

Towards Web-based Information and Knowledge Management in Higher Education Institutions

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Abstract. This paper is about knowledge management (KM) in organizations and reports the results of a research project carried out in the Department of Informatics (Computer Science) of the University of Beira Interior – Portugal. The study aimed at to identify and to understand knowledge generation, knowledge transfer and knowledge sharing among the actors of a university department. Based upon the study findings, a knowledge management model aimed at to facilitate personal interaction and knowledge sharing within the department is proposed.

1 Introduction

This paper is a follow up of a study undertaken in the Department of Informatics (DI) of the University of Beira Interior (UBI) - Portugal, as part of a research project carried out in 2001.

The main objective of the study was to understand the process of knowledge creation, transfer and use in the context of the DI/UBI and to design a Knowledge Management Model to improve knowledge sharing in this university department.

The case study approach was chosen to carry out the project, using triangulation of methods (questionnaire survey, participant observation and document research), for data collection [1].

Through a questionnaire survey, data on research activities, qualifications and specific scientific domains of all the academic staff of the DI were collected.

Through participant observation informal relationships and communication flows in common working areas as well as, in order socialization spaces, were identified.

Through desk and documentation research relevant administrative and staff related documents were collected and information flows identified.

Base upon data collected, a KM model and KM system structure was designed as described in section 3 to 5.

The project raised sufficient interest among interested parties in the University and moved forward to an implementation phase. Through a benchmarking process it is

expected to improve the KM system with other content subjects and to extend the KM process to other departments, as described in section 6 of this paper.

2 Knowledge management and Knowledge-based societies

Disparate definitions of the information/knowledge society have filled hundreds (thousands) of pages written by social scientists, “hard scientists”, technologists as well as by politicians, in the last decades. In spite of diverging in specific formulations by emphasising the economic, social or the technological element, it is indisputable that the pillars of such a knowledge society are **the enabling technologies (ICT)** and the **human capacity to create, transfer and use knowledge** in every aspect of their day live activity.

As it is pointed out by Castells [2], “in the last quarter of this [20th] fading century, a technological revolution, centered around information, has transformed the way we think, we produce, we consume, we trade, we manage, we communicate, we live, we die, we make war and we make love. A dynamic global economy has been constituted around the planet, linking up valuable people and activities from all over the world, while switching off from the networks of power and wealth, people and territories dubbed as irrelevant from the perspective of dominant interests”.

In Europe, the European Commission and the governments of various member countries have set up “Information Society initiatives” aimed at to improve information and communication infrastructures and, at the same time to prepare the citizens and the organizations to make better use of their knowledge assets. Under the 5th Framework Program, (the umbrella of R&D initiatives in Europe) a specific Information Society Technologies sponsored a great number of technology driven projects as well projects user oriented in response to concrete needs of citizens and business.

One of the most quoted statements of the Lisbon European Council (2000), is that the Europe should became by 2010, “the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and great social cohesion”.

Peter Drucker was one of the first authors to call attention to the importance of knowledge work and people doing such work in any organization and it is nowadays accepted not only by theorist but also by businesspeople that “knowledge work is in at the heart of innovation, which is itself the key to long-term organizational sustainability and growth” [3]. Not surprisingly, Knowledge Management (KM) became a popular topic abundantly discussed in the management literature. However, the interest of academia and the research community by KM has grown fast in the last decade or so and the topic became recognized as an area of study in several disciplines, from Management to Cognitive and Computer Sciences [4, 5, 6, 8, 9, 10, 11, 12].

The essence of KM is considered by some authors [13, 14] as the understanding of how knew knowledge is created and generated within an organization. Others take KM as the process that involves activities devoted to the creation, or generation, codification, storage, dissemination and incorporation of knowledge within an

organizational environment. Leif Edvinsson [15] who was appointed the world's first director of intellectual capital at Skandia¹ considers KM only a fraction of intellectual capital.

