Conceptual Framework of Innovative KMS Design within the Perspectives of Enterprise 2.0 and Cloud Computing

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Abstract. Today, the adoption of Enterprise 2.0 is not an option, but a must for knowledge-based organizations within the changing social paradigms. The new-coming generation of employees and customers expect the technological proficiency to be part of the customer-centered business models. On their turn, organizations need to apply new forms of cooperation with their employees, customers, suppliers and partners. The knowledge is recognized as crucial resource and its efficient management determines sustainability and survival of the businesses. Knowledge management is widely accepted management practice within companies, but knowledge management systems in fact are rarely used by knowledge workers. Within the shift of emerging Web 2.0 and Cloud Computing, KMS have to be reconsidered from more social and user-focused perspective. An overview of the existing KMS architectures is made and main characteristics, advantages and limitations of the social software components are identified and assessed. At the end, a new model of user-centric architecture for distributed KMS is proposed, based on Cloud Computing and Enterprise 2.0 paradigm.

Keywords: KMS, Enterprise 2.0, Cloud Computing.

1 Introduction

Web 2.0 technologies and Cloud Computing are quickly expanding, transforming fast Internet and IS landscape. Many organizations need to reformulate their IT strategies, as within the framework of Enterprise 2.0 and Web 2.0 there emerge many business opportunities. Within this new economic and technological paradigm, the question of knowledge management (KM) and effective information systems use becomes vital for organizations. Better action-oriented exploitation of information and knowledge empower organizations to adapt faster and give them additional competitive advantage within an overcrowded global market. Athough the big number of available tools, it is admitted that knowledge workers still lack efficient instruments to cope with increasing daily amount of information and knowledge.

Nowadays KMS represent in most of the cases centralized repositories, organized and structured around pre-defined company functions and workflow. As pointed out in [1], current KMS are not only expensive to purchase, but also necessitate the commitment of significant resources to their deployment, maintenance, and daily operation. Moreover, typical KMS are based on

predetermined workflows and rigid "information-push" approaches that reflect mainly the philosophy behind working practices in large enterprises[1], hardly adapting to end-users needs. As result, even customized and company-build solutions are underused, while in the same time, knowledge workers lack real IT tools supporting their daily tasks [2].

2 Research problem

Today there is a clearly recognized need for new KMS architecture and reformulation of KMS role in organization. On one hand KMS cannot neither codify users knowledge, neither collect and store all organizational knowledge assets. Thus KMS remain underused by knowledge workers. On the other hand, Web 2.0 tools and instruments are increasingly used by knowledge workers, but organizations still lack understanding how to apply Web 2.0 in a KM framework. Within this perspective there is identified a clear need for new effective organizational KMS, reflecting the need of organizations to facilitate knowledge processes and to profit from knowledge.

The present paper aims to propose a holistic approach for new KMS architecture, focusing on one side on the emerging business and social needs and on the other side, reviewing new technological opportunities and infrastructures. As a result of the analyses a new referencial theoretical model for distributed KMS architecture will be proposed and discussed.

3 Emergence of Enterprise 2.0 business concepts

Following the Web 2.0 conceptualization, the Enterprise 2.0 is described by [2], as emergent social software platform within companies or between companies and their partners or customers. These software platforms enable collaboration and promote community, but lack defined workflow and are indifferent to organizational identities [3]. Web 2.0 technologies are not equal to Enterprise 2.0 as the business function of the later is substantial. However, the knowledge flows within Enterprise 2.0 still remain unpercieved and unused by organizations. A short review of the underlying change factors, leading to Enterprise 2.0 business concept will be presented below.

3.1 Social factors

The emergence of Enterprise 2.0 concepts is due mainly on emerging social factors requiring new forms of business relationships. These factors influence not only the use of specific technologies, but as well adoption of new business practices, leading to new business concepts that influence the company performance [3].

- *Demographic change* - the new generation (net generation) is nowadays entering in the workforce and moving into management position. The new "wired" generation takes part in one pro-active and comfortable with Internet population, representing an always connected customer, citizen or employee.

