

Knowledge networks in professional business services firms

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Abstract: Professional business services companies represent a significant component of growth. Professional services are business services that are based on the application of highly specialized knowledge and expertise. As knowledge is increasingly recognized by modern professional business services companies as their most important source of lasting competitive advantage, the integration of “team-based” networks and KM is essential. This integration led to the evolution of formal and informal knowledge networks within these companies. This paper reviews the role, benefits and challenges associated with knowledge networks in professional business service firms.

Keywords: knowledge networks, knowledge management.

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1. INTRODUCTION

Professional services are business services that are based on the application of highly specialized knowledge and expertise (Dawson, 2000). This specialized knowledge is generally, but not always, certified by credentials from academic institutions or professional organizations. This definition enables us to understand the breadth of the field of professional service industries such as law, consulting, investment banking, and accounting. But it goes far beyond the traditional parameters to include firms in fields such as advertising, architecture, market research, engineering, public relations, software implementation, independent research and development, and many more; all these clearly provide services based on specialized knowledge. In spite of many differences, business within the professional service sector face very similar issues, regardless of the specific professions they are in, because of the fact that they are performing services based on distinctive knowledge and expertise. Table 1 lists key characteristics of PBS firms.

Characteristic	Description
Resources	Their key resources are certainly not fixed assets such as plants and machinery. Information and knowledge is the primary raw commodity used in performing core functions
Products	Their "products" are intangible, i.e. they do not consist of goods, but of complex problem-solving services.
Production processes	Their "production process" is non-standardised and highly-dependent on team-work; the majority of their employees are educated and creative people; their customers are treated individually and the "products" are rather adapted to them, than vice versa; see e.g. Sveiby (1992 and 1997).
Value proposition	Such companies add value to their clients by performing four key functions. These are (Dawson, 2000; Davenport et al., 1996; Starbuck, 1992):

	Adding value to information Developing knowledge and expertise Capturing and sharing knowledge Applying knowledge
Employees	Employees' work is characterised by variety and exception rather than routine, it is performed by professional or technical workers with a high level of skill and expertise. Work is performed in most cases in project teams (e.g. consulting, advertising) but there are also situations in which professionals (e.g. lawyers, architects) working independently (see figure 2.1.1).

Table 1: Key characteristics of PBS firms

Professional business services companies represent a significant component of growth. For example, 50% of the fastest growing companies in the US are knowledge-intensive, service firms, in the sense that they sell the knowledge and the know-how of their employees rather than manufactured products or provide services, while the PBS sector contributes about 14% of the total European value added and 6% of the GNP, which makes it a larger sector than agriculture.

This paper seeks to review the knowledge management (KM) aspects in professional business service firms. At first, we explain the need of KM in professional business services firms and analyse the KM efforts in a number of real cases. Based on the findings of the case study, we identify knowledge networks as key ingredients of KM in professional business services. Therefore, we discuss the social aspects of KM and provide an account of relevant collaborative KM tools. We conclude with a discussion of related research issues and outlook directions.

2. REVIEW OF KM IN PROFESSIONAL BUSINESS SERVICES FIRMS

2.1. The Need for KM in Professional Business Services Firms

PBS firms have three core assets: their people; the client relationships their people build; and the intellectual capital that members of the firm work hard to develop. Because these assets tend to be intangible in nature, it can be a challenge to make the most of each of them. All three assets do have one characteristic in common: Each is knowledge-based. It is knowledge that extends beyond knowing how to do a particular job. It is knowledge of how to deploy people to make the best use of their talents, how to make decisions that help build a strong client base, and how to guide change as markets and conditions change.

The success of PBS firms depends critically on the quality of knowledge which those firms apply to their key business processes as well as on the ability to share this knowledge with clients and develop enduring and profitable client relationships (Dawson 2000). Because of the central role of information and knowledge in professional business service delivery, professional business services firms have been among the first to implement KM programmes. Typical drivers for KM in PBS firms are the following:

- **Competition:** The market place is increasingly competitive and the rate of innovation is rising, therefore knowledge must evolve and be assimilated at an ever-faster rate.
- **Client relations' focus:** PBS Firms can either try to hold onto their knowledge and perform "black-box" services for the clients, or they can proactively share their knowledge, working with their clients to create value. Both of these models are valid; however, the powerful and accelerating forces of commoditization mean that those who are not prepared to work with rather than for their clients will find the fees and margins they are able to command will gradually wither away.
- **Mobile workforce:** There are trends for increasing mobility, which leads to loss of knowledge. The mobility of the workforce will increase to the point where many professionals will regard their career as a series of projects sponsored by a series of companies.
- **The global imperative:** Most PBS firms are becoming international in the sense that they have foreign customer and supplier relationships. More and more firms are becoming transnational operating as truly global companies in the sense that no one region is predominant. Transnational operation requires strong organisational communications and knowledge retention capabilities, which depend on organisational and individual learning and a unifying culture.

