Multimedia platform to support knowledge processes anytime and anywhere

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Abstract. The paper contains a presentation of the work done in two ESPRIT Projects in the knowledge management area: Klee&Co (Knowledge and Learning Environments for European & Creative Organisations, started in 1998 and ended in 2000) and MILK (Multimedia Interaction for Learning and Knowing, started in early 2002 and expected to be closed by 2004). Klee&Co developed an approach and a web-based prototype allowing users to view knowledge in its context: the main feature of the Klee&Co system is the "view with context". MILK is going to develop a system supporting users in any working situation, even mobile and social situations. It means a strong effort in interface and system design in order to create different technological platforms for PC environment, social environment, mobile environment. To get the expected results, it is important to start from the observation of users" needs and from the definition of a clear knowledge management strategy. The main outputs from the first stage of the MILK project will be presented and discussed to show the relevance of the integration between users, technology developers and designers visions for a successful knowledge management solution.

1. Introduction

The paper is focused on the vision of dynamic knowledge management, as a way to enable learning, communication and networking processes between and within communities of practice. The hypothesis is that "inspirational knowledge" is the driver to enact a network of knowledge-intensive communities, where people and organisations get value from relations and knowledge exchange. In order to do that, we developed a solution where "knowledge objects" can be visualised in their context. In this paper we present two different European research and technical development projects: the Klee&Co project (acronym of Knowledge and Learning Environments for European & Creative Organisations – ESPRIT Project 28842: project partners Irso, University of Milan Bicocca, Domus Academy, Philips Design, Xerox Professional Services) and the MILK project (acrostic of Multimedia Interaction for Learning and Knowing – IST Project – 2001-33165: project partners Irso, Butera e Partners, Orbiteam, University

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of Milan Bicocca, Domus Academy, Fraunhofer Institute, PictureSafe, Xerox Research Centre, Xerox Professional Services).

Klee&Co was aimed at implementing a knowledge management solution to support professional work and business processes in innovative environments like design companies. The goal was to develop a system able to support working processes providing the "right knowledge at the right time". Starting from the Klee&Co output, the challenge of the MILK project will be to define an integrated and comprehensive knowledge management solution supporting professional work in any situation.

2. Knowledge management theories

Nearly 80% of worldwide leading companies have some knowledge management efforts under way. Some of them have already established a clear pattern of knowledge management responsibilities within their organisation chart (Chief Knowledge Officers, knowledge managers, knowledge champions, . . .) [1]. A knowledge management programme is often related to

organisational development, change management and human resources management issues, such as training and continuous learning. This is due to the fact that knowledge management and organisational learning are the two faces of the same coin. A knowledge-based innovative organisation is taking care of individual learning and knowledge sharing processes and is a "community of communities", where people are used and encouraged to launch new ideas to innovate processes, practices and products. Knowledge and learning, indeed, are essentially social activities, by which people evolve themselves as individuals and communities. Connection and interaction between individuals with other individuals, communities, organisations and knowledge are the most powerful source of knowledge creation and sharing [2].

2.1. Tacit and explicit knowledge

A knowledge management system has to manage two different kind of knowledge: tacit knowledge ("kept in people mind") [3] and explicit knowledge (memorised through Information and Communication Technology and paper supports). Knowledge increasing the overall organisational value is not an object stored into a database neither a personal set of competencies and experiences "hidden in people mind". The relevant knowledge for organisations is collectively shared by members and can be effectively used in business processes. So the knowledge creation process is based on the transformation of tacit and/or explicit knowledge into new knowledge. The analysis of knowledge creation and transfer processes is based on Nonaka and Takeuchi model [4].

2.2. Knowledge management and communities of practice

A community of practice is as "an informal aggregation of people who share work practices and common experiences" [5]. The community is the place where social processes are enacted; through these processes people acquire skills and methodologies to act their organisational roles and to develop themselves in a lifelong perspective.

