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A Methodology and a Toolkit that Integrate Technological, Organisational, and Human Factors to Design KM within Knowledge-Intensive Networks

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Abstract: A well-functioning Knowledge Management is a competitive advantage for enterprises that act in co-operative and distributed networks with knowledge intensive production processes. A Knowledge Management approach that integrates both, hard factors (e.g., Information Technology) and soft factors (e.g., cultural aspects) for distributed and dynamic entrepreneurial (inter-organisational) networks is currently missing. This paper presents research findings of a project that is developing a methodology as well as an appropriate toolkit to support a service provider responsible for the KM within distributed entrepreneurial networks. The project integrates explicitly both new Information and Communication Technology driven organisational concepts, human-oriented approaches and existing KM methodologies and instruments.

Keywords: Knowledge Management, Knowledge Networks, Inter-organizational Networked Businesses, Collaborative Networks
Categories: C.2.1, C.2.3, C.2.4, I.2.4, I.2.6

1 Introduction

In recent years two major trends could be observed in the sector of manufacturing enterprises. On the one hand, the companies concentrate more and more on their core competencies, while on the other hand knowledge is increasingly recognized as a success factor in the tough competition of the global market arena [Parolini, 2000] [Wirtz, 2000] [Eppler and Sukowski, 2001] [Engelbrecht, 2001] [Laing and Forzi, 2002] [Bleck *et al.*, 2003] [Forzi *et al.*, 2004c]. As a result of the concentration on core competencies, peripheral functions are abandoned and taken over by external partners [Hagel and Singer, 1999] [Picot *et al.*, 2001].

Moreover, larger business units are split into small, more flexible, independent units [Picot *et al.*, 2001] [Bleck *et al.*, 2003] [Forzi and Laing, 2003]. This trend leads to a higher productivity and flexibility of the companies' core businesses, but also increases the interaction between different business units [Parolini, 2000] [Porter, 2001] [Killich and Luczak, 2003] [Forzi *et al.*, 2004c]. Complex business networks

come into existence. While this gives much more flexibility to the production process as a whole, it also bears the challenge of handling these interactions efficiently [Hagel and Singer, 1999] [Bleck *et al.*, 2003] [Luczak and Forzi, 2004].

Knowledge, on the other hand, has been accepted as a crucial factor in business life [Senge, 1990] [Nonaka and Takeuchi, 1995] [Davenport and Prusak, 1998] [Eppler and Sukowski, 2001]. Many companies have therefore implemented Knowledge Management (KM) solutions [Bach *et al.*, 1999] [Nonaka and Nishiguchi, 2001]. However, such implementations are focused mainly on internal and enterprise specific applications and are mainly technology driven [Gebauer and Buxmann, 1999] [Krcmar, 2000] [KPMG, 2001] [Klatt and Kopp, 2004]. They are therefore suitable only to a very limited extent to support companies in order to face the challenges of KM in distributed business networks.

Furthermore, a number of problems currently inhibit the exploitation of the potentials of networked knowledge [Davenport and Prusak, 1998] [Bach *et al.*, 1999] [Roehl, 2000] [Wirtz, 2000] [Eppler and Sukowski, 2001] [Klatt and Kopp, 2004]. As a matter of fact, different goals and ethic values among the network partners as well as dynamic changes of processes are very complex to handle [Killich and Luczak, 2003]. The higher the flexibility of the network, the more important the aspect of trust becomes, as it can no longer be built on extensive experience with the partners. Yet another major challenge, is the overcoming of cultural barriers [Eppler and Sukowski, 2001]. In addition, different goals, ethic values and cultures as well as a lack of trust inhibit the exploitation of the potentials of networked knowledge [Davenport and Prusak, 1998] [Grewe, 2000] [Eppler and Sukowski, 2001].