2.2. Case in Point: KM in Management Consultancies

Management consulting firms are considered typical examples of highly knowledge-intensive, professional business services firms since: they depend heavily on the expertise of their people; focus on customer relations; employ network architectures, i.e. confederations of professionals engaged in value-added/creativity-added work; the nature of their assignments is team-based and mainly project-focused; and they put considerable emphasis on applied creativity for solving the problems of their clients.

In our case study, seven examples (Arthur Andersen, Booz-Allen & Hamilton, Ernst & Young, KPMG, IBM consulting, McKinsey & Company, Cap Gemini) of KM efforts in consultancies from the literature were examined and analysed.

Knowledge generation

What concerned us in this study is the conscious and intentional generation of knowledge - the specific activities and initiatives firms undertake to promote and leverage knowledge creation. In general, this has been the least systematic of KM activities examined. Often companies examined viewed knowledge generation as a "black box", essentially trying to hire smart people and then leaving them alone.

When we refer to knowledge generation, we mean the knowledge acquired by the firm as well as that developed within it. The most direct way that firms use to acquire knowledge is to buy it - that is to buy an organisation or hire individuals that have it. One significant reason of the recent mergers and acquisitions of the big consulting firms was clearly the acquisition of knowledge. Consultancies that acquire other firms are buying people, that is the knowledge that exists in people's heads and within communities, perhaps some structured knowledge in document or computerised form, and the routines and processes that embody the purchased company's knowledge.

In addition to being purchased, outside knowledge is usually leased or rented. A common type of leasing is a firm's financial support of university or institutional research in exchange for the right to the initial commercial use of promising results. For example, IBM Consulting has developed and uses a Research Database, i.e. a repository for business research with information acquired primarily from external organisations such as the Economic Intelligence Unit and the Centre for Information Systems Research at MIT.

A usual approach that we identified in our study for knowledge generation is the establishment of units or groups specifically for that purpose. Research and Development departments are the most common example. Their overall aim is to come up with new knowledge and new ways of doing things. Ernst & Young's Centre for Business Innovation is a typical example of some kind of R&D department. The centre performs early-stage research

and creates new knowledge around emerging issues in technology and management.

By far the most common process by which knowledge is generated in consultancies is through fusion between knowledge networks. In all firms examined, bringing people together, with either similar or even different perspectives, to work on a problem or project and come up with a joint answer was a usual practice. Networks of knowers, usually talk together in person, on the phone, and via e-mail and use groupware technologies to share expertise and solve problems together. Arthur Andersen is building communities of practice, seen as the primary source of new knowledge, by establishing common aspirations, goals and business objectives. Usually such networks are being administered by knowledge editors or facilitators. For example, KPMG uses integration manager's to motivate, co-ordinate and manage projects where multiple communities of practice are involved.

Knowledge organisation and development

We found that a common practice is for knowledge codification projects to have more specific aims than just making knowledge generally available. IBM Consulting has adopted a customer-centric approach and has set as a specific objective in its KM programme to capture customer information and utilise it in context in areas such as distribution and marketing.

Mapping corporate knowledge sources is an important part of the knowledge organisation process. Once knowledge is found, someone must evaluate it to assess its usefulness and importance to the organisation, and to determine its type. Knowledge in consultancies ranges from the complex, accumulated expertise that resides in professionals, and is partly or largely inexpressible, to much more structured and explicit knowledge like a clear-stated methodology.

Organising the richest tacit knowledge in consultancies is limited to locating someone with the knowledge, pointing the seeker to it, and encouraging them to interact while providing the necessary technological aids to enable a rich communication. Arthur Andersen provides the AA Online system for linking communities of interest across the globe. Through AA Online, consultants can access members of the community for advice, ideas and material. KPMG's Knowledge On Line includes a database-driven expert skills directory. The assembling of virtual teams to work on a project also addresses the same issue: it is based on the understanding that providing access to people with tacit knowledge is more efficient than trying to capture and codify that knowledge electronically or on paper.

Knowledge maps are widely used in order to provide pointers to sources of knowledge. Knowledge maps typically point to people as well as to documents and databases and usually utilise some sort of list or picture that shows where to find important knowledge. For example, Arthur Andersen's knowledge map allows for a top down navigation based on competency area. Knowledge maps are

also used as tools to evaluate the corporate knowledge repository, revealing strengths to be exploited and gaps that need to be filled.