The community of practice is the strategic tool for the enhancement of knowledge and learning processes. In a community of practice people are consciously or unconsciously teaching and learning at the same time. Communities around topics and contents grow up spontaneously and should be recognised and culti-

vated to make them additional arms of the organisation. They have common goals and repertoires (i.e. shared archives), they are based on spontaneous participation and informal behaviour codes, and they are social networks among people sharing the same interests. Social exchanges and relations among people permit to facilitate knowledge sharing and creation processes [6].

2.3. The 4C organisation

A knowledge-based organisation, where learning processes are enacted promoting innovative and change processes, is characterised by some key elements [7]. The first one is represented by professional Communities, where people share needs and interests, values and scope, language and practices. Business processes and work practices are supported by extended Communication and tight Co-operation so that Cognition, information and knowledge flows are externalised and become more accessible for users. Through this network, people at all levels (inside or outside the company, independently from the business process or the working team they are involved in) become main actors in the knowledge processes and in the construction of common spaces of culture, sense, goals and activities.

3. Knowledge management to increase the value of organisations

Klee&Co and MILK projects start from the assumption that knowledge management increase the overall organisational value [8], in terms of performance and assets. They are based on the adoption of communication-intensive platforms, combining the management of objects with the management of people profiles (people experiences and competencies) and relations between people and objects (object to object, object to person, person to person). In Klee&Co and MILK, knowledge management is considered as a way to develop knowledge and communication circles and networking within and across communities: this is the reason why it is so important to understand working practices and organisational culture in order to identify users needs and behaviour. Communication flows in business processes are often hidden for the organisation and, moreover, they are running through different channels. A knowledge management system should capture the exchanged knowledge within communication processes at the scope to move tacit to explicit knowledge and to build an organisational memory. The

results are modified and improved business processes: indeed, several knowledge management projects are named and assume the aspect of change management or BPR (Business Process Reengineering) projects [9].

4. Klee&Co and MILK approach

In this section of the paper, the approach and main features of the two projects will be introduced.

4.1. The "seductive design"

The approach chosen to design the Klee&Co and the MILK solution are strongly focused on the need to integrate three different visions coming from different subjects involved in system design [10]: users, technology developers and designers. An effective knowledge management system has to be understood, used and useful for users: it means that they should be involved in the early stage of system development, the system could be tailored on business processes, working needs and working culture of future users. Technology developers should be involved in the programming and system integration activities in order to translate users" needs into system functionalities. Designers" involvement in the system development is an innovative method to enlarge system"s capabilities from the beginning, also through "look and feel" features and user interaction design (Fig. 1).

4.2. Content, context and community in different working situations

The inspirational side of knowledge management and the idea of dynamic knowledge management have been turned into the Klee&Co prototype in the "view with context" solution (Fig. 2). Information and knowledge are presented in their context and the visualisation changes according to the different working situation they support ("the right knowledge in the right time"). Once a document is launched, the system conducts a background search aimed to find related documents and related people. The Klee&Co prototype is a web-based environment where added value functionalities have been combined with basic document management features. In order to reduce users effort, in Klee&Co the uploading process is supported through a keyword extraction tool and through automatic abstracting technologies. Once the user identifies the file he wants to upload, the system produces an abstract and extracts a

set of keywords. These indexes are used by the system to build relations among objects. In addition to automatic relations, Klee&Co has been designed to track users" defined relations.

Starting from the Klee&co system, which is the MILK solution will be characterised by specific features that can be adapted to:

- the different technological platforms in term of interoperability, integration and performance optimisation;
- users characteristics, activities, roles and contexts providing appropriate interfaces, activity based interaction models and recognizing the different roles and profiles.

5. The MILK knowledge management solution

The MILK project team based the design process on users analysis and observation and is producing quick wins and early technical deployments, in accordance with the Seductive Design Approach, which the MILK methodological approach. The following sections of the paper give an overview of the work done in the first project stages.