Appropriate models and methods and in particular a methodology for KM in distributed and globally dispersed entrepreneurial networks are lacking [Nonaka and Takeuchi, 1995] [Probst *et al.*, 1998] [Eppler and Sukowski, 2001] [Forzi *et al.*, 2003a]. In order to build up and maintain co-operation and establish knowledge transfer in business networks, the companies involved require external support. Enterprises have to be taught how know-how transfer in a network can be accomplished. In order to achieve this objective, applicable tools and critical success factors for KM in networks have to be analysed, documented and disseminated. Appropriate models and methods and in particular a methodology for KM in distributed and globally dispersed entrepreneurial networks are lacking. We think that these tasks can be fulfilled optimally by an external knowledge manager who acts as an intermediary in the network and represents a neutral trust centre for each of the involved companies.

Thus, the idea behind our research is that, in order to build up and maintain co-operation and establish knowledge transfer in business networks, the companies involved require external support. Networked enterprises have to be taught how KM along complex and networked value chains can be accomplished. An external knowledge manager who acts as an intermediary in the network and represents a neutral trust centre can analyse applicable tools and critical success factors for KM in networks. The presented research project integrates both new Information and Communication Technology (ICT) driven organisational concepts and human-oriented approaches with KM methodologies and instruments, in order to implement an innovative KM Service Provider for distributed networks.

2 Motivation of Research and Research Rationale

The exploitation of knowledge as a production factor has been subject to research in a number of publications [Bullinger *et al.*, 1997] [Probst *et al.*, 1998] [Antoni and Sommerlatte, 1999] [Bach *et al.*, 1999] [Richter, 2000] [Roehl, 2000] [Eppler and Sukowski, 2001] [Remus, 2002] [Romhardt, 2002]. In general, currently available methods and applications for KM are mainly technology driven [Gebauer and Buxmann, 1999] [Diemers, 2000]. Although the cultural aspect is often emphasized, soft factors regarding human behaviour and organisational requirements are commonly neglected. This is especially true in a co-operative environment among companies with knowledge intensive production processes where knowledge is a decisive competitive advantage [Picot *et al.*, 2001] [Forzi *et al.*, 2003b].

Until recently, research paid only little attention to the aspect of establishing knowledge transfer in business networks [Nonaka and Takeuchi, 1995] [Davenport and Prusak, 1998] [Probst *et al.*, 1998] [Schöne and Freitag, 2000]. Although different descriptions and procedures regarding the introduction of single tools and methods for KM can be found in the literature, a holistic approach is still missing. In particular, a methodology for KM in distributed and globally dispersed entrepreneurial networks is lacking. This is due to the fact that basic elements for research were missing. Since preliminary results (especially experience reports and descriptions of a number of enterprise specific KM methods) have become available, the Research Institute for Operations Management (FIR) and the Institute of Industrial Engineering and Ergonomics (IAW) at Aachen University of Technology (RWTH Aachen) have initiated a research project[1] to integrate new Information and Communication Technology (ICT) driven organisational concepts with KM methodologies and instruments, in order to eventually implement an innovative KM Service Provider for distributed networks.

The research project consists of 6 main project modules, which are namely:

1. Development of an appropriate knowledge model, in order to highlight the relevant entities for a holistic KM in distributed manufacturing networks. The basic elements and processes of distributed and fragmented knowledge, as well as the objectives, types, flows of knowledge within networked organisations represent a set of inputs for the development of a holistic knowledge model for distributed manufacturing networks. Furthermore, in order to compare and evaluate different KM measures within the identified framework, it is important at this stage to identify a suitable catalogue of indicators and performance figures.

2. Analysis and classification of network typologies, in function of different entrepreneurial archetypes as well as of the different phases within the lifecycle of a network. As a matter of fact, e.g., inter-organisational networks of independent SMEs and intra-organisational networks within a large dispersed enterprise or a corporate group have different requirements concerning both KM as well as the tasks of the knowledge broker. For the above-mentioned reason, the several distributed (inter and

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[1] *Project „Der Dienstleistungsmanager im Netzwerk der Zukunft" (Service Provider for Knowledge Networks of the Future), funded by the German Federal Ministry of Education and Research (grant number: 01HW0206), duration October 2002 until September 2005. Partners: Bauer Maschinen GmbH, GPS Schuh & Co. GmbH, VIA Consult GmbH, WET Automotive Systems AG.*

intra-organisational) processes have to be modelled, the various information flows have to be analysed and open issues related to the required or generated knowledge have to be identified. The requirements concerning a distributed KM in function of different network architectures can be hence defined.

