

INTER-ORGANIZATIONAL KNOWLEDGE MANAGEMENT SYSTEMS: TYPOLOGY AND CASES

Kafentzis, Kostas, National Technical University of Athens, Iroon Polutexneiou 9, 15780
Zografou, Greece, kkafe@softlab.ntua.gr

Apostolou, Dimitris, Planet Ernst & Young, Apollon Tower, Louise Riencourt 64, 11523
Athens, Greece, dapost@planetey.com

Mentzas, Gregoris, National Technical University of Athens, Iroon Polutexneiou 9, 15780
Zografou, Greece, gmentzas@softlab.ntua.gr

Abstract

Although companies are more and more developing complex networks of connections with their partners and customers and shifting their focus towards expanding the knowledge management concept externally, research addressing the management of knowledge across organizational borders is rather sparse. Our aim in the present paper is to develop a typology of cross-organizational networks of information and knowledge flows. In order to arrive at such a typology we examine two issues. The first concerns the locus of control on the processes that enable knowledge flow. The second refers to the tradability of the streams of knowledge that flow among organizational entities. We examine four types of knowledge networks: open knowledge networks, private knowledge networks, closed knowledge exchanges and knowledge markets. For each type of knowledge network, we examine its distinct characteristics, study related examples, consider the associated research challenges and analyse an indicative case.

Keywords: Knowledge Management; Inter-organizational networks; Collaborative commerce; Extended supply chain management.

1 INTRODUCTION

The positioning of knowledge assets at the center stage in private knowledge networks is in line with the recent trend in the strategic management literature that positions knowledge as the primary resource [Drucker (1994)], which is also the primary assumption in the Knowledge-Based-View of the firm [Eisenhardt and Santos (2001)]. The goal of knowledge management has been to leverage both explicit knowledge and tacit knowledge and to reduce the size of the organizational knowledge gaps. In order to achieve this, a common thread running through many knowledge management initiatives is the challenge of developing and supporting new network-based communities, through which companies can improve internal collaboration and work more closely with partners and customers. This has led to ideas about “work as a network of conversations” and the “hypertext organization”, see Nonaka and Takeuchi (1995). Networks may take various organizational forms, ranging from communities of practice between individuals with similar experiences and/or purposes to supply chains of companies that exchange knowledge within their industry. As companies are getting aware that they are part of a complex network of connections with their partners and customers their focus is shifting towards expanding the knowledge management concept externally: they explore new ways to cultivate and exploit the knowledge chains with customers, suppliers, and partners and share with them their intellectual capital. However, research addressing the management of knowledge across organizational borders can best be described as sparse, see Holtshouse (1998). It is these inter-organizational knowledge networks and relationships with external sources of knowledge and expertise that is the focus of our analysis.

The aim of this paper is to develop a typology of cross-organizational networks of information and knowledge. In order to arrive at such a typology we examine two issues. The first concerns the locus of control on the processes that enable knowledge flow. The second refers to the tradability of the streams of knowledge that flow among organizational entities. We examine four basic types of knowledge networks: “open knowledge networks”, “private knowledge networks”, “closed knowledge exchanges” and “knowledge markets”. For each basic type of knowledge network we examine its distinct characteristics, study related examples, consider the associated research challenges and analyse an indicative case.

2 KNOWLEDGE NETWORKS

Knowledge networks are relationships among entities (individuals, teams, organizations) working on a common concern and they embed dynamism for collective and systematic knowledge asset creation and sharing; see Seufert et al. (2002). The structure of a knowledge network implies principles of coordination that not only enhance the individual capabilities of member entities, but themselves lead to capabilities that are not isolated to the network’s members. Cooperation can also engender capabilities in the relationship itself, such that the members develop principles of coordination that improve their joint performance. Or they might involve more complex rules governing the process by which innovations are collectively produced and shared. In this sense, the network is itself knowledge, not in the sense of providing access to distributed information and capabilities, but in representing a form of coordination guided by enduring principles of organization.

As knowledge networks across the organizational borders are more and more common (e.g. in the form of learning networks or linked to collaborative commerce efforts), various research challenges as well as managerial implications are evident. In the following sections we classify the various categories of knowledge networks and examine the related research directions using evidence from action research projects.