5.1. Knowledge needs and requirements

Knowledge needs and working practices of knowledge-intensive companies were discovered looking at two different organizations: a consulting company and a software house, both belonging to the highly dynamic context of professional services providers. They are project-based companies, where workers use to belong to different projects, with different customers located in different sites: therefore, their working activities are characterised by a high degree of mobility.

Both these organizations have specific business expectations concerning knowledge management and MILK solution.

Looking at consultants, they spend most of their time (80%) in front of their customers, not in front of their computers, hence traditional KM technology tools are not adequate, since they focus on working situations where users are invidually working in front of their computers. Consultants are mobile knowledge workers and they need a KM solution able to help them to "stay connceted" even when they are out of the company, in order to stop "reinventing the wheel"; to manage explicit knowledge on shared repositories; to make expert knowledge ("who knows what") visible and accessi-
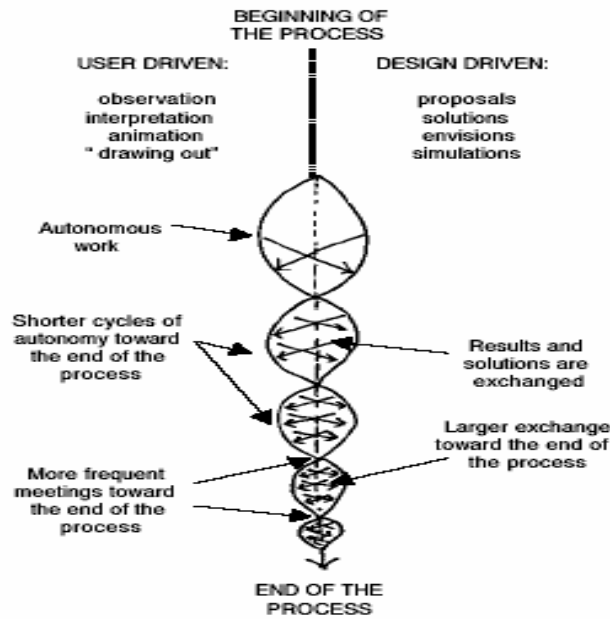
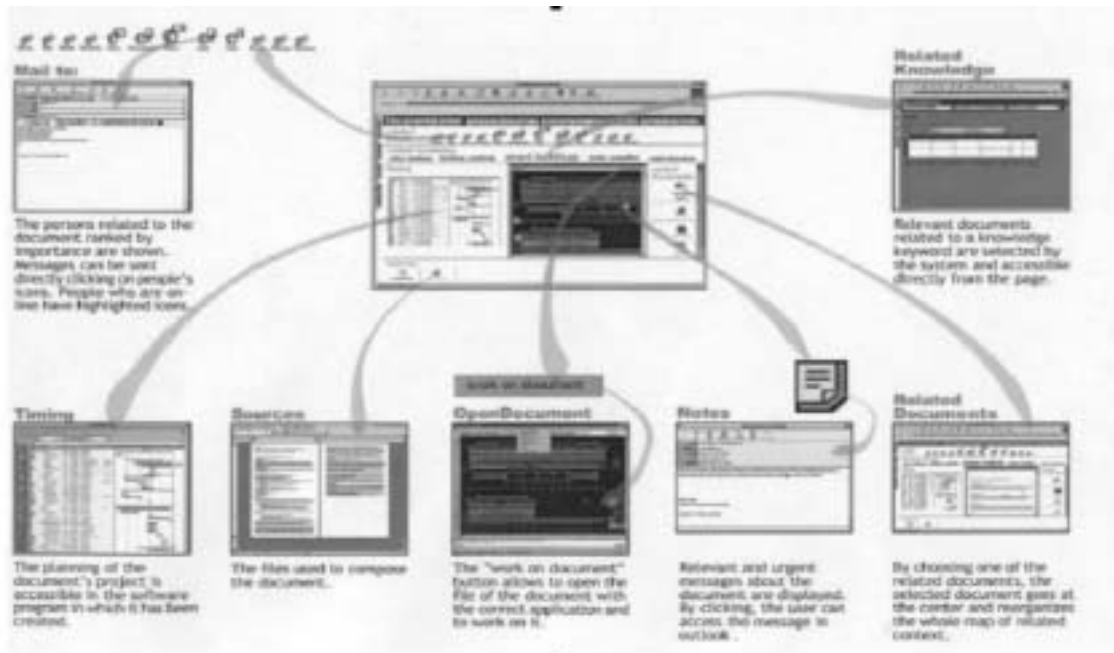Fig. 1. The seductive design approach.