3. Development of a reference model for the deployment of the service of the knowledge broker. On the one hand the reference model has to describe and specify the relevant elements of KM within distributed networks (such as KM-tasks, network characteristics or design elements of the considered problem), while on the other hand it has to describe how the service has to be implemented in the same network typology (procedure of the service deployment).

4. Compilation of a roadmap of KM methods and instruments. Such a multi-dimensional framework (to be implemented in a software tool) has to integrate the previously identified dimensions of KM and network requirements with the existing and planned KM methods and instruments. The main objective is to structure a framework to support decision-makers in the selection process of an appropriate portfolio of KM methods and instruments, given the constraints related to the network and entrepreneurial requirements, the specific application field and the considered phase of the network lifecycle. Because of the dynamics in the field of KM, the resulting software tool has to be extendible, in order to integrate new KM methods and instruments.

5. Testing and evaluation. The toolkit for KM within distributed networks has to be tested in practice and hence evaluated. To validate the concept, four networks are involved as consortial partners in the project, covering different branches, both intra-organisational and inter-organisational structure, four different network typologies as well as three entrepreneurial archetypes (Group, Medium Enterprise, SME): one corporate group with 10 globally distributed affiliated companies in the field of machinery industry; one Medium Enterprise, supplier in the automotive industry, with 8 globally distributed locations; one collaboration network of 17 independent SMEs which are suppliers in the automotive industry; one Virtual Factory with about 30 distributed SMEs.

6. Development of a Service Provider for knowledge networks, i.e., an external knowledge broker that, as KM Service Provider, will support the distributed processes of the distributed networks. The prototypic development of the knowledge broker will be initially only for one of the four collaboration networks, namely the suppliers' network of independent SMEs in the automotive industry.

3 A Description Model of KM within Distributed Networks

The first major result of the project is a model to describe KM within distributed intra-organisational and inter-organisational networks. It comprises all relevant entities for a holistic approach to KM in networks. The four core elements of the knowledge model of organisational networks are: Network knowledge, KM processes, KM resources and KM culture of the network (see also Figure 1).

Starting point is the actual *knowledge within the network*: its potential is the reason behind all KM activities. Network knowledge appears in different types of knowledge with specific attributes, it can be retrieved from different sources, and differs according to its accessibility [Schieferdecker, 2003] [Klatt and Kopp, 2004].

To realise the potential of network knowledge certain *KM processes* are necessary [Schieferdecker, 2003] [Klatt and Kopp, 2004]. They can be classified in different processes needed to retrieve knowledge, to change knowledge and to pass on knowledge. Such processes again rely on *appropriate resources* – both human and tangible. For example, employees need certain competencies to be able to carry out KM processes, but they also need the corresponding physical and IT infrastructure to fulfil their tasks [Becker, 1990] [Grewe, 2000] [Döring-Katerkamp and Trojan, 2002]. These three areas are all influenced by a fourth one: the *KM culture of the network.* Cultural aspects can enhance an open knowledge transfer or inhibit a positive attitude towards sharing knowledge [Ashkanasy *et al.*, 2000]. Thus a detailed consideration of the management style as well as the standards and values within the network is very important. Different aspects have to be examined: communication, employee orientation, decision decentralisation, importance of knowledge, trust and tolerance etc. The following chapters discuss the structure and attributes of the four areas of the knowledge model in detail.