The "hidden" intangible assets of the firm that need to be identified, valorized and to made visible in the company's balance sheets became to be designated as the intellectual capital, prior that the concept was clearly defined.

Thomas Stewart [16] probably the most recognized among the authors dealing with the subject gives a wide scope definition: "intellectual capital is knowledge, information, intellectual property and experience that can be used to create organizational wealth", while Edvinsson [15] in a condensed definition stresses the learning dimension: "intellectual capital is the output of accelerated learning at the organizational level".

Intellectual capital and Knowledge Management can be seen as part of a management approach that seeks to improve competitiveness and foster innovation in any organization.

KM is not about technologies, leading authors agree. However, technological development, in particular in collaborative and web-based tools, was an important factor that extended KM discussion to a wider audience.

3 The University as a knowledge-based organization

Higher Education establishments can be defined as truly knowledge-based organizations. The university is an organization whose mission is to foster knowledge creation and knowledge diffusion among communities of students, scholars and researchers. Through research and teaching activities, Universities have been throughout the years (centuries) knowledge-production and knowledge-sharing centers. In recent times, more and more universities feel the need to establish close links with the communities they belong be it enterprises, public and private organizations and individual citizens in order to complete the "knowledge cycle": from creation to use through incorporation in activities, products and services.

New strategies, techniques and processes to improve learning and apprenticeship have been devised, for the benefit of the society as a whole.

In Europe, recent strategies towards preparing the citizens for the knowledge society, such as the "Lifelong learning"² or "e-learning initiative"³, place new challenges to the University. One of them is for sure the need to implement new

¹ Skandia, a financial services company based in Sweden is acknowledged to be the first enterprise to set up a coherent strategy to manage its intellectual capital. In 1991, Leif Edvinsson's mission was to develop a coherent, practical and commercially powerful means of looking at the issue of intellectual capital. The knowledge and expertise within Skandia was uncoordinated, misunderstood and mismanaged and as a result it was largely worthless or unvalued. By 1995 this company was the first to make public a report on intellectual capital and to present the Navigator Management and Reporting Model, described as new economics model and a new economics taxonomy.

² Communication CE (COM 678 final) November 2001

³ www.elearningeuropa.info

management processes to become agile, flexible and competitive organizations. A KM approach to a university department is the underlying proposal of the present study.

The choice of an academic department was deliberately assumed as a challenge, taking into account that most of the published literature focuses on enterprises or business type organizations. However, if we take researchers, it is relevant, even a priority, to understand the underlying processes of such an activity, as well as to identify the mechanisms that facilitate knowledge sharing among the various actors.

4 Knowledge Management Model for the DI/UBI

A picture of what we call the “intellectual capital” of the Department of Informatics (DI/UBI) was created, based upon the analysis of data collected. The concept of intellectual capital, borrowed from the management literature is defined above.

Fig. 1 represents the main dimensions chosen to characterize both the existing human resources – the academic staff – and the information assets of DI/UBI.

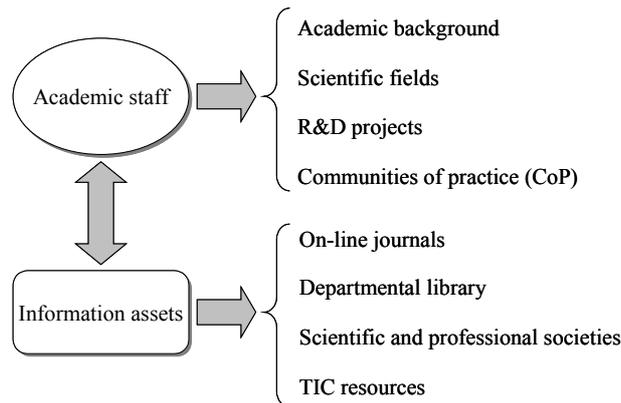


Fig. 1. DI/UBI “Intellectual Capital”

The proposed Knowledge Management Model for the DI/UBI represented in Fig. 2, is built taking into account Nonaka’s approach of the dynamic aspects of knowledge creation in organizations. Knowledge is dynamic and it is created in social interactions among individuals and organizations, via a continuous process.