Mentoring or apprenticeship is often seen as way to transfer tacit knowledge from one person to another. Multimedia computing and the hypertext capabilities of intranets provide the capability of effectively capturing at least some meaningful fraction of an expert's knowledge, making tacit knowledge explicit.

Another effort to support primarily organisation of tacit knowledge are the communities of practice. In Cap Gemini for instance, these work teams are specialised in any professional area of interest for Cap Gemini such as Applied Knowledge Management (AKM), Oracle applications, Microsoft products, etc. Communities of practice are also used for knowledge sharing, innovation, and capturing of opportunities by the employees in the specific areas.

Most consulting firms have stored descriptions (references) of earlier projects and their implications for the clients. Such applications are typical in the sense that they are directed towards sales and marketing personnel. In practice, however, even highly structured knowledge, such as a methodology, involves a high degree of creativity, experience, and imagination of the consultant who developed it, that it can not be stored entirely in a database; essential expertise in the head of the consultant needs to be linked to it.

An identified challenge for the cases we examined is the very loose coupling of the processes that produced the highly structured, explicit knowledge with the owners of the tacit knowledge. In most cases, the management of tacit and explicit knowledge was not addresses in a holistic manner.

Knowledge distribution

Transferring knowledge through personal conversations is being threatened by the increasing mobility of the consultants. Field consultants who work daily on the site are less likely to pass on knowledge and insight on clients and problems handled to their colleagues. Information technology, and in particular intranets and Lotus Notes-based applications are seen as substitutes to personal communication although they lack the idea generation capability and serendipity of personal, face-to-face conversations.

Tacit and ambiguous knowledge is especially hard to transfer from the resource that creates it to other parts of the organisation. Some consultancies are addressing this challenge by putting knowledge into circulation and transferring people in and out of the dedicated resource. Knowledge managers for example, can spend a period of time in one domain helping to generate new knowledge before they are replaced by newcomers. However there exists a challenge for most firms to make knowledge distribution an easier and, if possible, transparent process: Consultants should be faced with the minimum possible

overhead in sharing the knowledge gained in assignments with their colleagues.

Technological infrastructure

Although most management consulting firms only see technology as an enabling factor for KM, it is the availability of certain new technologies such as groupware and the World Wide Web that has catalysed their KM efforts. Groupware technologies are seen as a way to get more consultants to share information, experience and knowledge with each other. Intranet portals and Lotus Domino/Notes are the most frequently used groupware application.

Firms such as Ernst & Young have very large repositories of knowledge from serving clients, several of which exceed a thousand different databases. Notes is particularly appealing in professional services because work in that industry often involves travel to the client site, and the replication feature in Notes allows a remote employee to quickly download all new items added to databases of interest and then to peruse them off-line.

Notes- and intranet-based KM implementations are often accompanied by other tools, particularly where the management of external knowledge is concerned. KPMG LLP (UK) for example has deployed Autonomy's IDOL K2 software that manages unstructured information from sources enterprise-wide. IDOL K2 identifies information from KPMG's complex mix of off-the-shelf and custom applications, repositories and external news and research sources, and aggregates it all into a universal index.

Cap Gemini, has a global intranet, called the Knowledge Galaxy, spanning all offices around the world. The network was built in 1995 and has since been developed further and implemented in every Cap Gemini office. The purpose was to share ideas and thereby reduce the need to "reinvent the wheel". There are also local intranets, where some have KM objectives. The Knowledge Galaxy mainly holds assets such as documents of meeting minutes, project references, templates, presentations, PERFORM quality system, etc. There are also discussion forums, corporate yellow pages, statistics, and news available for all the employees.

Search & retrieval technologies are also maturing and offer out-of-the-box functionality for quick deployment and are often complementing intranet implementations.

Organisational infrastructure

Management consulting firms were among the first to realise this fact and have established structures and roles to support KM. Chief Knowledge Managers (CKOs) have been appointed to lead the KM change. CKO responsibilities include building a knowledge culture, designing, implementing and overseeing the knowledge codification and transfer schemes and measuring the value of intangible assets. At Ernst & Young, for example, the CKO has set up a substantial organisational infrastructure

that includes "knowledge networks" for each key practice area.

The day-to-day work of KM in professional service firms requires people who will extract knowledge from those who have it, output it in structured form, and maintain or refine it over time. Andersen for example has "knowledge integrators", who are sufficiently expert in a particular domain to determine what knowledge is most valuable and they synthesise it. The firm also has "knowledge administrators", whose work focuses on capturing, storing, and maintaining the knowledge that others produce. Additional roles include technical staff that can install and maintain such knowledge-oriented software packages as Lotus Notes.