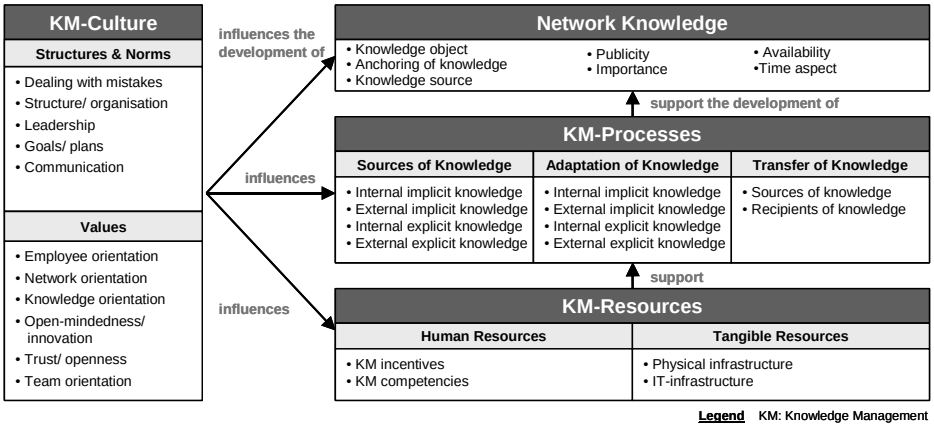

Figure 1: Description model of KM in distributed networks

3.1 KM Resources

As anticipated while introducing the description model, a key role in KM within distributed value-creating networks is played by the resources that make the desired KM possible. Within this model, we distinguish between tangible resources, namely physical resources as well as ICT infrastructure, and human resources. It is widely accepted that while the tangible resources and in particular the ICT infrastructure represent in many cases the precondition for KM within globally distributed networks, the specific consideration and integration of the personnel within the model (i.e. the actors that bear, develop and exchange knowledge) is a critical success factor for a functioning KM within the network.

3.1.1 Tangible KM Resources

According to our understanding, the tangible resources for the KM within distributed networks are on the one hand the physical infrastructure for KM that is available in the network and on the other hand the ICT infrastructure used for KM.

The **physical infrastructure** can be used in the case of face-to-face meetings of network partners and it can be available in different forms (e.g., offices, meeting or conference rooms) at the different locations of the network. Aspects that should be taken into consideration while analysing the available physical infrastructure are e.g., access to the physical infrastructure, the employee suggestion system related to the infrastructure or further development of the physical infrastructure. As far as the **ICT infrastructure** is concerned, there are two aspects that should be considered within the analysis, i.e., both *generic aspects* of the whole ICT infrastructure and *more specific facets* and related elements [Krcmar, 2000]. Examples for the former cluster of aspects to be considered are access to the available ICT infrastructure, the employee suggestion system related to the ICT infrastructure or the further development of the ICT infrastructure. As far as the latter group is concerned, the more specific aspects of the ICT infrastructure are manifold and relatively complex; the most relevant are: *(1) ICT resources for communication*, such as video conference system, email system or discussion forums. *(2) ICT resources for coordination.* During the past years several ICT instruments to support coordination were developed and offered on the market; they offer a manifold support of coordination, such as: personal (shared) electronic (group) calendar; shared system for resources management; electronic listing and assignment of tasks; access to electronic project plans. *(3) ICT resources for information/ knowledge search and information/ knowledge identification.* Also in this case, there is a wide range of functionalities that can be offered, such as: search for persons with specific skills (e.g., yellow pages); electronic support of a full-text or a keyword search; search for appropriate information within a tree diagram (e.g., ordered directory structure); search for documents which are not available electronically (e.g., virtual libraries, literature databases). *(4) ICT resources for information administration/ management.* Potential functionalities of such ICT resources are: provision of specific documents to closed groups; access to central structures for the assignment of attributes/ keywords for documents as well as document attributes; document versioning; automatic notification of modifications in specific documents or the saving of new documents provided with attributes; discussion and/ or evaluation of the saved documents.

3.1.2 Human KM Resources

With employees being the central source of knowledge in an organisation, taking the human factor into special consideration when designing KM is of great importance (see also Figure 2). Hence the model of KM-Resources also takes into consideration the mobilization of human resources for KM. This implies that employees are expected to act in accordance with the KM goals to guarantee best performance.

