Knowledge Management in Higher Education

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Abstract: - The goal of the paper is to present the results of a recent project for development of a Knowledge Management System (KMS) in university environment. First, it provides a brief introduction into KMS understanding and design approaches. Second, the approach followed by the authors is presented, and finally, an analysis is given of the feedback obtained by the users after the pilot testing of the KMS.

Key-Words: - knowledge management systems, learning management, users feedback

1 Introduction

Knowledge Management (KM) helps organisations to take advantage of their knowledge assets in order to increase their efficiency and productivity, as well as competitiveness [1], [2]. For educational organisations, similarly, KM supports better serving their stakeholders and implementing the mission of the organisation to serve the economy and the society. In fact, higher education is in the centre of the triangle of knowledge with its specific role to generate new knowledge within its research activities, disseminate it through the education of future employees, and finally, transfer it to industry within the innovation process. Therefore, when developing a KM strategy in higher education it is essential to take into account the needs of its internal and external stakeholders for knowledge and information, as well as the specific working processes in place in order to facilitate organisational learning. In fact, employees are acquiring knowledge from external sources and in the collaboration with their colleagues. The organisational learning, from its side, is based on proper management of knowledge assets of individuals, the existing knowledge flows and building an organisational memory (OM), which further facilitates organisational learning. More specifically, in the organisational memory should be captured knowledge generated within all available working (business) processes in order to be further reused. Here the focus is not only on the explicit knowledge, but also on knowledge which resides in the minds of individuals (tacit knowledge), and is acquired in the process of formal learning and practical experience.

Following the KM theory, a team of Sofia University was involved in developing a Knowledge Management System (KMS) at a faculty. The system was tested with its potential users. The aim of this paper is to highlight the results of the survey made among KMS users. Initially, the paper provides a brief overview of research literature in the field, and after that presents the KMS concept. Finally, the end-users feedback is discussed.

2 Knowledge Management Systems

Many researchers [3], [4] apply the system approach when developing organisational KM strategy. This provides them opportunities to consider, on the one hand, the functionalities of each system component separately, and on the other, their interrelations and the joint work within the whole system. For example, Coakes [3] investigates three systems that support KM in organisations – the organisational memory system (OMS), the OM and the KMS.

Central role plays the OM and its functioning is supported by OMS for storing, retrieval and processing of knowledge available in organisational repositories. The KMS, from its side, supports the knowledge processes of the employees and the knowledge identification, acquisition and transfer.

The early understanding of KMS is that they are based on information technology (IT) and represent a type of business information system aimed at managing organisational knowledge [5], [6]. This is the dominating understanding of KMS in the research literature [7], [8].

According to Alavi [9], KMS provide the basic infrastructure for KM and ensure for knowledge workers and organisations better access and use of all available knowledge resources. Maier [10] considers that the KMS represents an IT system which combines and integrates functions for processing of both tacit and explicit knowledge, and facilitates organisational learning through support of knowledge intensive processes. The author [10] points out that the KMS is the technology side of KM, however, integrates along with technical tools also personal and organisational elements, all aimed at higher productivity.

Yang [7] points out that some authors consider KMS as "a socio-technical system which has as its objective the management and sharing of knowledge to support achievement of organisational goals". The emphasis on knowledge sharing could be found in recent publications on KMS. Zhang et al. [11] stress that knowledge sharing is the 'most fundamental function of KMS'. Subsequently, the effective management of tacit knowledge requires a knowledge-sharing culture, good management mechanism and KMS facilitating employees' collaboration and communication [12].

Mohayidin et al. [13] consider that the KMS should comprise three layers – infrastructure, info-structure and info-culture. Lehaney et al. [4] highlight that the KMS is based on human activities and depends on the willingness of people to share knowledge, and therefore, all system components – people, organisation and technology should work in full synchrony in order to ensure its success.

Generally, the development of KMS follows different phases in company practice. According to Zhao et al. [15], initially, the emphasis of organisations is on organising all existing explicit knowledge and facilitate the employees finding and using it (static KMS). The second phase focuses on dynamic management of knowledge, and the proper functioning of knowledge processes (e.g. knowledge acquisition, integration, storage, sharing, transfer, and application), thus, building a dynamic KMS. By developing an 'integration gateway of knowledge application' (third phase) organisations ensure higher knowledge integration and facilitate the timely access to knowledge of employees. Finally, the 'intellectual asset management system' supports fully the knowledge life-cycle and ensures unified management, evaluation and optimisation of human capital, organisational capital and relational capital. The last phase is characterised with developing Knowledge Management/ Wisdom Management (KM/WM) systems, which take advantage of the concepts for KM, business intelligence and optimisation and provide decision makers 'with the ability to connect "points of wisdom" so that optimal decisions regarding forthcoming opportunities and upcoming problems can be reached today and into the future' [16].