The process of knowledge creation in organizations occurs converting tacit⁴ into explicit knowledge⁵ [13], in four modes: socialization, externalization, combination and internalization (the SECI model). Socialization (tacit to tacit) is the process of

⁴ Tacit knowledge is rooted in action, routines, values and emotions, is individual and hard to formalize

⁵ Explicit knowledge can be expressed in formal and systematic language and shared in the form of written or codified data

converting new tacit knowledge through shared experiences. Individuals learn by observing and imitating others, being exposed to hands on experiences. Externalization is the process of articulating tacit knowledge as explicit knowledge. It is a process of concept creation, the basis of new knowledge. Combination is the process of converting explicit knowledge into systematic sets of explicit knowledge. Finally, internalization is the process of embodying explicit knowledge into tacit knowledge, it is closely related to learning by doing.

As Nonaka points out, knowledge needs a context to be created, and expands in spiral (the spiral of knowledge) as much as it is shared among individuals working in teams within organizations, and inter-organizations [14]. Managers are more and more aware of the importance to create working environments and appropriate conditions to favor a knowledge sharing culture in the organization.

In the proposed model for DI/UBI these aspects are addressed. Considering the intervention at the organizational level, two main issues were identified: the need to implement information management procedures and the need to develop a “positive knowledge behavior”. To support the KM process a technology-based KM System is designed.

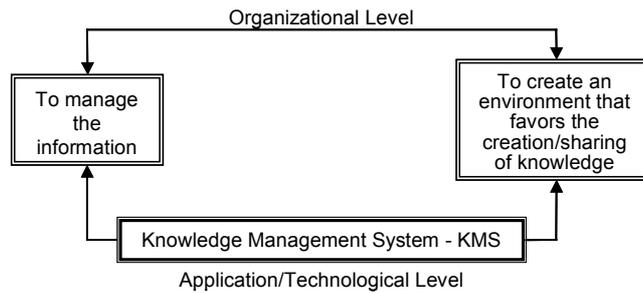


Fig. 2. DI/UBI Knowledge Management Model

5 Managing the Information

Information Management (IM) procedures and methods and a document management database (which will integrate administrative, scientific and pedagogical information), are considered in the KMS described in section 6. It is obvious that appropriate IM practices are beneficial to any organization. In the case of DI/UBI will contribute to improve secretarial work efficiency and to facilitate academic staff interaction with internal bureaucracy, as well as will help the integration of new staff, curricula development, R&D activities.

5.1 Creating a Knowledge Sharing Environment

The success of a KM strategy in any organization is dependent upon the fully commitment of the top management, but requires also that the members of such organization have to share a common vision and develop a common sense of belonging to the same community.

In the case of DI/UBI some aspects that emerged from the present study and can contribute to create the appropriate conditions for a successful KM strategy, are mentioned bellows:

Encourage the establishment of communities of practice (CoP), both related to pedagogical issues and organized by scientific areas. Within CoPs, tacit knowledge is shared and conditions for generating new knowledge are created. At the same time, CoPs contribute to improving the competencies of the academic staff [17];

Stimulate the creation of discussion *fora* or e-groups, allowing, also, the participation of people that are temporarily out of the University;

Register and Disseminate the “good practices” namely, related with pedagogical aspects; network and information systems administration; hardware and software problem resolution, etc. developed in the Department.

Other discussion *fora* that may be created are concerned to issues of different interest to the academic staff, such as: hobbies, holidays, sport, etc. This space allows the motivation of the participants, stimulating their familiarization with the system.