In order to channel the employees´ behaviour in accordance with KM goals three aspects are of importance [Killich and Peters, 2003]: commitment (“Are employees willing to act in a certain way?”), capability (“Are employees able to act in that

way?") and conditions ("Do organisational and cultural conditions enable this kind of behaviour?") [Döring-Katerkamp and Trojan, 2002].

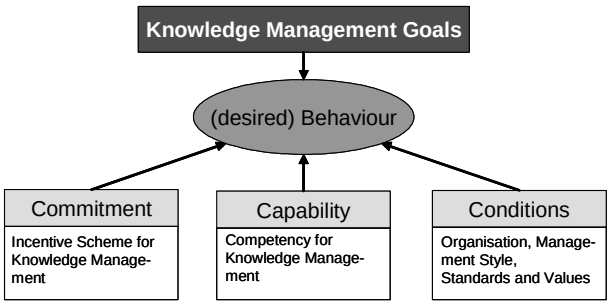

Figure 2: Model of Human KM Resources

3.1.2.1 Commitment to Knowledge Management

The area of commitment deals with the term incentive scheme in a narrower sense, meaning the deliberate use of incentives by management to influence the behaviour of employees [Becker, 1990]. Incentive schemes for encouraging the participation of employees in KM can be described using a system consisting of four dimensions [Bleicher, 1989] [Grewe, 2000]. The instrumental dimension describes the content of incentives, meaning the selection of tangible (salary, bonuses etc.) and intangible incentives (promotion, work contents etc.), as well as the relation of fixed to variable incentives. The subject dimension describes the basis of assessment for variable incentives, thus defining reference points for individual behaviour. The time dimension determines the assessment period, the relation of short-term operational incentives and long-term strategic incentives and the rhythm of distribution for incentives. Finally the object dimension describes the organisational unit, whose performance is measured for variable incentives (e.g. position, team, company).

Specific incentives for KM as described in scientific literature basically cover all the categories of incentives [Mergel *et al.*, 2000] [Bullinger *et al.*, 2001] [North, 2002]:

- Financial incentives: Performance bonuses, integration of KM-goals into daily work so that KM-activities are rewarded through the regular salary.
- Social incentives: Social communication, acknowledgement of experts or awards for the best knowledge worker.
- Organisational incentives: Career prospects through KM, professional education or free time as rewards.
- Incentive effect of work itself: Interesting work content or positive constructive feedback to support intrinsic motivation.

Returning to the instrumental dimension of incentive schemes, the question of which incentives create the higher motivational effect arises; this is a problem that is

not limited to incentives for KM. But in the end general statements concerning the attractiveness of tangible or intangible incentives are difficult to make since numerous factors influence the effect on the individual employee [Grewe, 2000]. An incentive scheme tailored to the needs of individual employees can only be achieved through participation or rather by offering a variety of incentives to choose from. This possibly explains why so many companies use monetary incentives as their value is easier to estimate [Bullinger *et al.*, 2001].

Regarding the ratio of variable to fixed incentives, most of the incentives for KM mentioned in literature are of variable character, being rewards for participating in certain KM-activities. Some authors regard this as an obstacle to KM becoming accepted as a normal element of daily work which should be a central aim of every KM-initiative [Döring-Katerkamp and Trojan, 2002]. This leads to the demand for integrating KM-activities into the performance that must be achieved in order to receive the regular salary.

Although a few KM specific aspects have been pointed out above, the main problem is how to relate the incentives to Knowledge Management as KM-activities cannot be easily quantified. It is, however, essential to demonstrate a clear relationship between the incentive and the KM-activity by choosing an appropriate basis for assessment of incentives for KM. A possible basis of assessment are measures of the KM-processes (e.g. utilization of KM-instruments), measures of business processes (e.g. time, costs, quality), financial measures (e.g. cash flow, ROI) or strategic measures (e.g. market shares, share of new products). For each area specific goals can be agreed on, to determine the measures. Whereas measures of KM-processes are directly connected to the KM-activities of employees, the correlation of the other measures with KM is not as obvious and therefore their use in incentive schemes is problematic.