The differences in KMS understanding reflect also on the design approaches proposed by researchers. For example, Remus and Lehner [17] consider three types of strategies for KMS design: portal-oriented aimed at integrating pre-existing data bases and bringing them together via a standard user interface; community-oriented focused on management of communities collaboration; and process-oriented providing knowledge workers task-relevant knowledge within the business processes.

Malhorta [18] considers two models for KMS design – technology and strategy driven, whereas the second is more appropriate as it takes into account the organisational needs and ensures synergy between technology, business processes and human activities. Therefore, the author suggests to focus the KMS design on meeting business goals by ensuring, with technology support, knowledge and information needed in business processes.

Dotsika and Patrick [19] propose how to support KM in small and medium enterprises (SME) with Web 2.0 technologies. The approach for KMS design investigates, first, the type of available knowledge and tools, then, the business requirements for a KMS, and on this base determines KMS functional requirements. The choice of tools follows the KMS users' requirements. Among business criteria the authors consider costs, scalability, simplicity, flexibility, user-friendliness and collaboration. From users perspective essential requirements are: easy of use, product maturity and user support.

Maier [10] follows the process approach by KMS design and suggests the following requirements to be considered:

- standard taxonomy or knowledge structure;
- wider focus going beyond the boundaries of a group or a project;

- support to knowledge processes with the provision of an integrated knowledge repository used by all KM tools;
- enhanced functions for administration of users, communications, sharing and search of knowledge.

A practical design approach is proposed in [20]. The authors consider that the KMS should integrate in a common knowledge repository all data, information and knowledge existing in various organisational repositories or systems. As shown on Fig. 1, different knowledge processes support building the organisational knowledge base. The most essential feature of the KMS is to ensure appropriate tools for end-users to access these knowledge resources, but also to collaborate and share knowledge. Therefore, a knowledge portal is considered as the most appropriate tool.

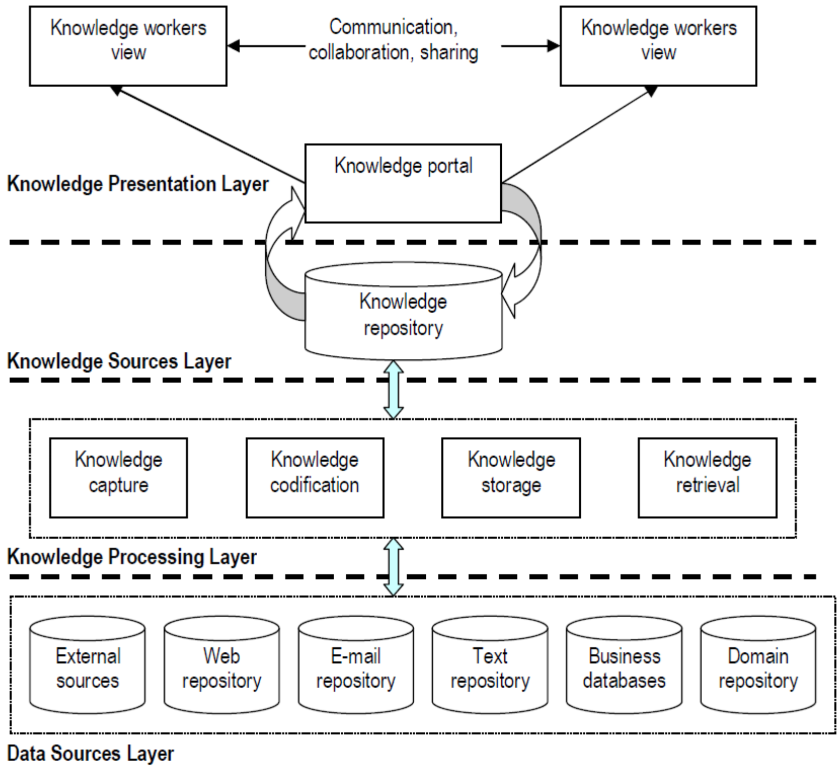

Fig. 1 KM architecture, adapted [20]

