Reflections Concerning Some Collaborative Systems
Portal-Based Approaches

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Abstract: - In the present global economy, strongly influenced by IT and information systems evolution, the modern organizations try to face the new economy challenges. It is certain, that the enterprise's performance will depend on the capacity to sustain collaborative work. It is obvious, that all collaborative environments (workgroups, communities of practice, collaborative enterprises) are based on knowledge and between collaboration and knowledge management there is a strong interdependence. Effective collaboration unlocks the potential of the collective knowledge and intellectual capital of the organization and its networks of business partners, suppliers and customers. At the core of true collaboration is the ability to share and catalogue knowledge, ideas, standards, best practices, and lessons learned and to be able to retrieve that knowledge from anywhere at any time. The evolution of information systems in these collaborative environments led to the sudden necessity to adopt, for maintaining the virtual activities and processes, the latest technologies/systems, which are capable to support integrated collaboration in business services. In these environments, portal-based IT platforms will integrate multi-agent collaborative systems, collaborative tools, different enterprise applications and other useful information systems. All considerations have a strong research background, our portal-based proposal for sustaining collaboration and knowledge management in organizations being subject of some Romanian research projects that are fitting in the European research demarches.

Key-Words: - collaboration, collaborative environments, knowledge management, collaborative systems, knowledge portals

1 Introduction

In the present global economy, strongly influenced by IT (information technology) and information systems evolution, the modern organizations are adjusting their strategies and restructuring all activities, their alignement to the constantly changing economy requirements. The new business models are capable of standing for e-business phenomena, wide open to potential clients and business partners.

Collaboration becomes a business strategy, which aims at the optimization of activities/processes within different workgroups, between these by the level of the organization or between connected organizations with the purpose of assuring a competitive advantage in the challenging environment. Nowadays, for an actual collaboration, people work in large virtual teams, spread around the world, including collegues, clients and different partners. Within these groups different projects of common interest are started, projects of short or long term, which in time develop to common competitive businesses [16].

It is certain, that the competitivity of the enterprises will depend firstly on the capacity to pass from the hierarchical and individual character at the workplace, to the promotion of a collaborative work. The evolution of information systems in these collaborative environments led to a sudden necessity to adopt, for maintaining mostly virtual activities/ processes, the latest technologies/systems, which are capable to support integrated collaboration in business services.

By the above statement we mean collaborative systems of conversational tools type, meant to support the socialization and sharing of knowledge at community level, collaborative systems based on software agents, and all these, together with various entreprise applications, will be integrated in portal-based IT platforms [17].

It is obvious, that all collaborative environments, starting with small workgroups, practice communities (of interest, target, action etc.) and finally with collaborative entreprises, are based on knowledge and between collaboration and knowledge management there

is a strong interdependence. Setting out from these presumptions we developed the entire scientific approach about the knowledge portal, i.e.: starting from the substantiation of collaborative valencies of such a portal, from the developing strategies of some IT solutions of this type for the collaborative communities, we proposed an agile development based on the prototype technique combined with MDA (Model Driven Architecture) valencies, as a personal contribution in the conception, design and building of portal-based collaborative systems.

Within an original theoretical approach, we defined agile development in the terms specified above [20], fundamenting the life-cycle phasis of product development. At the level of each considered phase, the necessary steps were established.

The scientific theoretical approach is doubled by the effective development of a knowledge portal for collaborative communities, a practical initiative, which is anchored in a real development project[1]. It has to be mentioned the fact, that the presentation of the portal functionalities implementation is sustained both by the PIM model (Platform Independent Model) and the PSM model (Platform Specific Model) with actual references to the Three-Tier architecture of this portal. Future concerns could aim the approach of the sustaining processes' functionality, so that the collaborative community could be extended to an organisational level.

2   Collaborative environments. Pleading for collaboration

After the scientific foundation of colaboration as a business strategy, the collaborative environments are approached starting with workgroups, practice communities, all these finding their utility within the collaborative (extended) entreprises. At the level of collaborative communities significant importance has been given to the value managemement and also analising the factors, which contribute to the consolidation of this type of communities.