3 A TYPOLOGY OF INTER-ORGANIZATIONAL KNOWLEDGE NETWORKS

As our interest in this paper focuses on inter-organizational flows of knowledge, the aim of this section is to develop a typology of cross-organizational networks of information and knowledge. In order to arrive at such a typology we examine two issues: the locus of control on the processes that enable knowledge flow and the tradability of the streams of knowledge that flow among organizational entities. So, the first axis of our typology for knowledge networks examines the control over the knowledge sharing processes. We classify knowledge networks into: “closed”, where a single firm or a small group of firms control and own the knowledge transfer and its outcome; and “open”, in which control and coordination are provided by a third-party, for example in the role of an intermediate. An emerging pattern from the existing practice of knowledge networks considers “closed” networks also as private, non-intermediated, with high degree of control and a few participants, while on the other hand “open” networks are public, intermediated, with low degree of control by participating parties and many participants. Hence, we may distinguish knowledge networks by the “nature of the community” in terms of control and privatization degree as closed or open, see Figure 1.

A second classification axis could be based on the nature of the knowledge exchange. Because knowledge is a scarce resource, it has an intrinsic value that can be assessed by economical terms. In altruistic communities, the value of knowledge is the property of the whole organization, whereas in other communities knowledge is exchanged on individual or group level. In the latter cases the return for providing knowledge is valued by financial, e.g., money or stocks, or communicational, non-financial equivalents, e.g. reputation or decorations. We call this dimension of knowledge networks the “nature of exchange”, see Figure 1.

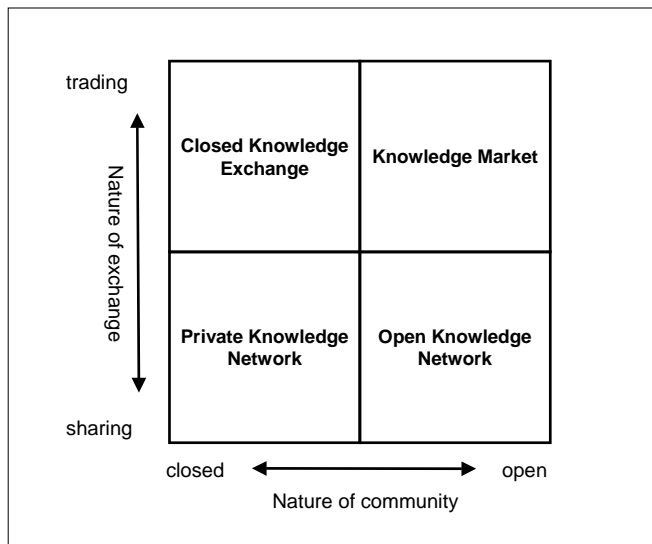


Figure 1. *Typology of Inter-Organizational Knowledge Webs*

Our research on knowledge sharing and trading networks shows that four basic types can be identified. We call them “open knowledge networks”, “private knowledge networks”, “closed knowledge exchanges” and “knowledge markets”. Open knowledge networks include inter-organizational structures that facilitate knowledge sharing, usually among a large number of participants, who may not have co-operated in the past – or may even be competitors. In the majority of cases organizations that actively participate in an open knowledge network share a common concern and expect to find knowledge relevant to this concern within the network. Usually open knowledge networks are purpose-driven and expertise-based. These attributes differentiate this category from other

organizational structures, mainly from communities of practice; see e.g. Wenger (1998) and Wenger and Snyder (2000).

Private knowledge networks are mainly found as an extension of collaborative supply chains and hence exhibit two significant characteristics: they are usually organized by a leader company in a value chain; and the participation of other – relatively limited in number – organizations in the private network is certified and endorsed by the leading company, see Ovum (1999). Hence, participants in private knowledge networks are usually treated as business partners who have developed rigorous and close relationships with the other members of the network.

The closed knowledge exchange category exemplifies the supply of knowledge in a manner analogous to the provision of information-intensive services by standardized channels. This category offers its members the opportunity to access quality information and knowledge objects of an expert organization and interact with highly knowledgeable professionals who can provide solutions to specific problems. Normally the number of suppliers and buyers are fewer than in an open market; however, the relationships between interacting parties are close and structured.