As far as the time dimension of incentives for KM is concerned, basically the same principles apply, as for any incentive scheme. Since this dimension deals with the necessity of long-term strategic incentives it is mainly relevant for incentive schemes at management level [Grewe, 2000].

Regarding the organisational levels of the basis of assessment (object dimension), group incentives are often mentioned as a possible means of supporting knowledge transfer within groups. For the implementation of incentives for a network-wide Knowledge Management a network level could be added.

3.1.2.2 Capability for Knowledge Management

While the area of commitment deals with the question whether employees are willing to act in a certain way, the area of capability takes into account whether employees have the skills to enable them to perform in this way. Capability in this context does not mean the competencies necessary to perform in everyday business processes, but the specific competencies required for an efficient KM, although a clear distinction cannot always be made.

Competency in general can be classified as follows:

- Professional competency, e.g. technical and economical knowledge, practical experience,

- Methods competency, e.g. methods for structuring and presenting information, methods for problem solving, management methods,
- Social competency, e.g. sense of responsibility, ability to cooperate and communicate,
- Personal competency, e.g. self-confidence, critical introspection, constructive handling of insecurity,
- Acting competency, the competency to purposefully utilize the skills and abilities of the four categories mentioned above [Erpenbeck, 1999].

This categorisation covers the complete range of competency and thus ensures a complete view of the problem. Which of the categories are relevant may differ from case to case.

The competencies required for an efficient Knowledge Management as they can be found in literature usually include media competency, the ability to communicate, cooperate, to solve problems and to work in a team [Vorbeck *et al.*, 2001] [North, 2002].

For the analysis of KM in business networks we concentrated on the following competencies for Knowledge Management (Figure 3):

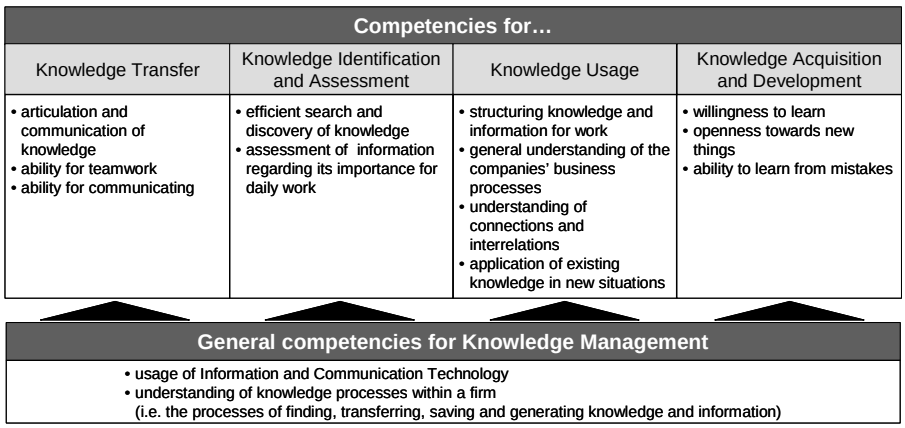

Figure 3: Competencies for Knowledge Management

Which competencies are required in detail, however, depends on the particular tasks and on the focus of the KM-project. The utilisation of a KM-database, for example, calls for computer literacy whereas the transfer of knowledge in knowledge meetings would be enhanced by appropriate social competency.

3.1.2.3 Conditions for Knowledge Management

With the third aspect of human resources the view is extended to the surroundings of employees by including the influence of *organisational and cultural conditions* on

employee behaviour. In the model this aspect is described as a component of its own and will be dealt with in chapter 3.4.