Concerning the collaborative entreprise, this entreprise represents a collaborative business environment, capable to exploit all the advantages offered by collaboration, the collaboration capacity of the extended entreprise, depending on a series of factors, such as the political, economical, cultural and IT factors. It can be appealed to

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[1] Detail elements represent the subject of some grants/research programs such as CNCSIS Grant no. 8/2005 „Informational Collaborative Systems in the Global Economy"; PN II Project nr. 92-100/2008 „Collaborative Support Systems for Economic Projects Management"

a simple questionnaire of primary self-evaluation, by which the entreprise could analyze its layout, from which it starts its demarche of transformation to a collaborative entreprise. Certainly, an entreprise, which is based on practice communities, has real chances to succeed.

An approach regarding the modeling of collaborative (virtual) communities has been initialized by means of multi-agent systems, the modeling of the collaborative behaviour of virtual entreprises representing a research field within there is much to explore. Remaining in the area of modeling, we affirm that the development of informatic systems is necessary as well as the development of all IT platforms for sustaining these collaborative communities, based on some specific formal models.

The major contribution of the author regards the unification in a particular manner of the existing approaches in the specific literature to the debate and the scientific foundation of the collaboration concept. From the new business models point of view, this fact includes profound concerns and involvements in organisational theory and practice, which we consider to have been achieved by synthetising them properly in this paper.

3   Knowledge management. Adapting the existing approaches

According to the defined collaboration, knowledge management (KM) comes to consolidate the collaborative community and through the client orientation (client knowledge management - CKM) it opens the environment to the necessities and the requirements of the clients. We considered the KM life cycle as being formed of phases such as: knowledge generation, knowledge storage/organizing, knowledge dissemination and knowledge auditing and we presented a possible maintenance of this within an unique portal approach as well as by a distributed platform [19].
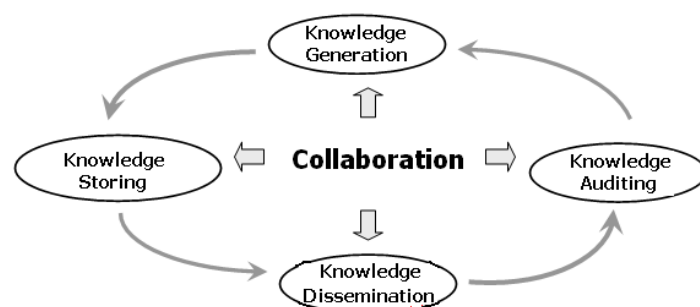

Fig.1 A Model for KM Lifecycle [18]

Together, collaboration and knowledge management give an intelligent behaviour to the collaborative

environment.

We appeal to the three big categories of initiatives in the area of knowledge management defined by Sveiby and we highlight the personal approaches of the author[2]:

- initiatives related to the external organisation environment: - client knowledge management: we highlight the relocation of the client knowledge according to the marks of real collaboration between the organisation and its clients;

- initiatives within the internal structure of the entreprise: - the development of an organisational culture, sustaining the collaboration and all the steps within the proposed KM lifecycle;

- initiatives in the area of competence: - encouragement of tacit knowledge transfers.

Concluding, we can say that knowledge management is not a goal by itself. Businesses don't exist with the purpose of spreading and advancing knowledge - they exist for selling competitive products and services of high quality. Because the competitive advantage is conditioned by an informed decision making within a business, knowledge management has a critical role in the current global economy based on knowledge [8], [13], [23].

We are convinced that the collaboration's profundity together with knowledge management maturity gives an intelligent behaviour to the community.

4 Collaborative systems, tools and technologies

Collaborative technologies underlie a large scope of tools, systems and IT platforms, which sustain collaboration in the global economy nowadays and contribute decisively to the consolidation of virtual collaborative communities of different types. Starting from the general frame specific for the collaborative systems, the charachteristic elements of the systems were synthetised based on software agents, on tools of social/conversational type, as well as on the portal platforms [4], [6], [9]. The utility of integrating diferent collaborative systems/tools is justified as is the utility of different entreprise applications within an IT solution based on portals.

At the end of 2008, Forrester Research Inc. surveyed business environment inquiring about companies' opening towards adopting new IT collaborative

platforms; a trend was obvious, more than 50% heading to collaborative technologies. Based on our research, we propose the adoption of portal platforms at the level of collaborative communities/ environments, and followed by integration of a series of systems, collaborative instruments, and enterprise applications which help to consolidate portal's SOA architecture (Service Oriented Architecture) meant to sustain collaboration as a business strategy.