6 KM System

The KM System proposed takes into account tendencies mentioned in the KM support technology literature and considers also the constraints and characteristics of the DI/UDI .The platform chosen to implement the system is based on Internet technologies. A fully description of the system is given in an earlier paper [18].

The general structure of the KM System (Fig. 3), shows the main functionalities of the system and respective relationship, at the present state, and includes new functionalities that were introduced after the first implementation tests. These are mainly those related with the need to facilitate public access to the students to the specific areas of the information repository.

The system has four different user profiles: (1) visitor user, (2) administrative staff, (3) academic staff – the main user of the application and referred in this paper, only like a user –, and (4) the system administrator.

The intuitive and friendly user interface offers help online. The dynamic portal allows the user to login the system (after doing Login and Password) and to customize and personalize his own interface. To customize the interface, the user can, namely, select the scientific areas of his own interest and the information that he wants to receive. To do so, we created a database that not only saves the user profile, but also registers its system logs.

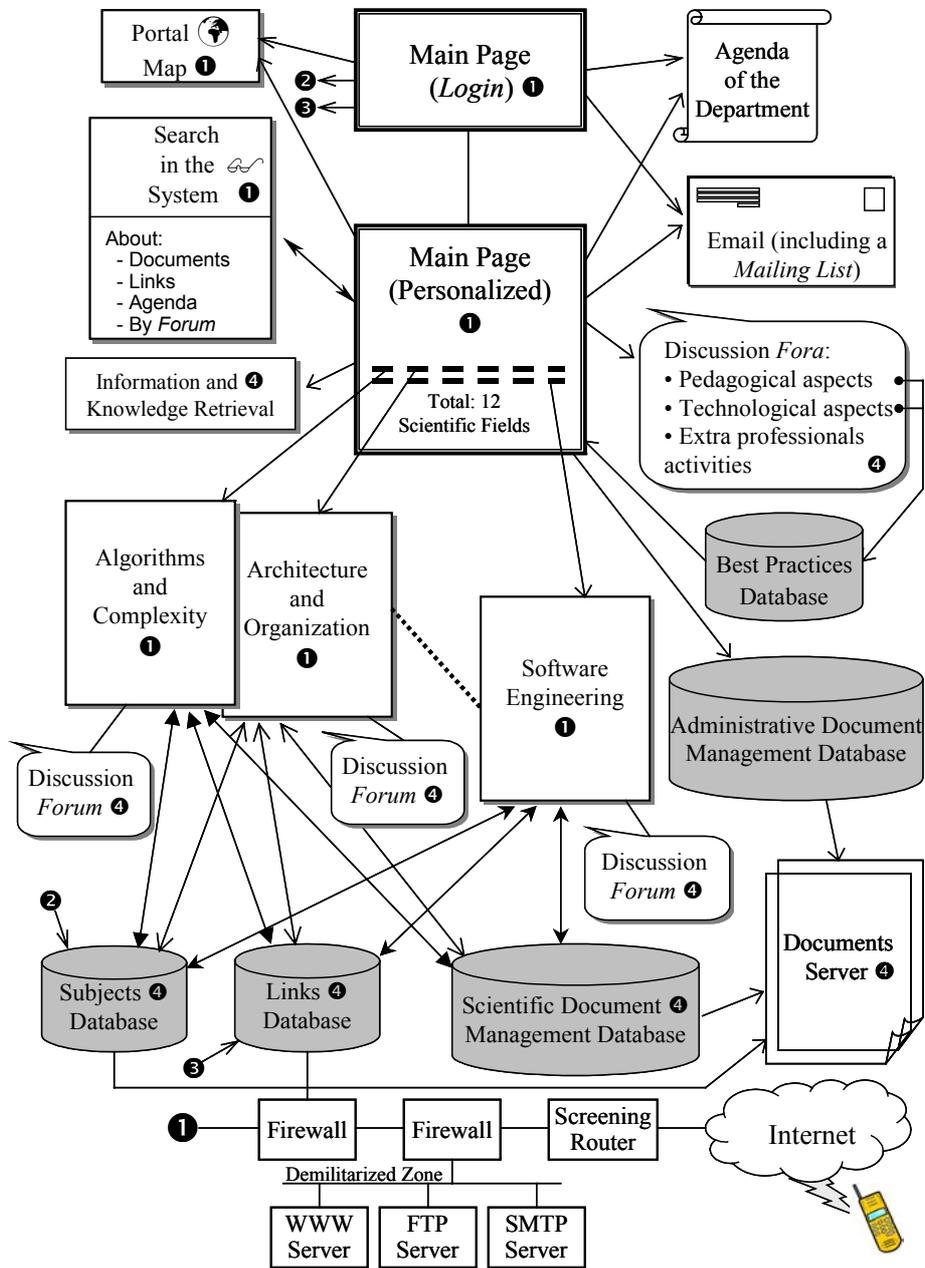


Fig. 4. General Knowledge Management System Structure

The user can also select and define the sending of short messages to his own mobile phone, to know that there are new participations in the system, for example: sending a new message to a forum that the user is member, place a new scientific document, diffusion of an administrative message, etc. This functionality can be implemented using the WML language (Wireless Markup Language), which belongs to the WAP protocol (Wireless Applications Protocol), using Internet resources [19].

The main portal page presents the intranet of the DI/UBI, facilitates the Internet access as any other page (signed by ❶ in the figure), and allows the authentication of the user and his login to the system. After the authentication, the user enters in the second page, called the main page (personalized). We consider this page also as main page, because is from there that the system is organized. As said before, its in this page that the user can define his own areas of interest, by personalizing the interface. In every portal page it is possible to go directly to the main page (personalized) and logout from the system.

We expect the creation of a best practices database from de discussion fora of pedagogical and technological aspects.