However since KM is everyone's role, active consultants are in all cases expected to contribute to the firm's knowledge capital and to use it in client work. At McKinsey for example, line consultants write articles as frequently as specialists in industries or functions. Research and practice development projects are typically staffed by active consultants, who thereafter go back to client service. At Ernst & Young the employees who compile and maintain knowledge repositories in particular industry or practice areas are former active consultants who have extensively worked in those areas.

KM efforts are in some firms links to the competence development process. In Cap Gemini for instance, every year the employee discusses the future of his/her employment and the movement in the competence model with his or her superior. The positioning in the model depends on what courses, experience, and knowledge the individual has. The purpose of this model is to visualize the company's competence structure. Another purpose is to visualize the career possibilities for the employees. By analyzing the future need for competence, e.g. due to the HAVS strategy, and comparing it to the competence structure today, it is possible to identify where competence will lack. This makes the model an excellent tool for managers to analyze the competence distribution today and where to direct competence development efforts.

2.3. Discussion

Existing KM efforts in consultancies can be typically characterised as "management-driven". Senior management, faced with strong market (such as internalisation of business) and internal forces (such as mobility of workforce), is recognising KM as a management practice to gain competitive advantage. This approach guarantees senior management support which is a key enabler for KM success. Senior management is also driving the overall change management process that should accompany any major "management-driven" initiative: They try to foster a knowledge-sharing culture; provide incentives and motivate professionals to capture, share and use knowledge and reward them for doing so. Moreover, senior management can assist the KM effort by clarifying what type of

knowledge is most important to the company and focusing the effort in the core business priorities; removing barriers and providing funding for the infrastructure; and making sure that the organisation's commitment to the KM effort is widely communicated throughout the firm.

The management-driven KM approach has merits and in many cases yields results. It provides clarity of purpose and vision, two critical factors in any type of organisational change project, but also two particularly important elements of successful KM projects. Senior management also assures that the KM project is linked to economic benefit or company success. However, on one hand it is costly and on the other hand it is not easily sustainable: It requires significant investment in change management, in establishing formal knowledge processes and organisational structures and in deploying expensive technology.

Another conclusion that can be drawn from our study is that issues of information technology infrastructure are less critical, as intranets emerge as a standard medium for collaboration and distribution and advanced searching, indexing and collaboration functionalities become an out-of-the-box functionality. However, local data persistency is still a necessity since professionals are highly mobile workers, working often at the client premises.

Regarding the nature of knowledge managed, the focus should be equally on tacit as well as explicit knowledge. Tacit, non-observable and complex knowledge in particular should be kept, but also, nurtured and leveraged, given that competitive advantage increasingly depends on tacit, difficult to replicate knowledge assets. Moreover, it is imperative for PBS firms to aim at embodying knowledge that is carried by individuals, into organisational routines. That is, converting personal knowledge into organisational knowledge and hence increasing its potential to create value, rather than moving information from "one head to another".

Finally, building organisational infrastructures for KM (such as knowledge networks) is a highly demanding task that involves establishing a set of clearly defined roles and expectations. Management consulting firms have rigorously addressed it in all cases we examined. However, it should be noted that excessive focus on roles and responsibilities, at least at the initial stages of the project, can be overwhelming and may lead to a "knowledge management bureaucracy" that could inhibit the progress of the project.

3. KNOWLEDGE NETWORKS

3.1. Knowledge Networks Definition

Modern organizations have come to acknowledge that knowledge is their most important asset in enhancing their competitive potential. However, the route to gaining lasting competitive edge does not lie in the management of present knowledge, but rather in being capable of incessantly generating new knowledge, and to diversify into new

products and services (Seufert et al., 1999). Therefore the sensible approach is not just to regard companies as agents who process information, make decisions and solve problems, but also to realize that knowledge seeking and knowledge creation is becoming increasingly more important and to integrate KM into networks (Seufert et al., 1999).

Concerning the integration of networking and KM, there are two crucial aspects (Seufert et al., 1999). First, KM should comprise a holistic view of knowledge, that is to say, the integration of explicit and tacit knowledge. Furthermore, KM should comprehensively regard where or rather how knowledge is being created and transferred. To focus on explicit knowledge only, or still to take a confined view of work, learning and innovation areas would incur the risk of erecting barriers of various kinds, functional and hierarchical, for instance: barriers to customers, suppliers and cooperation partners; or mental barriers which impede the generation, transfer and application of new knowledge, leading to hindering in short-term flow of knowledge as well as serious deterioration of a company's innovation- and learning-ability in long term. In the case of an integrated KM, knowledge barriers should be overcome by "networking", and knowledge islands should be cross-linked in order to stimulate the evolution, dissemination and application of knowledge.