On bases of all presented above, it could be concluded that when designing a KMS it is advisable to align technology with business strategy and users actual needs. It is not necessary to put in place very sophisticated IT tools. The technology should be carefully chosen according to the organisational specificity with the objective to put in place easy-to-use and intuitive knowledge-related services aligned with business processes. Before developing the KMS infrastructure, it is essential to build an info-structure, e.g. to collect and organise knowledge resources following standards and procedures aligned with business processes specificity. People should be placed in the centre, and the KMS should facilitate their tasks, and thus, ensure higher work efficiency and better performance of business processes. As sharing of tacit knowledge is one of the essential objectives of organisational KM initiative nowadays, special emphasis requires organisational culture and its appropriate changes aimed at building trust among employees, raising their motivation and commitment, and thus, enhancing their collaboration and cooperation for better organisational performance [14].

3 Approach for KMS design

The authors' approach for developing a KMS is a follow-up of the understanding of Mohayidin et al. [13] and focuses on [14]:

- Info-culture Change – How to motivate people to contribute to Knowledge Management?
- Info-structure Design – How to ensure knowledge needed by employees to implement their tasks and activities?
- Infrastructure Design – How to support knowledge flows to business processes?

3.1. Methodology

The methodology followed by the project team for developing a new KMS included some basic steps typical for software systems design:

- Problem identification – The team analysed the available technologies at the university, and the working processes in place in order to identify the existing gaps. On this base was defined the main problem and assessed the opportunities for solving it with the limited project financial resources.
- Concept development – The team brainstorming provided some insights on the possible solutions, and the realistic options for the KMS development. In addition, a survey was made on technology trends, research and practical experience for learning management and KMS in university environment. The combination of team ideas, and the knowledge gathered from the scientific community facilitated the KMS concept development.
- Validation of the concept – A special session at a conference in June 2013 was devoted to discussion of the KMS concept and its practical implementation. A special emphasis was put on assessing what is realistic and achievable within the project time-frame.
- Development of KMS prototype – The main objective was to prepare a KMS prototype for the winter semester of the study year starting in October 2013. Therefore, the team designed some basic functionalities and integrated a Moodle platform as a depository of all learning resources created by the project team, including video and text lectures, and virtual labs.
- Testing the prototype – It was decided after officially launching the new KMS to gather feedback from its users, as well as to collect comments from project members on its functionalities. Therefore, a special questionnaire was designed targeted at university staff as main respondents. In addition, a functionalities check list was prepared for project team members in order to validate the KMS in place.
- Finalisation of the KMS and entering into exploitation – The testing and validation phase were a base for the next phase of the KMS design and the development of all functionalities according to the feedback obtained. A staff training was foreseen in order to facilitate the exploitation, and especially, the knowledge gathering and sharing processes.

3.2. KMS concept

The main goal of the KMS is to ensure efficient access to organisational knowledge resources and to facilitate realising university mission as educational and research organisation. Additional objectives are:

- to ensure appropriate knowledge needed for all university working processes;
- to ensure access to individual knowledge resources;
- to facilitate collaboration and knowledge transfer among internal and external stakeholders.

As main users of the KMS are considered students and lecturers, university administrative and technical staff, as well as external stakeholders and faculty alumnus and partners.

On bases of analysis of the university environment and the existing technology, it was decided that the KMS should support all working processes at the faculty and ensure knowledge for educational activities and research activities, human resources management, and administrative management. A special emphasis was made on providing an environment that facilitates the collaboration between students and university staff, as well as with alumnus, partners, industrial stakeholders, and external academic institution.

The KMS architecture includes 4 layers:

- The access and authentication layer has mainly information security functions, and provides access to all available resources to students, lecturers and administrative staff. The access to the available university systems is ensured by a link provided on the portal. External users have access after registration on the portal to some of the faculty resources, incl. the research data base. As learning management system (LMS) is used a Moodle platform, whereas lecturers are responsible for courses administration.
- The collaborative intelligence and filtering layer facilitates knowledge processes, and ensures personalised services to the users. This faces developers with challenges for knowledge organisation and indexing, as well as data bases integration. The layer also facilitates the generation of different reports on bases of the available knowledge resources.
- The applications layer ensures access to different applications – Moodle platform, education management system, faculty research and projects, conference management, yellow pages of the personnel, etc.
- The data repositories layer includes 3 faculty data bases – education, research and faculty information resources, combining both structured and non-structured data.