Fig. 2. The view with context.

ble at a detailed and updated level. Furthermore, they need support for the development of new knowledge and for the mutual exchange of tacit knowledge in a context where they have little opportunities for meeting face to face. They also need to integrate the commu-nities working in different physical locations of their company (the consulting company has two different locations), giving people the opportunity to communi-cate through multimedia connections. In addition to those facts, observers detected different clusters – small

teams and small, informal communities of people who produce excellence and innovation: these clusters usually include a few people and are focused on specialistic topics. These kind of communities meet rarely, they mostly communicate through telephone/mail to solve short-term problemes, and they are fully recognised within the company

In this context, people are used to exchange files, information and knowledge related to their projects and their business activities mostly through emails: this means that the number of working emails in the people personal inbox is dramatically increasing, and this communication flow became very hard to be managed.

Concerning the software company, the organization is made of different communities (developers, project managers, sales people and support staff), with different social backgrounds and with different communication structures. Users from this organization believe that MILK could offer a new perception of their company"s opportunities; encourage people to participate actively to knowledge creation and knowledge sharing processes; they also need to make knowledge available in environments that are not connected yet (mobile plus social), in order to enhance the quality of their innovation process and to facilitate knowledge sharing among different communities. This firm, indeed, is characterized by two levels of knowledge circulation: inside each department and among departments. Shared knowledge is not always the same: people of a department manage a type of knowledge to deploy daily tasks, but they exchange another type of knowledge with other departments. For example, operating people manage the interaction between users and systems updating databases, controlling accesses, reporting bugs, etc. Thus, they develop and share "knowledge about customers" among themselves, and at the same time they are able to provide the project manager (PM) with the necessary knowledge to write detailed concepts for new projects. Being the one communicating and exchanging information with all the organisational roles, the PM is a sort of "trait d"union" between different players. Besides, due to the potential lack of strong communication flows between different professional communities, customer knowledge may be fragmented across different functions and roles.

To discover these knowledge needs, the MILK observers conducted an ethnographic analysis at users" sites [11] in order to identify users work practices and main requirements for the development of the MILK solution. The analysis has been realized through the identification of some basic working scenarios concern-

Fig. 3. Example of a working scenario representation.

ing knowledge networks, working processes and physical spaces in which mobile knowledge workers usually work (Fig. 3).

The study focused on the main barriers to knowledge creation and knowledge sharing when people are working in social and mobile environment:

– lack of fast access to documents and information on customers, projects, new products, market and to organizational news;
– need to increase the opportunities to work on innovation processes. Innovation is rarely transferred from one project to another and to the whole organization;
– coexistence of "organizational artifacts": projects, innovative clusters of experts, organizational departments. Each of them produces valuable knowledge which is sometimes not well known by the whole company, with a reduced opportunity to make synergies and support business development.

5.2. MILK concept and technical architecture

In the initial conceptualisation phase, a specific focus has been identified highlighting the relevance of:

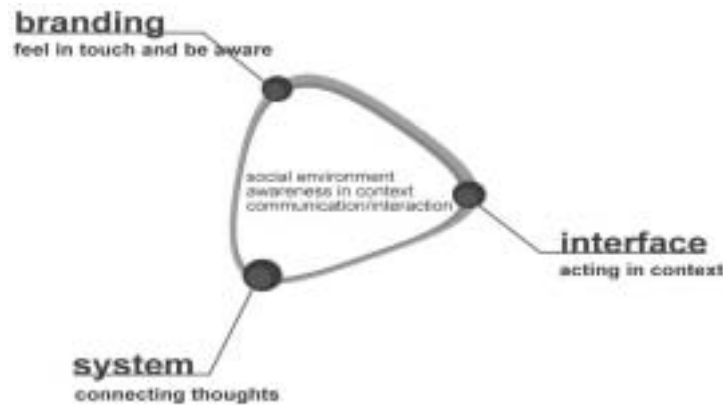– social and community aspects (social environment);

Fig. 4. Three main aspects of the MILK solution.