- *Rise of independent workers* (part-time employees, contractors and consultants) As result employees tend to be more loyal to own network of colleagues and professionals than to companies. Companies that provide an environment for collaborative learning and growth will be able to attract and retain the best and brightest individuals. Knowledge workers are virtual, mobile, and global.
- *New management role* - The emergence of highly mobile and independent knowledge workers will challenge the traditional management practices. Employees will work from anywhere, at any time, and on virtually any device, freely communicating and networking. So organizations will have to achieve their competitive advantage not through command, control, and operational excellence but relying on collaboration, communication, and management vision.

All these phenomena influence the organizational KM practices and processes. Accepting and adopting new forms of KMS is fundamental for organisational survival in networked knowledge-based societies.

3.2 New business models

Most of the new Enterprise 2.0 business models are based on mass customization and customer self-service. The notion of "prosumer" emerges and organizations routinely outsource activities, closely collaborating with partners and customers. The business concept of "Long tail" was defined as new source of competitive advantage for the Internet business.

A new way of achieving operational excellence is allowing customers to access to the organization's systems and processes. The advantages are decreased company's costs for high-quality data. Moreover, it strengthens the company's value proposition, as more customers are requesting self-service capabilities. Often customer self-service models are combined with mass customization where every transaction is tailored to the customer's specific needs. The old inside-out model in which the organization determines and performs the processes is changed to outside-in model in which the customer is responsible for driving the business process.

New business models tap new intrinsic collaborative and conversational mode of information exchange. The exchange occurs between organizations, employees, partners, and customers. As a consequence, hierarchical communication of essential business information is no longer effective or efficient. Instead, existing technology should be leveraged to make relevant information available so that all who need the information can consume, modify, and replicate it. Such an organic and networked communication paradigm has important implications for how content is changing. The focus is no longer on pushing out information or opening an exclusive channel to specific groups in a linear fashion. Instead, the focus has changed to collaborating with people and systems [3].

4 KMS architectures

KMS and architectures have been widely discussed in research and professional literature during the last decade [2,4,5]. KMS are defined [4] as IT-based

systems developed to support/enhance the process of knowledge creation, transfer, and application. KMS are complex socio-technological solutions, providing opportunities for users to create knowledge assets and to share them while interacting with other agents. On the other hand, KMS are recognized to be one major enabler for KM processes within organizations.

KMS provide the basic KM infrastructure within organizations, enabling knowledge workers and organizations to better access and use existing knowledge resources. Various approaches and methodologies are proposed for KMS architecture building [4,5,6].

However, the practice shows that even well designed KMS are hardly used by knowledge workers [2], thus influencing badly KM implementation and motivation. Recent survey [7] discovers that knowledge workers even do not recognize KMS as part of their KM instruments. In the same time knowledge workers and organizations struggle for a system (and not focused particular tools) that could facilitate their knowledge-intensive work.

The emergence of Web 2.0 technologies transformed the vision of KMS place and role. Conclusions of a recent report [8] summarizing the Web 2.0 technologies and KM implication, point out on the following trends: ¨Web 2.0 enabled democratization of content and appearing of crowd intelligence, expanding collaboration, focusing on networking and limiting content storage, free use of user-driven tools depending from the content, social software tools offering more holistic approach to sharing knowledge instead of e-mails¨ [8]. The Web 2.0 approach is based on synergy and cooperation, so in fact many technologies are adopted in parallel or together, complementing its interactivity and functionality for the user. An emphasis is put on the way how technologies can add new dimension for KM process for persons, for teams or for company. Thus new architectural model of KMS is expected, combining most of the Web 2.0 trends with Enterprise 2.0 vision.

Among main KM architectural models, we can outline 2 main KMS models as described by [9]. This classification corresponds on two main directions of KM research, human orientation and technology orientation. It reflects as well the idea of differentiation of tacit and explicit knowledge.

- *Interactive KMS architecture* – focusing primarily on the exchange of tacit knowledge, or aiming to integrate persons and thus to facilitate knowledge sharing.
- *Integrative KMS architecture* – aiming to facilitate the explicit knowledge management within organization, or focusing on effective content management, indexing, tagging etc.