Without iterating different consecrated approaches in the field of collaborative systems, we will develop our scientific approach around some considerations towards:

- **Collaborative Systems Based on Software Agents**: multi-agent systems offer an innovative perspective on the capacity of configuration virtual communities.

  But some of their capabilities must be perfected, as follows [18]:

  o incrementing the intelligence level of the agents through perfecting their capabilities, aiming autonomy, cooperation and learning;

  o introducing new valences as for agents collaboration within MAS (Multi-Agent Systems) and, maybe even new approaches at protocol level and communication languages (KQML, KIF, COOL, etc.);

  o upgrading the MAS's security level (processes, systems, respectively network security – securing communication between agents).

  It is obvious that developing MAS is a complex process which can raise real problems modeling some collaborative communities. In the last years it is ascertained the emergence of some specialized platforms for developing multi-agent systems, which contributes substantially to reducing the effort of developing those kinds of systems.

- **Collaborative Tools (in fact, conversational tools)**: social or conversational technologies imposed themselves in the last years as tools that sustain knowledge management in collaborative environment [28]. Bypassing the stage of simple conversational support, these instruments maintain tacit knowledge dissemination at the community level, consolidating collaboration through offering various facilities of collaboration

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[2] These approaches are subject of a detailed research within the CEEX project nr. 550/2006 "Strategies, systems, methods and tools for knowledge management in universities"

based on the considered environments' demands/necessities, in literature contouring the concept of „on demand collaboration anytime/ anywhere". Therefore, it is recommended the integration of this kind of tools in IT virtualizing collaborative environments platforms. We recommend the development of these tools with the help of various open-sourse solutions.

- **Portal-Based IT Platforms**: the IT infrastructure of collaborative communities presumes the existence of complex platforms, with various capabilities in order to virtualize a large part of the communities' reality. This can be achieved only with the help of portal technologies, at their level being integrated multi-agent systems with specific functions as well as a diverse range of conversational tools.

We synthetise some of the author's points of view regarding the conception, design and building of collaborative systems :

- the development of multi-agent based collaborative systems occurs according to some specific metodologies, the model-oriented approaches being efficient [25];

- the development of collaborative tools can be simplified by appealing to the open-source market and there is a series of solutions for sustaining on demand collaboration anytime/anywhere [28];

- the portal development metodologies comply with the general system development metodologies, but in literature there exist very few significant marks [1], [7], [10], [26], [27].
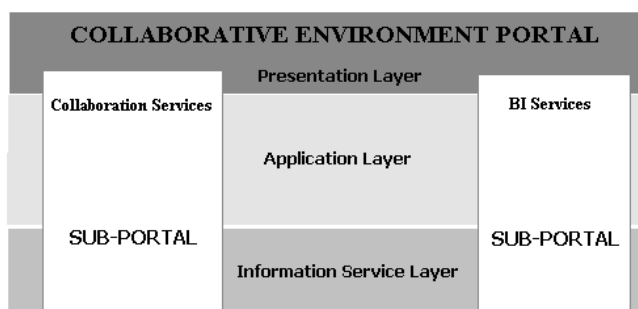

Fig. 2 Portal solution based on sub-portals

In our opinion, the portal development can underlie on the principles of component reuse and standard sub-portals representing elements, that could decisively contribute to a specific lifecycle optimization for this process [18].

We consider, that this proposal could be a future research direction for consolidating the conception, design and building of portals.

Although the ERP applications and the corporative portals are separate initiatives, an unsuspected sinergy is realized, when the entreprise applications are integrated in the collaborative business community portal:

- a unitary modeling is realized at collaborative environment level for the business processes regarding the philosophy of ERP type applications;

- the adoption process of ERP type products by members of the collaborative community is accelerated and this contributes to the augmentation of ROI (Return On Investment) of the whole collaborative platform;

- the portal platform enhances the visibility of the specific ERP system content for the whole collaborative community;

- the ERP, CRM or SCM applications, which are usually adopted for the internal audience, could be externalized through the portal, offering to the partners and to the constant clients access to the developed business;

- a unitary training for the portal platform users could be realised by including within it, the necessary steps of training specific for entreprise applications.