According to (Gartner, 2006) the KM processes are the creation, capture, organization, access and use of knowledge. Furthermore, collaboration is seen as the heart of the Knowledge Management Process Model (Figure 1), because it is considered that KM does not exist without collaboration. The term "Knowledge Networking" signifies a number of people, resources and relationships among them, which are assembled in order to accumulate and use knowledge mainly by means of knowledge creation and transfer processes, for the purpose of creating value (Seufert et al., 1999). As these networks of knowledge-resources are continuously being increased by knowledge gained from learning situations, Knowledge Networks should be viewed as dynamic structures rather than static institutions (Seufert et al., 1999). In our view Knowledge Networks build a collaboration form supporting the KM processes.

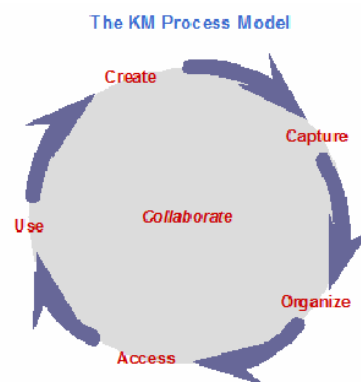


Figure 2: Knowledge Management Process Model (Source: Gartner)

3.2. Characteristics of Knowledge Networks

Berli et al. (2003) cite the characteristics of knowledge networks in terms of their evolution process, the roles assumed by network members and the relationships formed among them, as well as the type of knowledge shared within the networks.

As regards the evolution of knowledge networks, we can differentiate between intentional and emergent ones. Intentional knowledge networks are perceived as newly-created in their entirety, whereas emergent knowledge networks already exist but have to be cultivated in order to enhance their performance. This can be achieved, for example, by creating a common language among participants or developing a common set of values and objectives.

Members in a knowledge network can be people, groups, communities or organisations. There are many different roles that the members of knowledge networks can assume. From an organisational viewpoint, customers, suppliers, competitors, or government organisations, as well as employees, are allocated specific roles within the network. Furthermore, members' contribution within the network can be either active or passive. The type of membership within the network can be task-orientated or output-orientated. While some members may identify strongly with the network and demonstrate considerable dedication, others may be less attached and therefore less committed to it. Further, the type of membership can substantially vary depending upon one's position within the network. A member can be at the core of the network or more at the periphery (Wenger et al., 2002); s/he may assume a knowledge domain or practice role, a leadership role, a support role or an intermediary role (Fontaine, 2001).

In order to improve the connectivity of the members through interaction within the network, we have to examine the relationships between them. The characteristics of these relationships are the "platforms" for knowledge exchange. Relationships within networks can vary in duration, intensity, as well as the frequency of the interactions (Seufert et al., 1999). This naturally implies the personal involvement, commitment, and care behind the relationship. The immediacy and interactivity of the communication of the knowledge networks' members is inextricably linked with the media richness of the communication tools they use. The connectivity of a network also depends on the size of the network. Centralisation, formalisation, posture, or geographical scope of the network influence the way knowledge is exchanged. Entry barriers, participation possibilities, and ownership can restrict the flow of knowledge. Moreover, the integration of business, the origin of the network, and the ownership play a distinct role.

Knowledge shared within the network can vary: it can be explicit or tacit. While explicit knowledge, coded in formal language, can often be easily transferred through electronic media or other forms of documents, tacit knowledge, being rooted in personal experience, subjective perceptions,

values, and emotions, is difficult to share with others. To share tacit knowledge, direct communication among people is crucial. Focusing on explicit knowledge only, not only restricts knowledge sharing but also entails the danger of erecting barriers to the inter-personal exchange of tacit knowledge.

3.3. The Benefits of Effective Knowledge Networks

The integration of KM into networks yields benefits for organisations. These benefits are greater for those firms whose cultures are already strategically aligned and steeped in trusting relationships, than for companies that do not possess these organisational attributes (Deloitte, 2001). The openness and richness of knowledge networks help companies create, share and apply organisational knowledge and leverage their knowledge assets more effectively. According to Millen et al. (2002) and Allee (2000) there are three distinct categories of knowledge networks benefits: individual, networks and organizational benefits. According to Deloitte (2001) and Seufert et al. (1999) the most important benefits of effective knowledge networks are:

Employees become more productive and make better decisions faster, due to the fact that they have easier access to relevant knowledge, spend less time looking for information and have more time to apply it.