According to [5] the KMS architectures can be basically divided on 3 main groups:

- *Theory-driven architectures* that are result of theoretic investigations and which represent a theory-driven decomposition of an organizational knowledge base and derive ideal groups of functions or components of a corresponding ICT system respectively.
- *Vendor-specific architectures* aiming to integrate the existing IS within specific organization, placing the KM tools according to the already available ICT infrastructure. KMS is just moved in between a standard Web browser and relevant data and document sources that exist in

an organization. Comprehensive KM suites comprise an often large number of modules offering functions such as text mining, tools for semantic integration of meta-data on data and documents, a search engine, visualization, administration of users and privileges, publishing and reporting.

- *Market-driven architectures* – The market-driven architectures are based on empirically proven important components of an organizational knowledge management environment which is integrated with more traditional data and document management systems as well as communication systems and other integrated company IS. These architectures are mostly presented on the base of layer models (varying from 4 to 7 according different authors) and are the mostly exploited in practice.

Another classification proposed by [5] makes the distinction between *Centralized* and *Distributed KMS* architecture. Organizations emphasize mainly on the Centralized KMS frameworks, figuring out that they can organize and thus manage knowledge assets and resources around one unified platform. On opposite, *Distributed KMS* are based on peer-to-peer collaboration. The goal of the distributed KMS is to engage users in a knowledge acquisition and dissemination procedure that enables both utilization of tacit and explicit knowledge, and merging knowledge from different organizations in a transparent to the user process [10]. KMS architecture could be considered as well from the point of view of knowledge market, connecting knowledge producers and knowledge seekers (11).

There are reviewed several innovative theoretical models for KMS architectures, combining some Web 2.0 aspects (Organik- Bibikas [1], Infotop-Maier [5], Webblog KMS- Roll [12], E-KMS Woitsh [6], Abdullah [13&14] and others). However, there still lack model of holistic KMS architecture combining both Web 2.0, Enterprise 2.0 business model and Cloud Computing and SLATES technologies.

5 Enterprise 2.0 architecture, cloud computing and extended KMS model

On the base of the developed model of Enterprise 2.0 architecture, McAfee [2] believes that Enterprise 2.0 technologies have the potential to transform the company Intranet to what is the current Internet – a distributed online platform with constantly changing structure, built by autonomous and highly interested users. Enterprise 2.0 technologies are subject to network effects, leveraging its utility for knowledge community. The SLATES framework, presented in Table 1 outline the basics of Enterprise 2.0 system architecture and its implication to KMS.

All elements of Enterprise 2.0 are easy to use – not special skills are required, and the end users have the freedom to use them without preconceived categories or structures.

The successful Enterprise 2.0 platform is modular in its architecture. This way, organizations are able to add components, resources, and services that are required as the business evolves and grows. Most importantly, the platform

model means that employees are not required to constantly learn new software products and business processes in order to use technology. The technology evolves processes where possible, eliminates them when they are obsolete or redundant, and makes the employee's interactions more conversational and convenient [3].

Table 1. SLATES model, Web 2.0 and KM adapted from McAfee [2].

SLATES	KM Function	Web 2.0 Technologies	KM application
Search	Provide mechanisms for discovering information	Semantic search	Key words
Links	Provide guidance to knowledge workers in order to discover the needed knowledge and ensure emergent structure to online content	Collaborating bookmarking	Best resources are better referenced
Authoring	Enable knowledge workers to share their opinions with a broad audience	Wikis and Blogs, Podcast and Videocasts	Technologies allowing people easily to become authors
Tags	Present an alternative navigational approach exploiting non-hierarchical categorization of intranet content	Collaborating bookmarking Wikis and Blogs	Users freely categorize content/ folksonomy opposed to taxonomy/
Extensions	Exploit collaborative intelligence and recommend to knowledge workers contextually relevant content	Recommender system	Automatic recommendations
Signals	Automatically alert knowledge workers for fresh available and relevant content	RSS	Automatically update of information

5.1 Cloud Computing model

Cloud Computing is one of the major consequences of Web 2.0 in the software development, discovering new business models and extending the philosophy of IS use. The benefits of Cloud Computing are widely discussed in practice, focusing on increased agility, adaptability, flexibility, cost savings and interoperability[15]. However, Cloud Computing today faces some security, privacy, and other barriers that prevent their widespread enterprise adoption [15]. This is the reason for appearance of external and internal clouds, trying partly to overcome the stated limitations.