We consider, that such an approach is necessary for the maintenance of collaborative electronic business carried on at the level of virtual entreprises. On the other hand, in global economy the maintenance of value chains includes the integration of constant clients, suppliers and different partners within the extended collaborative entreprise. In this context, the integrated and collaborative platform:

- offers to all extended community members an unique access, personalised and based on user roles, to the multitude of integrated systems and applications (including ERP, SCM, CRM and HR entreprise applications); in the last years the development of some access facilities of the remote portal by means of some mobile devices and vocal systems has been observed; regarding the mentioned entreprise applications, they can constitute themselves in real sub-portals, then be integrated in the unitary portal platform of the collaborative environment;

- promotes dynamic and efficient communication, including virtual collaboration spaces, sustained by a series of collaboration tools;

- allows modelling and business process deployment in dynamic environments, the maintenance applications of these covering up the whole value chain;

- offers to the decident users the information/knowledge as well as the necessary tools for taking the appropriate decisions in the shortest period of time; by means of some dedicated portlets, the integration of some Business Intelligence models is possible, which sustain the decision processes at every level [17];

- at the level of the collaborative entreprises a collaborative management is promoted, the decision making processes being marked by this desideratum[3].

5 Portals development. Recommended approaches

Starting from the metodologies, methods and techniques used generally in the development of information systems, a personal approach regarding quick development of portals has been introduced. After a strict theoretical foundation the proposal has been applied within a real collaborative Knowledge Portal development project. We consider that the agile development proposed by the author (based on the prototype technique enriched with MDA valencies, i.e. the building of a PIM is endorsed, followed by the planning of a PSM for the portal prototype) for proper portal solutions could be also applied to other information systems [20].

The agile development framework, which proposes the use of prototype technique enriched with MDA specific valences, includes the following phases:

- **Conception**: at the level of this phase the PIM model elaboration is targeted, according to the requirements of the knowledge based collaborative community; prior, a feasibility study is made for justifying the efficiency and efficacy of the project, being also made a business plan for demonstrating that the project does or does not bring a measurable benefit; the modelling of the requirements will lead to the outlining of the functionalities of the portal, of the user communities, all this being represented at a level of PIM model;

- **Design**: targets the elaboration of the PSM model specific for the portal prototype, i.e. the finalisation

of the architecture of this model, taking into account all details regarding the IT infrastructure, which must sustain the unitary, integrating vision of the PIM model. The building of the PSM model will take into account the future implementaion solution of the prototype by relating the model to a certain IT platform and to certain maintenance technologies;

- **Implementing-Testing-Installation** (I.T.I): has the goal to implement the portal prototype according to the PSM model, followed by the testing of the prototype. Often, the prototype invalidation as a result of testing its functionality, leads to the revision of the PSM model and aims at correcting some aspects related to technology and the considered IT platform. Practically, the final version of the portal prototype is obtained by an iterative process, which regards the adjustment of the PSM, its implementation and the testing of the prototype solutions for verifying the imposed requirements. After the validation of the prototype follows the portal installation and its transfer to the users, who posess knowledge of the collaborative community.
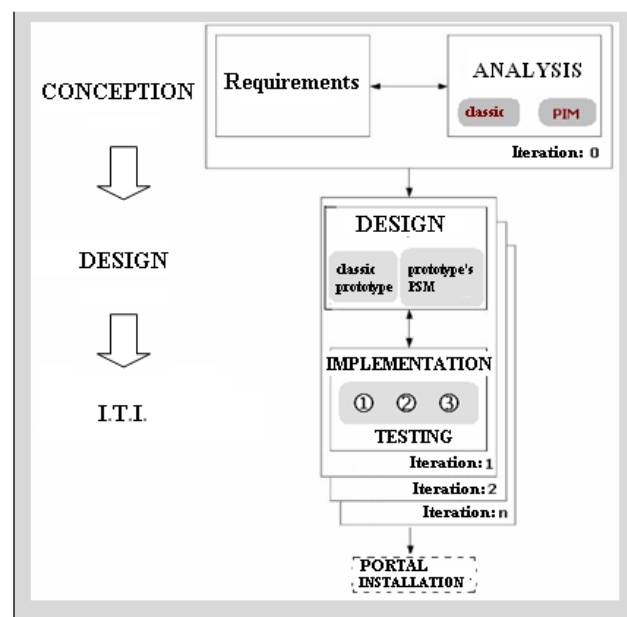

Fig. 3 Agile development[4] of portals

In the development of the portal, we traced the achievment of the following functionalities: content/document management, collaboration and personalisation, also highlighting the relevant references to the implementation specific for the Three-Tier architecture of the portal. By means of the facilities offered by the UML language the specific models of these functionalities were built, which were later

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[3] PNII research project nr. 91-049/2007 "Intelligent systems for supporting economic decisions"

[4] The bases of agile development are grounted in [24]

integrated, first consolidating the PIM model and then the specific PSM. The future researches could target the approach of process sustaining functionality, so that the collaborative community could be extended at organisational level by sustaining also business processes.