Finally, knowledge markets refer to open and commercial marketplaces – analogous to the ones of business-to-business (B2B) marketplaces for goods and services. The idea of an open knowledge marketplace with many different buyers and suppliers implies that price and volume are the most important determiners of supply and demand, which is also the case for commodity goods; see Wijnhoven (2001). This may take place in knowledge markets when many suppliers offer similar products, which are clearly identifiable, highly codified and thus receptive to comparison. However, knowledge markets may also support the trading of more intangible assets like information intensive services or even tacit knowledge represented by the skills and capabilities of experts.

Hybrid cases of the above four basic types may emerge by merging the characteristics of one with the other. For instance, an open knowledge network may provide value-added services for a fee or impose a membership fee for access to specific parts of the network. However, the majority of knowledge networks actually active in practice may fall within one of the basic four types. The following sections outline the main attributes of the four categories in more detail and present a case study in each one.

4 OPEN KNOWLEDGE NETWORKS

Open knowledge networks focus on the facilitation of sharing among a large number of participants. It is interesting to note that the participants in an open knowledge network may be either close collaborators, or ad hoc partners or even competitors. Usually, the reason for bringing the members of the network together is a specific shared concern. These networks are driven by the need to address this concern (purpose-driven) and by the availability of expertise to address it (expertise-based). In many cases an intermediary plays the role of the coordinator of the network's processes and knowledge flows and provides the necessary governing rules and controls for the efficient operation of the community. Standardization consortia like W3C and OpenSource communities belong to this type of network, while the most characteristic example is the "learning network" a scheme which has been introduced recently in several countries in Europe. Learning networks are inter-organizational networks, formally established to increase the participants' knowledge and innovative capability.

The term learning network does not refer to networks where learning simply happens as is the case with Communities of Practice (CoP) – groups of people who share a concern, a set of problems, and who deepen their knowledge and learn by spontaneously interacting on an ongoing basis; see Wenger et al. (2002). On the contrary, learning networks are formally established and defined; have a structure for operation with boundaries defining participation; have a primary learning target; have formally developed processes that can be mapped on the learning cycle; have practical learning outcome that can be measured; see Bessant and Francis (1999). A learning network is usually a formal initiative involving both private and public sectors (e.g. companies, Universities, industry associations, research councils etc.) that in most cases leads to the creation of a new legal entity undertaking the role of the

broker or the operator of the network. On the contrary, CoPs in most cases remain informal and without having a legally established management structure.

Examples of learning networks include professional associations (Institute of Mechanical Engineers, UK), sector based associations of firms with common interests in the development of the sector (Automotive Cluster of Styria, Austria), region-based networks (3rd Italy), government-promoted networks (London Innovation and Technology Counselor's network, UK).

As learning networks are the most advanced instance of the category of open knowledge networks, the following paragraphs focus on their characteristics, the required functionalities of information technology infrastructures for their support and the research challenges therein. Learning networks exploit the widely used approach of "action learning": the active participation, challenge and support of groups of employees facing similar problems; see Pedler and Boydell (1991). The whole idea of action learning is based on the combination of personal example (the action dimension) with the notion of learning community. This concept stresses the value of experiential learning and the benefits that can come from gaining different forms of support from others in moving around the learning cycle. Previous research of Bessant and Francis (1999) has shown that the successful operation of a learning network requires three things. First an intensive participation is needed of people (from both the broker and/ the members) who have decision-making authority. Second active interaction is required from member organizations, in order to guarantee efficient sharing of knowledge and to exchange experiences. Third, captured knowledge has to be diffused across organizational borders by allowing people to access the learning content in order to derive benefits for a wider set of people and to enable the conversion of learning outcomes into specific changes in organizational routines.

Developing an appropriate Knowledge Management System (KMS) for a learning network can enable its members to counter with all these problems; by minimizing their losses from missing particular sessions; by increasing both the duration and the efficiency of learning; by providing training services to lately joined members enabling them to cover part of the lost ground; see Apostolou et al. (2003). For example, a system could incorporate functions to keep related documents and other material (e.g. training courses etc.) or it could expand the exchange of knowledge in between the learning sessions and hence increase the efficiency of learning.

