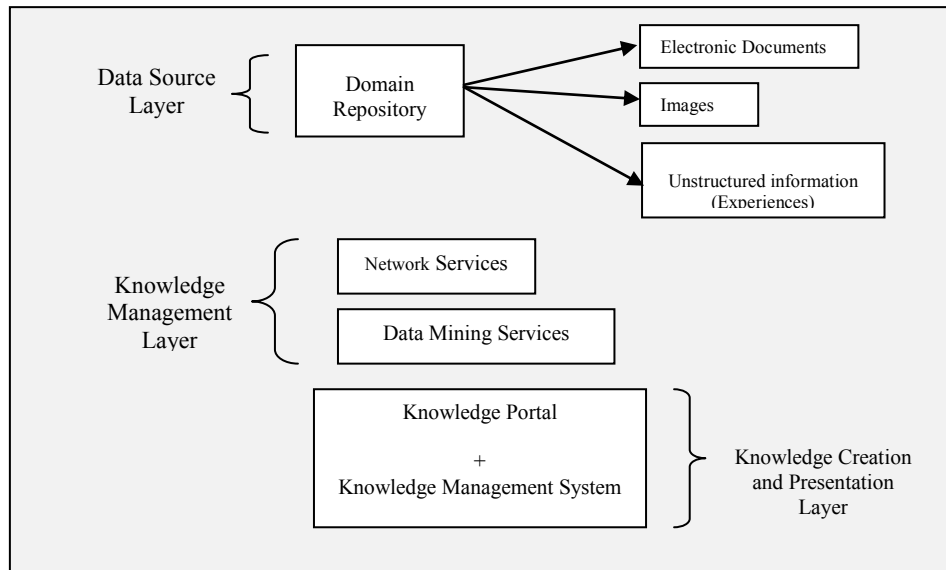


Figure 2: General Scheme of the Framework "Knowledge Portal"

CONCLUSIONS

The main goal of this research was to develop a framework which enables organizations to understand and assimilate the process of knowledge management and to highlight the importance of adopting the practice of using knowledge, a key resource, as part of the culture of the organization so that it can progress and remain competitive in an uncertain commercial world. This paper introduces the formulation, design and prototyping of a knowledge management framework as a very feasible and well-worth endeavor used to consolidate organizational knowledge.

The authors were also conscious of the need to consider the impact of the organizational culture as a key element in the introduction of a Knowledge Management System. The efforts of every individual in their everyday activities constitute the raw material for the experiences and information that will enrich the KMS which in turn will provide protection, durability, accessibility and consolidation for the tacit and explicit knowledge generated in the organization.

One of the limitations of this work is that the proposed framework relies on the existence of a document management system. Another limitation, or precondition for success, is that there must be a total compromise from process owners and project managers who should be committed to contribute detailed, and insightful, information to the system on a regular basis. Therefore this effort must be accompanied by an organizational change strategy, with top-level support, which will facilitate the adoption of the framework.

From the technical point of view it is essential to structure the information hierarchy properly and to define the users' profiles according to the needs of each area within the organization and abiding by the corporate security and business policies.

Further work can be pursued to derive the instantiation and customization of the framework so it can be applied to different organizations. The framework modular design permits the enhancement of point features of the system such as enhanced document search or natural language queries.

REFERENCES

- Alavi, M. and Leidner, D. 1999. "Knowledge Management Systems: International Emerging Views and Practices from the field", *Proceedings of the 32nd Hawaii International Conference on System Sciences*.
- Bernal, C. and Briceño, M. 2010. "Estudio de Casos sobre la Gestión del Conocimiento en Cuatro Organizaciones Colombianas Líderes en Penetración de Mercado", *Estudios Gerenciales* (26:117).
- Calabrese, F. and Orlando, C. 2006. "Knowledge Organisations in the twenty-first century: deriving a 12-step process to create and implement a comprehensive Knowledge Management System", *Journal of Information and Knowledge Management Systems*.
- Choo, C. 1996. "The Knowing organization: how organizations use information to construct meaning create knowledge, and make decisions", *International Journal of information Management* (6:5), pp 329-40.
- Davenport, T.H., and Prusak, L. 1998, *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press, Boston, USA.
- Davenport, T. 2005. *Thinking for a living*, Harvard Business School Press, Boston, USA.
- Fayad, M. and Schmidt, D. 1997. "Object-oriented application frameworks (Special issue introduction)", *Communications of the ACM* 40, pp 39-42.
- Jennex, M.E. and Olfman, L. 2005. "Assessing Knowledge Management Success", *International Journal of Knowledge Management*, 1(2), pp 33-49.
- Marin H. 2005. *Gestión Del Conocimiento, Capital Intelectual, Comunicación y Cultura*. Medellín, Colombia, Impresos Begón Ltda.
- Nonaka, I. and Takeuchi, H. 1995. *KNOWLEDGE-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Editorial Patria, S. A. de C. V.
- Nonaka, I. and Takeuchi, H. 1999. *La Organización Creadora de Conocimiento: cómo las compañías japonesas crean la dinámica de la innovación*. México, Oxford, Editorial Patria, S. A. de C. V.
- Nunamaker, J.F.; Chen, M.; and Purdin, T.D.M. (1990) "Systems development in information systems research", *Journal of Management Information Systems*, (7:3), pp 89-106.
- Ortega, C. 2009. "Modelos de gestión de conocimiento en las organizaciones", *Folleto Gerenciales*, 13(2), pp 81-86.
- Smuts, H., Looock, M., Van der Merwer, A, and Kotze, P. 2009. "A Framework and Methodology for Knowledge Management System Implementation", *Proceedings of the Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists*.
- Valhondo, D. 2003. *Gestión Del Conocimiento, del mito a la realidad*. Madrid, España, Ediciones Diaz de Santos.

COPYRIGHT

Yesenia Castellón and Jairo A. Gutiérrez. © 2013. The authors assign to ACIS and educational and non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to ACIS to publish this document in full in the Conference Papers and Proceedings. Those documents may be published on the World Wide Web, CD-ROM, in printed form, and on mirror sites on the World Wide Web. Any other usage is prohibited without the express permission of the authors.