– awareness mechanisms connected to the variables of the context (awareness in context);
– communication and interaction processes
– branding process (Fig. 4).

Branding: keep in touch and be aware – the focus is on the ability of giving users both a feeling and an opportunity to manage the relation with the others. At the same time MILK provides a seamless access to awareness modalities that help the user to maintain a link between people, contents and processes.

System: connecting thoughts – the focus is on the ability of connecting people and of providing an informal access to their knowledge.

Interface: acting in context – the focus is on the ability of MILK in facilitating the users in their work practises by providing the right information, contacts and contents according to the context in term of people involved in the processes, time framework, activities etc.

In accordance with the output of the user analysis, it emerges the design of a knowledge management based on idea: "the right knowledge at the right time and format". In order to do that, the main MILK metaphor is leveraging on an integrated solution made of three different environments and interfaces (Fig. 5).

– *PC environment:* focuses on *content management*;
– *Social environment:* focuses on *content sharing*;
– *Mobile environment:* focuses on *awareness*.

PC environment

the objective of the PC environment is to provide communities of users with "contextualised" views of information. The work roots on experiences of the previous Klee&Co project in which experiments and demo prototypes have been developed. The information displayed on the screen will be personalised according to user profiles (including access rights, preferences and habits) and on document profiles, (including statistics and users" evaluations).

Social environment

The Social Environment Component will develop user interaction mechanisms supporting collaborations going on in the physical workspace [12]. In particular, we will start from the development of an interactive large screen interface (named CommunityWall) aiming at supporting the full range of social interactions. The CommunityWall is an interactive system for displaying dynamic information in public spaces.

Mobile access environment

The Mobile Access Environment component of MILK provides the end users with situated access to the Knowledge Engine in mobile work situations. The Mobile Access Environment component considers mobile technologies based on the Wireless Access Protocol (WAP), Global System for Mobiel Communication (GSM), General Packet Radio Service (GPRS) and the upcoming Universal Mobile Telecommunication System (UMTS) networks, as well as wireless Lans (WiFi IEEE 802.11). Appropriate user interfaces on mobile devices will be designed and implemented.

The MILK environments will be implemented in an integrated technical architecture (Fig. 6). The MILK system architecture follows a modular approach: each of the three components acts as an autonomous entity which offers its services via an Application Programming Interface (API). By this approach we mean to achieve a high degree of flexibility which allows us to
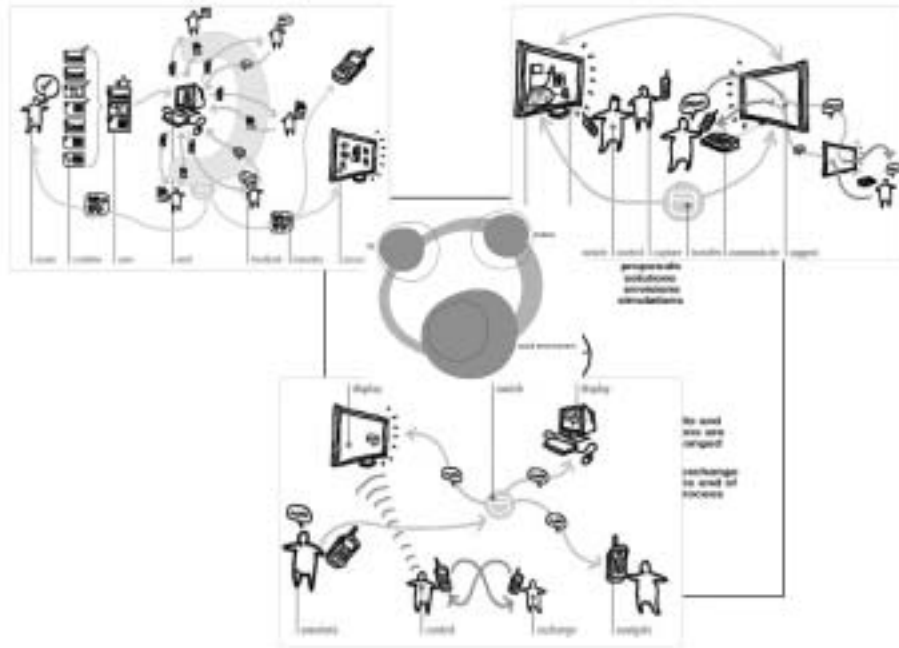
Fig. 5. The MILK solution metaphor.