3.1. KMS users feedback

After the KMS was launched, a questionnaire was disseminated among its main users. It is structured in 4 sections, the first including general questions, and the others focused on KMS usage, satisfaction with info-structure and functionalities provided. Despite the low level of responses received, some interesting patterns could be observed. Most of respondents use the KMS for search of information about educational processes or information for other staff members. Publishing research papers is the less used service, followed by publishing educational materials (Fig. 2). It is interesting to note that senior lecturers (habil) are less ready to publish information, whereas the users aged 41-50 and women are the most active users of all services.

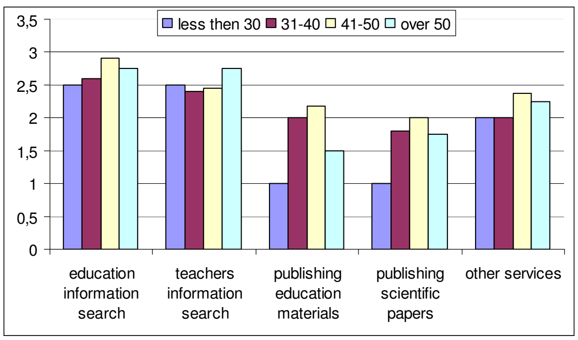

Fig. 2 Use of KMS services

Generally, the KMS users do not face particular difficulties by accessing it via different devices and by using different operating systems or browsers. Women face higher difficulties then men, and senior staff, especially for uploading documents or educational materials. The KMS navigation and structure are satisfactory for the users, but content visualisation and search tools should be improved.

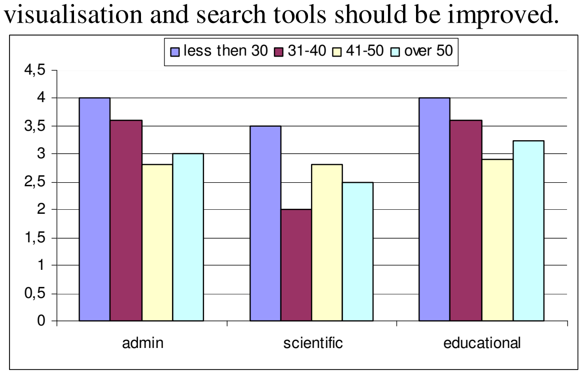

Fig. 3 Assessment of info-structure quality

Regarding info-structure, respondents of age 31-40 years and junior research staff are the most demanding. They are not satisfied with the content quality and consider that it is not up-to-date and not sufficiently comprehensive, especially scientific information and knowledge (Fig. 3).

It is interesting the attitude of respondents to different knowledge types. For example, the knowledge where to find information or expertise (know-where) and especially sources of knowledge among colleagues is much higher appreciated by all types of users then the practical skills and capabilities (know-how). It is surprising that the theoretical knowledge (know-what) is underestimated. This could be explained with the fact that most respondents are quite advanced in their field, and put higher importance on other knowledge needs in their everyday activities.

The users' satisfaction with the KMS functionalities shows that again the junior research staff and people aged 41-50 are the most demanding. All users' categories consider the functionalities for support of educational processes and students' management and control as the best developed, whereas the tools for scientific management are not satisfactory. This could be explained with the emphasis of the university on provision of excellent educational services, for which it obtains state subsidy. Although research activities are essential for raising educational quality and provision of advanced knowledge to students, the university pays less attention to them.

The communication tools are especially important for a KMS as they support knowledge sharing among its users. Nevertheless, the KMS does not meet the users' needs for such services as indicated by the respondents. Most of them are very critical regarding the availability of comprehensive staff directories (yellow pages), opportunities for discussions in the virtual space (forum), building virtual groups of interests or social networks use. In fact, these are new functionalities included in the KMS concept by the project team and their development highly depends on the willingness of users to provide additional content in staff directories or to undertake initiatives for virtual collaboration and discussions.

Another area which requires more efforts is knowledge organisation. Most respondents put higher emphasis on traditional tools such as data or knowledge bases, while topic maps, ontologies, taxonomies or wikis are considered less important for the KMS.