According to the particularities of the collaborative organisation/community (the size of the organization; working requirements) will be chosen between a solution of a unique portal or a solution based on a federative model. The federative portals support communication and knowledge/information sharing by the capacities of the remote portlets.

6 Portals. Collaborative capabilities

For remaining competitive, the modern business organization must create a fortunate environment for developing KM processes and sustaining the knowledge life cycle. During its evolution, the portal technology proved to be an IT infrastructure with collaborative valences, which concur to the building of knowledge-based organization. We propose the following basic functional architecture, having as an objective to facilitate the access to the knowledge base (as part of the organizational knowledge, which has been transposed to the portal) of the collaborative community members, the knowledge exchange between them and generally to provide a knowledge flow in the whole virtual community.
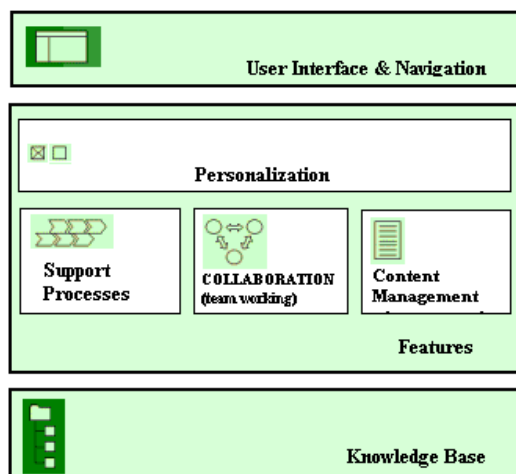

Fig. 4 Portal's functional architecture [11]

Among the functional components of the knowledge portal we will highlight the following four major categories: process support, collaboration, content management and personalization[5].

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[5]The four major functionalities (content/document management, collaboration, process support and

The portal incorporates, horizontally, different collaborative tools [20]. These sustain knowledge management and intervene in different stages of KM life cycle. It's obvious that collaborative tools concur decisively to the creation of new knowledge, on-line "conversations" helping to refine this knowledge and thus generating pieces of knowledge relevant for the organization:

- the e-mail remains one of the most common communication tools in business, at the level of the collaborative environment being necessary to establish a management politics for the messages propagated like this;

- the chat can be seen like a virtual space for voluntary and unmoderated discussions;

- the Internet forums are web applications for hosting discussions and advertising content generated by users;

- the electronic conferences provide the means of bringing people together, enabling easy sharing of ideas;

- the groupware supports and speeds up the activities that are common for workgroups ;

- the blog (personal or corporatist Web journal) – a needful tool for communication at the level of work-teams in a project or practice community) operates based on practices of the storytelling type;

- the wiki, a system that is open to knowledge exchange, offers editing facilities and collaborative content management to the members of the virtual community;

- podcasting represents a method for sharing media files etc. on the Internet.

The knowledge portal, a top representative of portal technologies, represents a concrete IT solution of knowledge management, which was formed, according to Firestone, from the informational portal solution through the building of intelligent sustaining capacity of the whole life cycle KM[6].

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personalization) guide to the outlining of the service oriented architecture, unlike other functionalities, which only provide the operation of the portal in the imposed parameters or, indirectly, sustain these four.

[6] In 2000, Firestone defines the knowledge portal as a solution of support portal of e-business processes in a collaborative (and/or extended) knowledge based organization. In the next years he improves the technical architecture of the portal of type EKP (Enterprise Knowledge Portal) by optimization of the AKS structure and the introduction of intelligent agents, by which the implementation of a distributed knowledge management
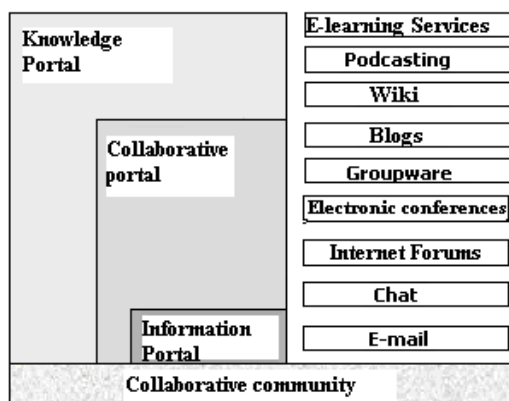
Fig. 5 Portals & Collaboration facilities (adapted from [1])

Taking into account SOA philosophy, all these tools will be integrated with special portlets, as services in the portal architecture and will be provided to the collaborative community users.