As can be shown in Fig. 3, without authentication in the system, the Department's students, mainly, can easily consult information about their subjects (signed by ❷ in the figure) and download documents associated, visit links database (signed by ❸ in the figure), portal map, and agenda of the Department.

The administrative staff profile allows the utilization of all functionalities defined to visitors and the issues related with administrative (insert events in the agenda and administrative documents).

The administrator profile has the general activities normally considered to this user: management of user accounts, analyses system logs, etc.

7 Further Developments

A new functionality under implementation is an information retrieval tool to search knowledge and information stored in the databases, document files and discussion *fora* of the system (signed with ❹ in Fig. 3) and to answer automatically to multiple questions.

Another important feature to be developed in future work is the integration of E-learning facilities in this platform. However, the implementation of these functionalities is dependent upon the availability of a high-speed network at the University. The bandwidth of the Local Area Network is at present not enough to guarantee quality of service.

Nevertheless, as said above, the new challenges of the universities are related with the capacity to extend their activity beyond their internal walls, and distance learning is becoming a priority issue.

8 Conclusions

A Knowledge Management system's model based upon an integrative approach that considers Information Management, Knowledge Sharing and Cooperative work, fundamental axes of the working environment, was developed within the project carried out at the Department of Informatics of UBI.

The proposed model incorporates results obtained through a study undertaken, which looked at barriers to information flow and knowledge sharing in a knowledge-based organization. The novelty of the approach is related with the identification of existing "intellectual assets" that should be taken into consideration within a global management strategy of the department and the organization (university) as whole.

It was not a purpose of this research to study in depth the technology related issues, on the contrary, the intention was deliberately to show, through the use of available technologies, that a simple, suitable application to a concrete organization, can be a driver for change.

The KM System, now in its implementation phase, is a proof of concept to further incorporate new facilities and to provide new services, as far as the potential of high-speed networks permits.

Acknowledgements

Part of this work has been supported by the Group of Communications Networks and Multimedia of the Institute of Telecommunications at Coimbra, Portugal. The authors also acknowledge Prof. Mário M. Freire the collaboration in this work.

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