Learning Networks typically charge fees to the companies that join the network, nevertheless there are completely different strategies adopting by existing networks for doing so (Bessant and Francis, 1999). Some LNs rely mainly to external funding while the members fees represent only a very small part of their income. Other LNs aim to attract additional resources which come mainly from large companies participating in the networks. Some LNs provide premium services at an added cost to their members while other generate revenues from commercial exploiting the knowledge generated during their operation. Finally the way the benefit coming out of the participation in LNs may come comes out of the collective learning sessions. In other words most of the benefit coming out of the network activity is captured at the network level from where the individual companies-members should draw and benefit their organisations. In other LNs although there are some benefits that are captured at the level of the network, most of the benefit comes out from either activities taken place within limited groups of companies or more often in individual companies (within individual learning sessions).

4.1 Case in Point: The KNOWLABORATION project

The toolkit developed in the KNOWLABORATION¹ project provides support to five² typical types of LN users:

1 KNOWLABORATION: Knowledge Applications for Collaborative Inter-Organizational Networks, IST - 2001 – 32505.

2 The sixth stakeholder of Learning Networks (policy makers) is currently not supported by KNOWLABORATION.

- The managers of the broker - organization, which co-ordinates or wish to co-ordinate the knowledge network.
- The managers of the collaborating organizations who have decision making responsibilities within the network; the number of managers with such responsibilities vary from a few people representing all members to one representative from each collaborating organization.
- The employees who participate in actual learning and knowledge sharing sessions of the network.
- The employees who do not participate in specific learning sessions of the network; usually members appoint specific persons to follow the learning sessions of the network who however find it difficult to convey the learning content of the sessions to the rest of the organization.
- The employees of associated members (if existing) who can also reap the fruits of learning that is taking place within the network, if the network decides to allow access to the shared knowledge base; this is the case of members which pay reduced subscription and have limited participation and access to the network. Depending on the specific case, a learning network may allow access to unregistered Internet users.

KNOWLABORATION has been piloted in three learning networks: Ecole de Paris - a public sector organization in the executive education field in France, AC Styria - a regional automotive cluster in Austria, and the South Dublin Chamber of Commerce. The main reported benefits that the KNOWLABORATION toolkit brings in the operation of learning networks are summarized as follows: topics of discussion can be decided quickly and interactively between the network members, group facilitators and the network operator; the content of each learning session maintains in the system, for following up and for those who missed the session; interaction between group members is possible before and can continue long after the physical meetings; colleagues who are not members of the group can access and receive relevant parts of the learning took place within the actual learning session; new members can catch up with the rest of the group; finally, an interface is provided with learning and developments of other groups and the whole network.

5 PRIVATE KNOWLEDGE NETWORKS

The recent take up of private knowledge networks has allowed companies to share knowledge more effectively because they offer the: required deep collaboration between interacting parties; the speed and flexibility required for timely provision of critical, sensitive knowledge products; the privacy and control needed to create trusted relationships; and the quality of service that is a prerequisite for customer satisfaction. On the other hand public networks fail to cater for mission-critical collaboration that is the requisite in most cases at a supply chain level since many of the capabilities and services required to drive significant value have been difficult to implement in a public environment. Public exchanges have struggled with a number of issues including [Ferreira et al. (2002)]: the massive scope of true transformation of an entire industry's value chain; the integration of multiple technologies; addressing member concerns around security and privacy; enrolling, and integrating member company trading partners; and convincing industry leaders to use standard capabilities and relinquish current advantage. The complex capabilities that proved difficult to enable in a public exchange environment are now being implemented with compelling results through private collaborative networks. Unlike their public counterparts, private network capabilities can be tailored specifically to the companies' unique value chain needs and opportunities, can be built rapidly, and can provide the companies with the desirable level of control over the network processes and knowledge flows.

Private knowledge networks are usually organized in a value chain by a leading company, and aim to extend the notion of the virtual community to include stakeholders outside the company; see Ovum (1999). The challenge in such initiatives is the development and support of network-based communities that will provide collaborative engineering environments, support work with suppliers and business partners and forge new relationships with customers. Knowledge sharing activities within a private knowledge network are typically linked to commercial exploitation of knowledge or other commercial transaction (e.g. launching of a new product into the market, supplying components).