Generally, the most important tools needed for KM at the university comprise learning management systems (86%) and document management systems (81%), followed by IT tools for project management (59%) and research management (59%). Yellow pages or staff directories are needed by 55% of the respondents, while virtual communities are important for the half. Social network sites (e.g.

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Facebook) or human resources management systems are not essential for the dominating part of respondents, while only 23% of them stress the need for a decision management system.

4 Conclusion

The KMS facilitates the access to the knowledge assets at the faculty, and especially, to fast and easy search, find and retrieve the information and knowledge needed. The feedback of users clearly shows some additional challenges for improving the KMS services and infrastructure in place. More efforts are needed for overcoming the resistance of staff for using and maintaining the KMS, and especially ensuring staff commitment to sharing knowledge and improving the info-structure.

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References:

[1] K. Dalkir, *Knowledge management in theory and practice*, Elsevier, Butterworth Heinemann, 2005.

[2] K. Wiig, *People-Focused Knowledge Management*, Butterworth-Heinemann, 2004.

[3] E. Coakes, *Knowledge Management: Current Issues and Challenges*, Idea Group Publishing, 2003.

[4] B. Lehaney, S. Clarke, E. Coakes, G. Jack, *Beyond Knowledge Management*, Idea Group Publishing, 2004.

[5] L. Zhen, G.Q., Huang, Z., Jiang, An inner-enterprise knowledge recommender system, *Expert Systems with Applications* vol. 37, 2010, pp. 1703–1712

[6] J.A. Rah, S. Gul, Z.A.Wani, University libraries: step towards a web based knowledge management system, *VINE The journal of information and knowledge management systems*, vol. 40, No.1, 2010, pp. 24-38.

[7] L. F. Yang, On Some Issues of Knowledge Management System: A Review, *4th International Conference on Wireless Communications, Networking and Mobile Computing*, Oct. 2008, pp. 1-6.

[8] L. Zhen, L. Wang, J.-G. Li, A design of knowledge management tool for supporting product development, *Information Processing and Management*, Vol.49, 2013, pp. 884–894.

[9] M. Alavi, D. Leidner, Review: knowledge management and knowledge management systems: conceptual foundations and research issues, *MIS Quarterly*, Vol. 25 No. 1, 2001, pp. 107-136.

[10] R. Maier, *Knowledge management systems*, Springer, 2007.

[11] J. Zhang, W. Zhao, G. Xie, H. Chen, Ontology-Based Knowledge Management System and Application, *Procedia Engineering,* Vol. 15, 2011, pp. 1021 – 1029.

[12] Y.-L. Wu, B. Zhou, A Management Object Oriented Solution of Knowledge Management System, *Proc. 4th International Conference on Wireless Communications, Networking and Mobile Computing*, 2008, pp. 1-5.

[13] M. G. Mohayidin, N. Azirawani, M. N. Kamaruddin, M. I. Margono, The Application of Knowledge Management in Enhancing the Performance of Malaysian Universities, *The Electronic Journal of Knowledge Management*, Vol. 5, No. 3, 2007, pp 301 – 312.

[14] E. Gourova, K. Toteva, Design of Knowledge Management Systems, *Proc. VikingPLoP*, Estonia, 2014, 15 pages (in press).

[15] J. Zhao, P.O. de Pablos, Z. Qi, Enterprise knowledge management model based on China's practice and case study, *Computers in Human Behavior*, Vol. 28, 2012, pp. 324–330.

[16] R.J. Thierauf, J.J. Hoctor, *Optimal Knowledge Management - Wisdom Management Systems Concepts and Applications*, Idea Group Publishing, 2006.

[17] U. Remus, F. Lehner, The role of process-oriented enterprise modeling in designing process-oriented knowledge management systems, *Proc. of the AAAI Symposium on Bringing Knowledge to Business Processes*, Stanford, CA, USA, 2000, pp. 30-36.

[18] Y. Malhotra, Integrating knowledge management technologies in organisational business processes: getting real time enterprises to deliver real business performance, *Journal of Knowledge Management*, Vol. 9, No. 1, 2005, pp. 7-28.

[19] F. Dotsika, K. Patrick, Collaborative KM for SMEs:a framework evaluation study, *Information Technology & People,* Vol. 26 No. 4, 2013, pp. 368-382.

[20] N. Wickramasinghe, D. von Lubitz, *Knowledge-based Entreprise: Theories and Fundamentals*, Idea Group Publishing, 2007.