The evolution of knowledge networks is also believed to increase the innovation rate, as a result of the communication between enthusiastic, self-motivated, diverse sets of people. Powell et al. (1996) demonstrated a ladder effect, in which firms that have or participate in knowledge networks competed more effectively in high-speed learning races. Rather than trying to monopolise the returns from innovative activities and forming exclusive partnerships with only a narrow selection of organisations, successful firms positioned themselves as the hubs at the centre of overlapping networks, stimulating rewarding research collaborations among the various partner-organisations.

Furthermore, knowledge networks help firms to minimise the costs associated with finding, organising, and leveraging knowledge and to increase the quality of knowledge (Allee, 2000).

To achieve these benefits, companies cannot simply push new technologies to their employees' desktops and expect them to collaborate with creativity and innovation. To begin, employees must be willing to share their knowledge. Therefore firms must be prepared to invest first in their people – and second in the technology they employ to perform. Explicit permission to participate may be necessary and job descriptions as well as performance metrics and reward systems may need to be redefined.

3.4. Types of Knowledge Networks

Knowledge Networks can be informal as well as formal (Beerli et al., 2003):

- Informal networks can be regarded as loosely-knit group consisting of individuals who share a common interest, and who are willing to share the information they have regarding their interest. Communication among members may not be regularly sustained, as a result of absence of cohesion and shared purpose. Members of such communities know what the interests of the other members are. The lack of an implied practice and the relatively low involvement of group members do not cultivate high-care relationships. Since informal networks come into existence bottom-up, they originate from the employees' interest, but they run the risk of gradually disintegrating due to the fact that they are hardly visible to the management and consequently receive no support (Fontaine, 2001). Examples of such, informal, networks are the communities of interest and the communities of practice.
- Formal networks represent a group of people having a specific issue or a problem to solve occurs as a result of a specific goal. The participation of members in this network takes place with a view to their experience and their abilities or interests with respect to knowledge. As a rule, the development of formal networks is not prompted by the members themselves, but by management, i.e. managers identify knowledge networks based on the strategic goals of the organization and therefore formal networks come into existence top-down (Wenger et al., 2002). These networks have a high formalization degree. This common goal provides cohesion for the group's identity and fosters commitment. Members of formal networks are consistently chosen from different sectors and skill areas with a distinct view to generating creative friction and intellectual conflict among their diverse viewpoints. Such networks are temporally and mostly end with the completion of the task. Project teams and task forces are some formal networks.

Project Teams, Communities of Practice & Formal Knowledge Communities

The essence of a project team is a set of interdependent tasks that contribute to the achievement of a specific, predefined goal. The team makes a commitment to this goal and ensures that individual commitments are kept. A project team is time-bound, since their members come together to accomplish a specific task and when their objective is met, they disband (Kaplan, 2002). In a project team, legitimizing occurs principally through the assignment of formal roles and relationships (i.e., team membership and structure are defined external to the team) (Lesser & Strock, 2001). The team leader keeps the team focused on its deliverable and coordinates individual contributions to the overall objectives. Project teams have a discrete lifespan that's tied to specific business deliverables (Kaplan, 2002) and after achieving their goals they disintegrate and their learning

tends evaporate as well. As a result, new teams often repeat the mistakes of past teams. The organization, in a sense, doesn't become any smarter.

On the other hand, the essence of a community of practice is the members' personal investment in its domain. A community of practice is a group of people who come together to share what they know, learn from one another regarding some aspects of their work and advance a specific domain (Kaplan, 2002; Nickols, 2000a). A domain is different from a task; it is not so much a specific achievement as a territory, an area of shared interest that the community explores. Community members are connected by interdependent knowledge, not by interdependent subtasks. A community coordinator does not "lead" the community in the traditional sense, but brings people together and enables the community to find its direction. A community may undertake specific tasks and projects in the course of developing its practice. It may charter a team to establish a standard or to document a procedure. But the community is not defined by any of these tasks. Rather, it is defined by its fundamental commitment to exploring its domain and to developing and sharing the relevant knowledge. Communities of practice tend to live longer than teams – creating knowledge among participants in a continuous and iterative fashion. In this sense, the knowledge is "sticky." It is more easily retained and evolves through members' consistent participation. As indicated above, members of a community of practice establish their legitimacy through interaction about their practice. (Lesser & Strock, 2001)

While the term communities of practice usually refers to self-organizing and self-governing communities, in PBS more formal community formations are also met. We call these formal knowledge communities (FKC). According to (Nickols, 2000a; 2000b) FKC are established, chartered, and supported directly by management, are expected to produce measurable results that benefit the company and get needed resources. FKCs have more formal roles and responsibilities than other communities of practice, but they are much more self-governing and wide-ranging than typical project teams.

Sometimes communities of practice can be converted or transformed into FKC through a process of migration that involves identifying them, recognizing them, supporting them and, finally, influencing them (Nickols, 2000b).