5.1 Case in Point: The WIT project

The effective management of external relationships is vital to the success of several users whose business revolves largely around collaborative joint ventures. The close relationships that these organisations have established with business and supply-chain partners relies heavily on the co-ordination, transfer and exchange of knowledge, best practice and learning. Several users expect collaborative working with their suppliers and customers to increase [Ovum (1999)]. Knowledge management is key to enabling them to complement each other's strengths and is shaping their partnership and supply-chain management strategies. Furthermore, knowledge sharing at the supply-chain level can enhance the competitive advantage of the supply chain as a whole (Bell et al., 2002). Several companies are already using their intranet/extranet technology to provide a platform for enhancing their partner relationships, e.g. British Aerospace, JD Edwards Business Partners and Michelin; see Ovum (1999) and KMWorld (1998).

The concept of 'knowledge chains' was central to the WIT³ project's approach. In WIT we see knowledge chains as linked processes that run parallel to the well-defined links in the supply chains of the wood / furniture sector. Processes such as the design and synthesis of furniture items to suit the needs of the customer use and supply information to supply chain processes such as product design or sales. To support such processes, the WIT project developed an environment that enables the downstream entities of major manufacturers (franchisee shops, designers, architects) to have easy and real time access to up to date product databases. Business partners could be kept aware of the latest product series, gain a rich visual representation and good understanding of their properties, query about delivery dates and costs and even decide and have their orders extracted and automatically delivered to the manufacturer over Internet. Furthermore, the possibility to reconstruct, through VRML techniques, the details of the client site and to realistically position therein the proposed furniture items, can help shorten the time to the conclusion of the design, and to the agreement and full satisfaction of the client.

This WIT platform operates partly locally on the end-user's computer and partly in collaboration with remote entities (WIT-servers). Technically, WIT is based on a 3-layer service architecture, where the main elements are: (1) WIT-N layer, its main purpose being to provide directory services, which will help clients navigate themselves to the correct sites, where meaningful (to their purpose) product information might be hosted; (2) WIT-server layer, hosting three kinds of services (and the respective data, naturally): User administration, product data delivery and a "point of contact" service (collaboration brokering); and (3) WIT-client layer, consisting of an applet that provides an integrated user interface to the WIT functionality. The end-user may search for furniture products, thereby building up his own customized product catalogue, build interior designs with the chosen products, negotiate prices or other details and finally, place orders.

WIT has been piloted tested by two major European industries in the wood / furniture sector. Primarily, the WIT networked infrastructure helped these companies increase the "surface area" of their supply chains, or the number of points at which they provide access to knowledge. Companies that participate in the WIT-enabled supply chains are much more likely to stay in the knowledge flow than those that do not. Such access is as important in continuously refreshing knowledge as it is in acquiring it in the first place. For instance a designer can visit the WIT virtual world to see and read about a new product of company X or she can search among the WIT servers for a product that fits her needs. She will then be able to discuss with other users (architects, designers, etc.) or with the manufacturer itself about product functionalities, best practices or she will be able to see successful installations. In a way, WIT has the capabilities of fostering an organic community. Clearly, the

³ WIT: Enabling Data Sharing And Business Interactivity Across The Wood Sector Value Chain By Developing A Custom Set Of Internet Based IT Tools, ESPRIT 1997 - 17345

technology is seen only as an enabler; it is the community members that will maintain the ties that bind them together. The role of the technology - and of the broker providing and maintaining it - is to further facilitate the growth of that community by assuring that value chain members enjoy closer contact with each other and with the knowledge sources.

6 CLOSED KNOWLEDGE EXCHANGES

As already mentioned previously, the closed knowledge exchange category exemplifies the supply of knowledge in a manner analogous to the provision of information-intensive services by standardized channels. This category offers its members the opportunity to access quality information and knowledge objects of an expert organization and interact with highly knowledgeable professionals who can provide solutions to specific problems. Usually the number of suppliers and buyers are fewer than in an open market; however, the relationships between interacting parties are close and structured, the buying company can attain higher control over the knowledge exchange process, the rights and obligations are well-established and contractual agreements governing the transaction.

There are some reasons why a closed network like this may be a better means of supplier-buyer interaction than open markets. First, it may be too difficult to select the best supplier in cases of an over-abundance of suppliers and networks thus it serves to reduce search costs. Second, stable knowledge networks as provided by standardized knowledge supply channels establish trusted relationships that also encompass a mutual understanding of the domain and expertise. Third, the intangible nature of many knowledge products complicates with price formation and ownership. Finally, it may be difficult to detect who may be interested in the knowledge products outside the lines of known people.