At the big enterprises level, a unique portal solution with centralized services is difficult to manage and maintain; it is recommended to use an IT infrastructure based on a federative model which provides the interoperability between different communities/workgroups[7].
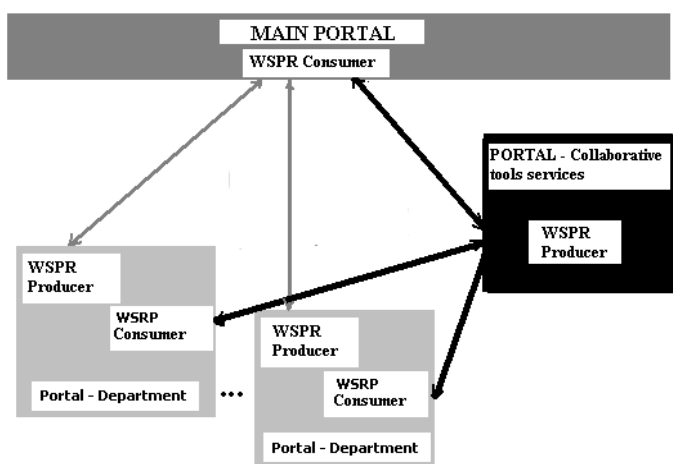

Fig. 6 Federative portals. Implementing collaborative tools

We propose a solution based on a primary interface portal (for the type of top-manager users or users with equivalent rights) and a series of departmental portals having their own knowledge bases and on which specific applications are run ning (for the members of those communities). The top-manager is offered a vast range

of services, some of them integrated through the local portlets, the others through the remote portlets in the departmental portals. The collaborative tools can be locally implemented by the level of each portal or an appropriate remote portlet server can be chosen. This (WSRP producer) will offer to everyone Web services for on-line synchronous or asynchronous communication, which will be called on from distance anywhere within the federative model.

The federative model involves separately administrated portals, so that every portal could be a remote portlet producer (WSRP producer) for others, a consumer of such portlets (WSRP consumer), or could have both roles.

Summing up, the federative portals are distri-buted (remote portlets on different systems localized on distance), very low connected (from the point of view of the autonomy of the remote portlet server towards the portals that call the WSRP services), collaborative (the remote portlets can communicate and share information/knowledge), plug-and-play (easy use and locating of the re-mote portlets) and standardized (they are viable due to the facilities offered by the WSRP, SOAP, WSDL, SAML, SAML, UDDI and WS-Security standards).

WSRP (and the other mentioned standards) together with JSP 168, allow an innovative approach of the SOA architectures, the federalization of complex services, offered in a single frame, being necessary for a better maintenance of these services in a complex environment.

7 Portals. Sustaining knowledge management

The portal must enable the creation of knowledge through collaboration tools, such as chat, threaded discussions and workflow. The created knowledge needs to be captured and stored for future use. In addition, outside knowledge needs to be brought into organization, and users need to be able to easily place their knowledge into the portal. All the knowledge, both structured data and unstructured content, must be easily retrievable. The portal must be configured to push relevant knowledge directly to the users. The level of support for each of these objectives defines the effectiveness of any enterprise portal solution. Considering the KM lifecycle based on phases such as: knowledge generation, knowledge storage/ organizing, knowledge dissemination and knowledge auditing, we present a possible maintenance based on the knowledge portal technology .