3.5. Tools for Knowledge Networks (Collaborative KM Tools)

Knowledge networks members belong to multiple organization units or even organizations and work in dispersed locations. Therefore, they have a strong requirement for flexible and easy to deploy collaborative KM tools. These support knowledge network members working together and sharing information in a decentralized, distributed environment, as they bring geographically dispersed teams together across great distances. This results in many benefits for organizations and their employees,

such as tremendous time and cost savings, faster and better decision making, increased knowledge worker productivity, improved communications flow throughout the organization as well as parallel processing within organizations over great distances (KM Tools, 2002). We serve the following selected technologies contributing to knowledge sharing within business networks to give a picture of the currently most important technologies supporting knowledge networks.

Large distributed, global organizations have a hard time locating experts in given subject areas. Since the most efficient way to transfer skills and knowledge is from one person to another, this presents a problem for many of today's virtualized and geographically distributed organizations hindering collaboration or reuse of expertise. Expertise Location and Management Tools provide help in finding the expertise needed by asking a database, a person or a community. In the best implementations, the three are functionally linked, so that if the answer can't be found in the database, there is a direct link to an individual expert or to a community. Expertise management combines expertise capture applications, that allow the structure of knowledge in a knowledge base and then provide an engine and an interface that enables users to access that knowledge base with specific queries, and expertise profiling applications identifying experts and their areas of expertise, and presenting it to users in a searchable format (Logan, 2006 a). Examples of systems that enable expertise capture include Talisma for customer self-service, and Portblue and Mindbox, classic expert system-building applications, while vendors, such as Tacit Knowledge Systems, AskMe and Entopia, are leading the way in expertise profiling applications, though major players, such as IBM and PeopleSoft, are sharpening the expertise location systems in their toolboxes, as well.

Wikis are relative newcomers to the commercial collaboration space, even though the technology has been around in one form or another since the second half of the 1990s. Wikis constitute an extreme form of "Web democracy", since they are Web pages that can be edited by any reader or can have authentication set by the site owner. Enabling shared authorship and delivering facilities for multiple authors to work on content, exchange ideas and connect information in a potentially sophisticated network of pages, Wikis can foster rapid and easy collaboration within business networks. Wikis can be used to create multiple workspaces with page hierarchies and page linking for projects or topics. Taken together, a wiki can deliver functionality similar to discussion groups, bulletin boards, workspaces, blogs and a range of other asynchronous collaboration facilities. This all means that wikis offer at least a partial alternative to the big collaboration suites. Wiki software is often available at low cost, as shareware or as open source. They are evolving rapidly — RSS and Atom feeds are available, and Ajax-based front ends have also appeared. There are now wiki templates for Lotus Notes, and Microsoft is likely to include wiki-like functionality in

Office 12 by year-end 2006 (0.7 probability); hence, the technology is on the edge of mainstream adoption. Open-source alternatives include MediaWiki, JSPWiki, WikiTikkiTavi and WikiWiki, and other commercial offerings include Socialtext's Workspace and Confluence from Atlassian. Finally, tools such as IBM's Activity Explorer are expanding the notion of a wiki to include shared collections of user-editable, ad hoc workflows. (Logan and Austin, 2006) (Haris-Jones, 2006)

Visualization tools have been developed to investigate the structure of knowledge domains and knowledge within domains and include tools like taxonomies and knowledge maps (O'Riain et al., 2004). Taxonomies, i.e. shared classification scheme of terms, provide assistance for the classification and structuring of knowledge. Customers typically receive a predefined taxonomy, according to which documents are classified automatically, although the user or a domain expert overrule the classification. Therefore, users not only are saved the extra work and trouble of manually categorizing what they create, but they also avoid the risk of creating inconsistent, non-comprehensive and badly-organized taxonomies. Some of the companies offering taxonomy-based products are Verity and Entrieva. Knowledge Maps can provide assistance in identification of knowledge that falls between tacit and implicit leading to its codification, and therefore they represent a route to overcoming the taxonomies' hierarchical limitation. They originated in 1993, but their long-term future is unclear.