Closed Knowledge Exchanges can be found in areas with formalized and codified languages (type A), such as engineering, computer science and business audits but also in areas with informal languages such as traditional consulting (type B). In type A we find again well-established, specialised languages which are used to exchange complex knowledge. In particular engineering has developed formal codes that are the basis for describing and solving problems. These codes are learned over years at universities. Engineering associations are important links so that also people on the job keep inside the moving scope of the language. Examples for type A knowledge suppliers are The Welding Institute for engineering and Caliso Consulting for ISO9000.

Consulting companies tried over years to establish a common language that gives enough freedom for differentiation but gives enough logical structure so that companies can unleash transferred knowledge. Nevertheless consulting is still a people-oriented knowledge network so that knowledge supplies are attached to single experts who transfer their trustworthiness to additionally supplied consultants. In more formalized areas of economics, business consulting can provide knowledge supplies in the sense of type A. Examples are know how on procedures for the evaluation of mergers & acquisitions and other controlling areas.

The demand for Closed Knowledge Exchanges of type A is rising as the market for expertise gets more transparent. This will nurture fractal and distributed organizational structures which temporarily in-source high-level expertise as known from the pharmaceutical industries for product development. This requires an industrialization of knowledge-based organizations. Knowledge suppliers can either operate independently or in conjunction with others. In the latter case marketplace functions are required. Additionally they can integrate, syndicate, or meliorate knowledge services of suppliers as it is known from the newspaper industry.

6.1 Case in Point: The INKASS project

The INKASS⁴ project focused on developing a knowledge exchange software platform with trading functionalities, i.e. a knowledge marketplace. The INKASS knowledge marketplace is being piloted as a closed knowledge exchange by the management consultancy Planet Ernst & Young (PLEY). PLEY's expectation of the INKASS platform has been both to provide an electronic medium channel for supplying knowledge to its established clients and for extending its market reach to selected SMEs and other organisations that do not typically hire consulting services. To fulfill these objectives, and following the methodology of Schmid and Lindemann (1998) for designing media platforms – described in detail in Apostolou et al. (2002) – we identified the specific system support we would like to provide to the users for trading knowledge assets. According to Schmid and Lindemann (1998), the trading lifecycle of a knowledge asset, can be considered as a sequence of four phases; Information, Intention, Contracting and Settlement.

In the PLEY knowledge marketplace, the Information Phase refers to the tracking of the best-suited knowledge product for the user need. This phase is the most important phase in the case of consulting companies, because the user need is rather vague and often can't be clearly expressed. In this phase, the user is able to retrieve knowledge about the documents and services of a consulting. The result of this phase is the establishment of sufficient knowledge by an agent in order to conclude if and how interaction with the consulting company will occur. In the Intention Phase, the agents signal their intentions derived from the knowledge in the knowledge phase and from their desires and goals. Offer, counter offer and demand are the prevailing form of expressed intentions in a consulting company. In the Intention Phase, the system designed provides a variety of workflows to be executed by the company and the client. The Request For Quotation workflow for instance, concerns two agents, the buyer and the seller, and realises an iterative negotiation process between the two agents aiming to reach an agreement between the buyer and the seller. In the Contracting Phase, and in cases where new knowledge is to be created, the agents create contracts as service level agreements, starting from the agreement reached in the end of the Intention Phase. The Contracting Phase is implemented as a separate interoperable e-contracting model implemented on XML and Java, providing the capability to be adjusted to any consulting company's operational needs. The result of this phase is a legally binding contract which documents the agreed upon obligations of supplier and buyer as far as they are not already defined in the protocols. In the Settlement Phase the agents have to act according to the negotiated contract. This includes the payment for the products or services purchased and the delivery to the buyer which may involve the use of specialised services. The result of this phase is the correct termination of a knowledge transaction (i.e. a successfully executed contract or a mutually agreed form of cancellation of the transaction). INKASS is providing a workspace, shared between the buyer and the seller, as an ad-hoc means for submitting deliverables and communicating messages related to the work specified in the contract.