replace single components without affecting the overall design and with as little as possible effect on the other components.

User data management will be implemented using the existing BSCW (Basic Support for Cooperative Work) system, but may be replaced at any time by an LDAP conformant directory (Lightweight Directory Access Protocol).

5.3. Early deployment of the social environment

The major part of knowledge-creating interactions arises from neither formal nor pre-planned situations: they are spontaneous, short, and opportunistic [13]. They cannot easily take place in current virtual environments. On the basis of these considerations, MILK project team decided to develop CommunityWalls as a multimedia tool, able to support social working situations. CommunityWall, indeed, can allow: gathering workers attention on relevant information; promoting high quality sharing of timely information; providing a window on other people and their availability; promoting exchange among peers; and supporting an adequate collaboration among groups.

In this first stage of the MILK project, after the installation of the large screens in one of the two users" organizations, we are experimenting an early deployment of the social environment. Some basic functionalities have been defined for that environment:

– Visualization of people available in different offices;
– Publication of institutional and community specific information;
– Visualization of other office locations through video connection;
– Videoconference tools.

The innovative element of the CommunityWalls, in its final development, is represented by the Social Broadcasting interaction mode. Through a set of rules, which the users can easily manage and set, the Social Broadcasting interaction mode permits to change the visualization and the priority of the specific system services, in accordance with both the working activities pace during the day and the presence of people in front of the screen. It means that CommunityWalls can broadcast different system services (visualization of people availability, organisational and community events notification, videoconference services, etc.) in different moments of the working day.