"Knowledge in the cloud" is a new concept formulated in [17], extending the idea of "data in the cloud". The "knowledge in the cloud" need firstly to extract semantic knowledge from the underlying data. This knowledge is shared in the overlying knowledge cloud in active spaces which provide collaboration and coordination. The knowledge in the cloud extends the enterprise infrastructure and organizational boundaries.

The main services that Cloud Computing include may be broken down into 4 components [16].

Table 2. Components of Cloud computing services [adapted by Kim [16].

Managed services	A managed service is aimed at delivering an application to an enterprise, rather than to end customers directly.
Software as a service SaaS	The SaaS vendors run a single application in a data center, and deliver the functionality via the Internet to the users.
Web services	Web services are similar to SaaS. Web service providers offer APIs that application developers can use in developing applications.
Infrastructure as a service (IaaS), Utility computing	Many players have recently started to offer computing resources, that is, virtual servers and storage as utility computing service.
Platform as a service (PaaS)	PaaS also is a variation of SaaS. PaaS delivers an application development environment (platform) as a service, typically with computing resources for hosting the applications developed on the platform.

5.2 Model of Extended KMS architecture

Development of KMS architecture model using Cloud Computing approach can be the next step toward more effective and user-oriented distributed KMS, supporting organizational business processes. The proposed model (Fig.1) depicts KMS platform as combination of Internal and External clouds (due on security issues). Knowledge workers (KW) have access and share resources within distributed P2P networks inside and outside organizations. The 3 perspectives of Cloud Computing – SaaS, IaaS and PaaS allow organizations to develop new models of relationships with KW. The model is based on SLATES framework and integrates various web services and Web 2.0 applications, emphasizing on managing knowledge on the level of KW. This way organizations can have an overview and map of the knowledge assets, and KM processes, and in the same time KM remain part of the KW daily work. Thus, the KMS can support highly distributed knowledge work and could be accessed via various clouds.

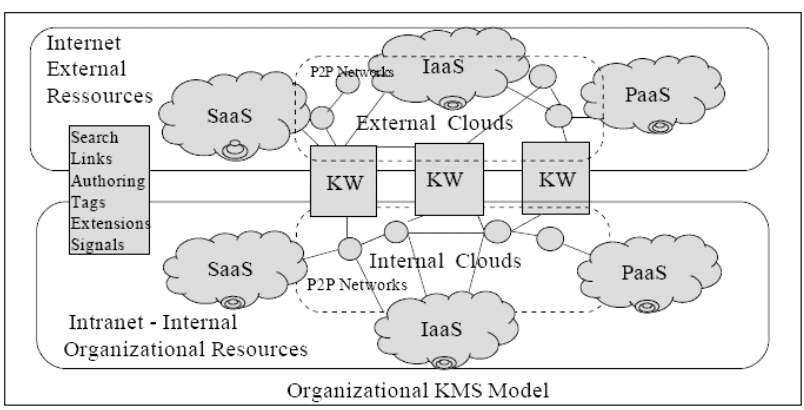

Fig. 1. Distributed KMS platform based on Cloud Computing and Enterprise 2.0.

5 Conclusions and Future Work

The benefits and the obvious superiority of distributed KMS have attracted considerable interest [10]. A large number of DKMS have emerged, other focusing on the expansion of knowledge sharing capabilities, other emphasizing on authentication schemes. The proposed theoretical KMS model combines several DKMS approaches with emerging Cloud Computing and Enterprise 2.0. The model puts the KW in the center of various internal and external knowledge clouds, as responce of the new social environment within organization.

In general two potential cultural and organizational threats for Enterprise 2.0 practical implementation exist [2], reflecting the readiness of the KW to adopt the new technologies, and the slow management shift to open culture.

The future work concern practical implementation and assessment of benefits and limitations of the proposed theoretical DKMS model.

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