7 KNOWLEDGE MARKETS

Knowledge markets are open and commercial marketplaces where knowledge assets may be traded in a manner analogous to B2B marketplaces of goods and services. This analogy is clear when highly codified – and thus receptive to comparison – information goods are traded. Knowledge markets, however, may satisfy more complex demands for specific knowledge by adopting flexible mechanisms (human mediated or automated) that allow for information bundling from primary information objects residing in large repositories. In this case the opportunities of meeting specific information and knowledge needs is much higher than in marketplaces with only pre-bundled

4 INKASS: Intelligent Knowledge Sharing and Trading, IST 2001 - 33373

information and knowledge products. Examples of this kind are market information services and news agency services, which enable their customers to buy a selection of information objects based on their specification. The most advanced forms of knowledge markets are the ones that allow the trade of procedural knowledge (know-how). Problem solving can be seen as a step-by-step procedure that allows one to ensure the achievement of a desired goal situation. In formalized areas, these procedures can be packaged and sold. Examples are certain types of due diligence methods or credit risk procedures. If the buyers are able to understand the logical structure, which contains the necessary roles, required expertise, and step-by-step behavior of the procedure, then they can successfully apply it to perform certain tasks or solve specific problems.

Although the previous may lead to an assumption that only codified products, namely explicit knowledge, are traded in the aforementioned marketplaces, yet the reality has proved to be quite different. A number of knowledge markets have emerged during the last years providing community infrastructure and innovative business models in order to tap a latent source of knowledge; the tacit knowledge residing on people's heads. Most of existing knowledge markets are targeted to individuals or very small enterprises. Yet, in some cases major players have been induced to participate like Sun Microsystems which saw a potential in Hotdispatch and agreed on linking the Sun developer connection to the expert community. For a more detailed analysis of knowledge markets, see Kafentzis et al. (2002). A crucial issue in knowledge markets refers to the role of the intermediary, i.e. an organization which aims to match knowledge supply and demand, and has the control of the knowledge-trading medium. Such intermediated internet-based knowledge markets that support buying and selling of knowledge assets across internal organizational boundaries are a relatively recent phenomenon, see Muller et al. (2002). Existing approaches vary on a number of issues.

An in-depth review of existing implementations presented in Kafentzis et al. (2002) identified the following points of consideration for the development of knowledge marketplaces: knowledge has manifold complex context and content features, which determine its applicability and usefulness in a given situation; thus knowledge assets can not be described and retrieved with a simple keyword retrieval; in electronic knowledge trading one can not simply copy ways of working that are already known from traditional business, but should exploit the strength of manifold synchronous and asynchronous communication means; the technical, business and organizational mechanisms for managing and maintaining an electronic knowledge market do not derive from simple adaptation of conventional e-commerce paradigms. These issues are crucial for knowledge markets. The fact that a marketplace is a meeting point of agents with different languages, mental models and world perceptions, significantly increases the complexity of this network category. Sharing a common understanding of the needs, and the knowledge assets that meet these needs, depends on the one hand on the degree of formalization of the language used within the specific agent community served by the marketplace.

Finally, a rich representation of the problem and solution space is necessary in knowledge markets. The breaking point is the representation of the traded knowledge assets, which, as showed in Kafentzis et al. (2002) is usually weak, though some of the examined contemporary marketplaces employ interesting metadata sets for their knowledge products. Usually, a knowledge product is classified to a more or less elaborated hierarchy of subjects. Potential usage context (which may be different from a pure content description in some cases) is very seldom described. Furthermore many other aspects (like evaluation of knowledge quality, community aspects, feedback mechanisms, etc.) are either not supported at all, or there is only an implementation of some functionalities which uses implicit data structures not generally known or accepted.

7.1 Case in Point: HotDispatch

HotDispatch is a knowledge marketplace that addresses the need of IT/IS professionals for in-time solutions to specific problems by providing an electronic medium for buying and selling knowledge assets such as questions and answers, projects and software. The company has set up a community that

allows for the development of trust relationships between buyers and sellers mainly by the utilization of a reputation-building mechanism and the employment of payment mechanisms that eliminate the sellers' financial risk of transactions, namely the possibility of not receiving compensation for their services. HotDispatch provides several means for locating knowledge the most usual and powerful being to pose a question or outsource a project and expect answers or bids from sellers. In the case of a question posting the buyer includes a fixed price that represents the total amount the buyer is willing to pay for solutions and which is divided as payment among all providers contributing to the solution according to the buyer's appraisal of their work. On the other hand when outsourcing a project, which is distinguished by a question in terms of solution complexity and labour time, more flexible negotiation mechanisms could be used including one-on-one negotiation and sealed bidding. The project is assigned to a single seller so that synthesizing a solution on a combination of approaches is not possible in this situation. Following the assignment a communication process commences for reaching an agreement regarding project deliverable(s), processes followed, expectations and handling any needed clarifications. The final project agreement is considered as a binding contract.