For example, CommunityWalls can be set to broadcast in the early hours of the working day the people availability service (allowing people, just entering the office, to know immediately "who is where") and, maybe, in the middle of the day it can broadcast the
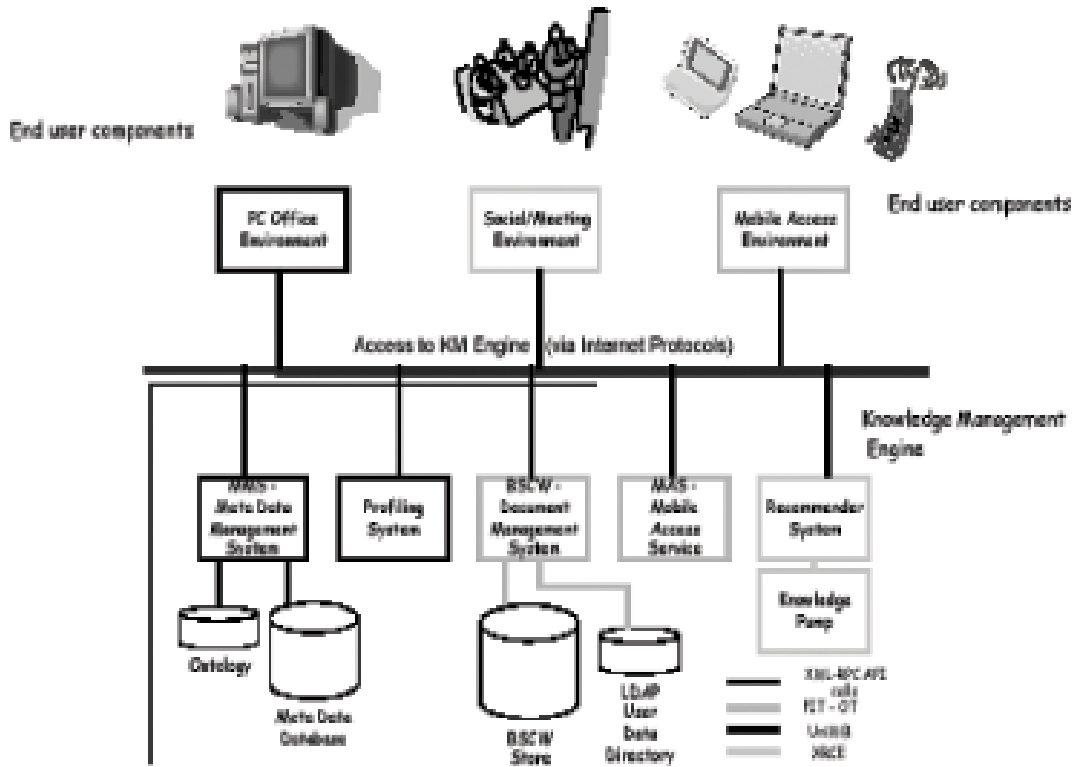
Fig. 6. MILK system architecture.

event notification service (allowing people, just passing in front of the large screen, to be aware about organizational news, meetings, events, ect.). In short, CommunityWalls are designed to allow people to stay in touch and keep aware, looking at what is happening around them.

5.4. Collaborative tools for working over space and time

In this stage of the project we are now experimenting collaborative tools which can be used to support the MILK solution for working over space and time, one of them is BSCW (Basic Support for Cooperative Work): this is a document management system that allows information sharing and management; group organization; and, platform for inter-organizational team and knowledge management. Through the functionality "Cockpit", BSCW (Basic Support for Cooperative Work) offers also the possibility of sharing and structuring information in communities and teams, because it allows to know who is on-line and "who is doing what" and, most important, it allows also to keep social interaction with a group of mobile workers. These

tools are aimed at playing the same role of the water cooler in traditional firms, that is, a source of useful knowledge exchange within social contexts.

6. Conclusion

Looking back at the work done, these are the main findings.

– An effective knowledge management solution should start from the comprehension of users needs and behaviour.
– An effective knowledge management solution is not only a "set of software tools", it is the joint combination of processes, organisation, culture and technology.
– Knowledge in context is the way to effectively support knowledge sharing and knowledge creation processes.
– Users can work in different situations, so the system should be able to present the same contents in different ways.

All these points confirm that a knowledge management solution is a combination of top-down and bottom-up perspectives and implies a cultural change to the way people use to exchange their knowledge among themselves.

In terms of future perspectives, adding "mobile and social working situations" features to a knowledge management system is giving strong opportunities to the development of knowledge processes within organisations. This is also opening a new door towards new ways of working. The MILK social environment is completely changing the space and content perception of an organisation, affecting logistics, people management, content management and visualisation, giving to individuals and groups emerging capabilities, not experienced yet. Same reasoning challenges can be considered for the MILK mobile environment: mobile communication is growing a lot, in terms of services, protocols, devices and related components [14]. Furthermore, third generation mobile devices and Universal Mobile Telecommunications System (UMTS) technologies will be soon available and they will dramatically change the current working environments and business scenarios. It is already very common to have companies which owns more mobile terminals than fixed phones and that have more laptop than desktop PCs. It means that there is a strong need for people to communicate all during the day. Giving employees the possibility to combine communication with knowledge management means to create a strong value opportunity for the company and, at the same time, for the society.

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