Social tagging as a form of metadata management has interesting implications for KM. Also known as "folksonomies," social tagging is a way to obtain user-created metadata that doesn't rely on the tedious, error-prone and notoriously expensive method of having document authors or editors supply it. Social tagging sources metadata creation to communities of users, reflecting what *people* really think and call things, rather than what an editor "thinks" they should be called or what an author "knows" these things as. Because many hands make light work, social tagging isn't as labor-intensive as traditional tagging. One of the best known examples of social tagging is del.icio.us; others are Flickr and Furl. Although social tagging can improve information access and help with community building, its application is limited in a corporate context. (Logan, 2006 b)

4. RESEARCH ISSUES AND OUTLOOK

In the modern (knowledge-based) economy, hardly any company remains unaffected by the evolution of network-like relationships within and between firms. The complexities in tasks and the demand for creative work from the workers have shifted the style of work from, historically, one of coordination and cooperation to collaboration and the management's focus from the traditional "process-based" framework to a "teams-based" network structure (Tsui, 2002). Since knowledge is

increasingly recognized by modern organizations as their most important source of lasting competitive advantage, the integration of "team-based" networks and KM is essential. This integration led to the evolution of knowledge networks signifying a number of people, resources and relationships among them, which are assembled in order to accumulate and use knowledge mainly by means of knowledge creation and transfer processes, for the purpose of creating value (Seufert et al., 1999). Knowledge networks are not just formal networks with high formalization, e.g. project teams and task forces, occurring as a result of a specific goal and having a specific issue or a problem to solve, but also informal networks without cohesion and shared purpose, e.g. communities of information and communities of practice, which are loosely-knit groups consisting of individuals who share a common interest, and who are willing to share the information at their disposal regarding their interest (Beerli et al., 2001).

Knowledge network members belong to multiple organization units or even organizations and work in dispersed locations and therefore, they have a strong requirement for flexible and easy to deploy collaborative KM tools. While in the last years comprehensive sets of tools including a mixture of different technologies supporting communication have increased, the individual components are not always well integrated (Harris-Jones, 2006). Since the trend grows among users who are seeking to support a broad range of collaboration capabilities for the purposes of teaming, collaborating and sharing knowledge and buyers are specifically asking for a "laundry list" of technical functionalities, including communications, shared work spaces and coordination services, the integration of collaboration technologies is vital.

It is not only integration among different communication technologies which directs the development of collaborative software. Collaborative software must be flexible enough to support informal as well as formal networks (Woods, 2003). As mentioned above, a knowledge worker participates in both informal and formal knowledge networks. While informal collaboration is typically defined bottom-up by the requirements of the team or community supported, formal collaboration is more often defined top-down in accordance with the needs of the organization for process control. As (Woods, 2003) notices, collaborative KM tools should balance the different requirements of informal and formal collaboration, that can also be understood as a relationship between practice (how people work together to get the job done) and process (the explicit or formal definition of how work should be done). At best, there is a creative tension between those two aspects of work, but, too often, they are in conflict and thereby undermine the effectiveness of the organization.

Furthermore, the metadata management is an important topic affecting the development of collaborative software. Metadata management provides a complementary approach in better organization of data in cases in which search and analytical functions are not working well enough due to

inconsistencies and ambiguities in the data. Metadata makes it much easier for machines to process and interpret the data automatically. This is extremely valuable for the knowledge worker of modern companies, who still participate in manual processes, e.g. accounting processes, and have to copy data from one application and paste it into another or, even worse, re-key data into different applications. Metadata management can enable most data transfers to be fully automated.

Semantic, ontology-based, technologies have to play an important role in the development of collaborative KM tools. Due to the increased availability of data and evolved standards within the corporate environment in the last years, applications of semantic technologies within an organization in the area of KM increase. New semantic architectures are enabling organizations to co-manage or converge their KM and information management initiatives, since they make it possible to bring together unstructured data that can be associated with KM with structured data most often associated with information management and bring together information sources, which, previously, would have been more difficult. The semantic wiki is such a supporting technology.

The application of ontologies in information systems in the area of KM allow the integration of heterogeneous information items within the corporate memory (Mika, 2003). But to create an ontology supporting a network within a company is not an easy task, since there are many problematic issues concerning metadata. First, metadata tends to be scattered and there are often conflicting approaches for describing the same things. Second, creating coherent metadata can be difficult and expensive, and third, it is not easy to interpret different proprietary metadata schemes in various application modules. To overcome these difficulties, it is necessary to regard the collaborative KM tools developed as embedded in the network which they support (Huysman and Wulf, 2006), and therefore, to take into consideration the social context elements (Mika, 2006). Knowledge networks must not be seen as merely sets of users, but as an integral and dynamic part of the architecture and the organization should take a more active role in the development of ontologies by helping in capturing of domain-specific metadata (Mika, 2006). Otherwise, networks will create their own ontologies and islands of semantics will arise (Mika, 2006).

NEPOMUK promises to provide a solution for knowledge workers participating in knowledge-based networks within and across organizational boundaries taking into consideration the above mentioned trends/problems. One of NEPOMUK's aim is to facilitate the knowledge sharing within knowledge networks using semantic, ontology-based technologies.

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