With regard to knowledge objects, questions and projects, metadata they are structured in a similar way to web-based e-mail messages. The attributes of a posting are its Name, the Category that pertains to, the Subject of the task, the Recipient group it can be routed, a Pricing Mechanism, possible Attachments, preferred display Format and finally the task detailed Description. In addition to posting new questions and projects, HotDispatch has created an archive of previously answered questions and completed projects, the latter publicized after obtaining their owners consent. The archive can be browsed through based on a categorization schema or a search engine enables multi-attribute searching based on keywords. Yet, there are no semantic relations defined among the various knowledge objects, excluding this way the presentation of associated items and the application of recommendation mechanisms. During the initial phase of its operation HotDispatch focused on acquiring a critical mass of members, especially on the experts side that would result in short and satisfactory transaction cycles. Attracting large technology companies that would contribute with their experts' base would be an impetus for the marketplace. Thus a relationship with Sun Microsystems was developed followed by other global corporations. As a result of such collaborations combined with attracting new subscribers by handing out coupons and also word-of-mouth HotDispatch has grown to a marketplace of more than 50.000 members.

8 CONCLUSIONS

This paper introduced the concept of knowledge sharing and trading at the inter-organizational level, provided a typology of knowledge networks and analyzed specific instances of such networks. Independently of which knowledge network category is adopted, our research and practical experiences unveil a number of issues that should be taken into consideration for efficiently sharing and trading knowledge at the inter-organizational level.

Firstly, knowledge is by definition highly context-dependent and all explicit representations (at the seller side) will necessarily de-contextualise it to some extent. Sophisticated representations of knowledge objects and needs, which should express aspects like knowledge quality and knowledge actuality, are necessary for dealing with this problem. Our INKASS approach proposes a knowledge-rich, ontology-based formalization of knowledge objects as well as the domain of application as the backbone of electronic media for matching supply and demand.

Secondly, tacit knowledge exchange is usually not supported – especially in trading environments – which results in ignoring rich sources of knowledge. Yet, our research has showed that – with careful planning – tacit knowledge trading could be accommodated, in terms of offering expert advice through physical (e.g. selling consulting time) or virtual (e.g. through on-line collaboration) channels. Furthermore, powerful approaches may result by incorporating tacit and explicit knowledge in a unified offering.

A third issue refers to the modeling of knowledge flows and related transactions. Traditional knowledge management approaches for modeling the interactions (or modes of knowledge conversion) that occur during knowledge transactions within an organization are not sufficient for modeling knowledge networks as electronic media of interacting actors that exchange knowledge over space and time. According to the e-media approach of knowledge networks, agents interact with the medium in order to exchange knowledge assets. This interaction process can be referred to as a market transaction. This market approach brought in by the Media Reference Model [Schmidt and Lindemann (1998)] is useful in order to model the knowledge transactions as market transactions between market participants in various roles and provides a methodological basis for modeling the community of both knowledge sharing and trading networks, their business processes and for developing the infrastructure required for their operation.

The fourth issue regards the increased need for trust and established relationships especially as the critical dependency of highly customer-specific knowledge product and services increases. Trust is a critical component to true partnering and a pre-requisite to create long-term, knowledge-intensive solutions to industry pain points and to create new forms of value. It is imperative that a trust relationship be forged through an inter-organizational knowledge network.

Moreover, it should be noticed that price is not the only driving factor in knowledge transactions. Factors such as quality, expertise (which is proven in previous cases), consistency, and timely delivery weigh heavily in the decision for a knowledge sharing and trading decision.

Finally the formalization of the specification of knowledge to be shared or traded, in other words, the formalization of contracts or frameworks governing knowledge transactions, appears a challenging task. Specific dimensions of intangible goods cannot be easily depicted. We believe that frameworks that will support co-opetitive (collaborative and competitive) environments to capture the willingness of managers to share their knowledge in inter-organizational settings and the extent of this willingness will be of prime importance for future research.

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