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strategy is possible), including the help of competitive collaborative tools.
[7] In 2004 IBM develops, by means of the facilities offered by the WebSphere Portal Server, the first solution of federative portals for business environment.
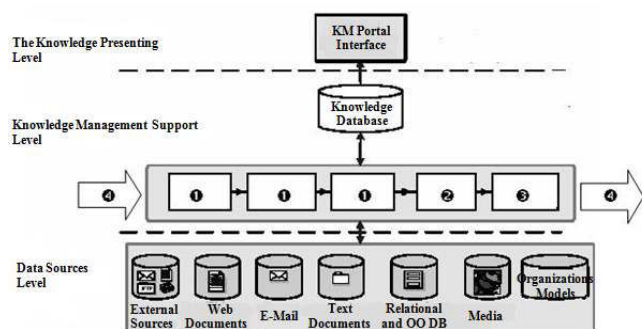
Fig. 6 MK life cycle phases implementation at the portal level [13]

-   **Knowledge Generation**: at the portal level, creating new knowledge is possible through acquiring/attaining of some knowledge pieces from the collaborative organizational environment (or even external from the organization), or is a following of some intelligent reasoning made by modules of artificial intelligence incorporated in the portal's architecture. The knowledge created that way are collected and refined to eliminate unjustified redundancies and filtering the ones most "valuable" for the organization. Creating documents represents a significant percentage of the current activities, so the less time is allocated to this activity, more time will remain for the members of the organization to achieve the other tasks. Therefore, at the portal level, we will have to integrate some instruments that facilitates creating knowledge of document type, such as: text editors, multimedia, Web pages, images, sounds, video editing systems, spreadsheet editors, graphic programming's.

-   **Knowledge Storage/Organizing**: at the portal level, in the central or distributed knowledge database (meta-base), different kinds of knowledge are coded efficiently, assuring quality, accessibility, and their representativeness with the help of some specific tools/technologies. Knowledge can be stored in data warehouses, knowledge databases specific to artificial intelligence, content specific structures or in a documents management system; all these will form the portal knowledge meta-base. One of the forms in which knowledge can be stored is knowledge repository, which stores knowledge that is often text based and has very different characteristics. It is also referred to as organizational knowledge base. A knowledge

repository is not a knowledge base of an expert system, the repository containing all the organizational knowledge, not only the one needed in solving a specific problem. Concordant with the different knowledge storing technologies, we will use specific methods/techniques to access/locate them.

-   **Knowledge Dissemination**: the opening of the portal to its users, the members of the collaborative community, permits accessing the knowledge database and the use of different knowledge. Knowledge sharing goes beyond communication – it provides additional support by ensuring fast access to the latest information, being able to assist users in finding the most up to date knowledge needed for their task and the effective use of that knowledge.

-   **Knowledge Auditing**: auditing represents a complex activity of verifying the conformity degree of the knowledge database with the standards in that domain, and its capacity to sustain the achievement of the strategic objectives of the organization. The main subjects tested are regarding the reliability and performance of the product, the efficiency of the operations and, not last, the security facilities. Auditing the organizational knowledge implies analyzing its impact on decisional processes, the contribution of each piece of knowledge in optimizing business processes, therefore in raising the quality of the products and services offered. At the end of this process, it is possible to have to regenerate some knowledge pieces.

8 Conclusion

The scientific research made within this approach is well founded and convenient, the collaborative communities representing the enterprising's different forms of expressing themselves, which wish to remain competitive in the business environment. Being entirely or partly transposed in the virtual environment, they have to adopt a malleable business strategy, to make decisions based on knowledge, which regards the consumers, suppliers, shareholders, investors or even competitors.

Many innovative companies have long appreciated the value of knowledge management to improve their processes, products and customer service and to create competitive advantage.

The collaborative systems, tools and technologies come

to maintain the work teams, the collaborative communities and entreprises, **the portal-based IT platforms proving their efficiency as infrastructures of the considered environments**. Depending on the particularities of each environment, organizations can choose either a unique portal solution or one based on a distributed model. The importance of paragraph 5 must be highlighted. We consider that the presented theoretical approach concerning portal development could be also applied to many other information systems.

It is obvious that, the collaborative capacities of a knowledge portal consolidate the support of the KM live cycle and sustain the strategy of the organization for innovation and achievement of economic performance by generating knowledge. Each collaborative tool presented above has its own role inside the community; the collaborative tools palette will be established depending on the requirements of the virtual community members.

For Romania, the relevance of the collabortive entreprise concept results from the engagement of our country in the evolution towards the informational society - knowledge society, a condition of lasting development and the consolidation of its european and euro-atlantic integration. It would be risky to assume that, given the differences with higly developed countries, the collaborative (knowledge based) entreprise would represent, on a national scale, only a future problem or an exaggerated sophistry.

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