3.2 KM Processes

For the analysis of KM-Processes several structures are provided by KM literature. Probst *et al.* for example describe eight elements of KM [Probst *et al.*, 1998]. [Mertens *et al.* again integrate these into four processes of KM [[Mertens *et al.*, 2001]. To keep the complexity manageable for an analysis of KM within business networks the model described in this paper reduces the number of KM processes to three:

- The i*dentification of knowledge sources* that are currently present and used in the network,
- The *adaptation of knowledge* to specific contexts, describing how knowledge is acquired and further developed within the considered network,
- The *transfer of knowledge*, describing the interaction of the bearers of knowledge and the users of knowledge within the network.

To provide for the specific aspects of KM in business networks the KM processes are arranged into a matrix that distinguishes between internal and external knowledge as well as implicit and explicit knowledge [Gissler, 1999]). Within each quadrant, two questions are raised within the analysis: “Who?”, when referring to the sources of knowledge; “How?”, when referring to the acquisition of knowledge (see also Figure 4).

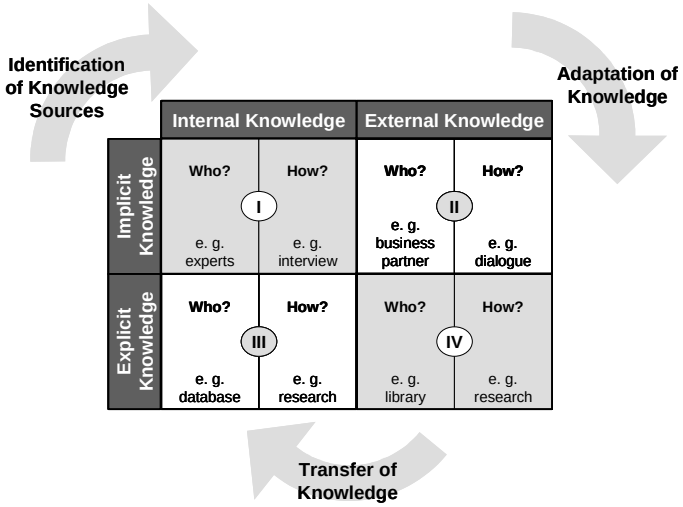

Figure 4: Identification and description of KM processes

As far as the usage of **knowledge resources** is concerned, in order to identify knowledge it is necessary to know which knowledge sources are used and where knowledge is stored. *(1) Internal implicit knowledge* (1st quadrant): personal information sources, comprising roles and responsibilities need to be identified. Also the experts within the network need to be known with their special skills, competencies and experience and have to be readily accessible. For the areas of technology and process knowledge, it is important to know the developers of new technologies and affiliated responsibilities. All these aspects depend on the organisational design and layers of hierarchy within the network and its companies. *(2) External implicit knowledge* (2nd quadrant): relations to external bearers of knowledge are important. These can be business contacts or relations to suppliers as well as contacts to universities or consultants. *(3) Internal explicit knowledge* (3rd quadrant): the focus lies on non-personal information sources like IT-systems, in-house libraries and file systems. Organisation of workspace, documentation of processes and information and communication culture influence the accessibility of internal explicit knowledge sources. *(4) External explicit knowledge* (4th quadrant): the usage of external information like libraries, professional journals or the analysis of competitive products is considered.

The **adaptation of knowledge** is again structured along the four quadrants of the KM-processes portfolio, this time with the focus on how the knowledge is altered. *(1) Internal implicit knowledge* (1st quadrant): in the area of development of mechanisms of knowledge transfer, documentation of implicit contents and instruments to identify knowledge are analysed. *(2) External implicit knowledge* (2nd quadrant): similar tools are used but with an external focus. Another possibility is the acquisition of knowledge by hiring personnel. *(3) Internal explicit knowledge* (3rd quadrant): means of internal communication and administration as well as access rights and possibilities and usage of information systems are analysed. Another focus is the importance of knowledge acquisition, the organisation of training and the retention of the knowledge of retiring employees. *(4) External explicit knowledge* (4th quadrant): the combination of existing knowledge, a systematic approach to the development of knowledge and the completion of knowledge are considered. In addition, media and channels as well as responsibilities for the acquisition of knowledge play an important role.

The **transfer of knowledge** deals with the interaction of the bearers of knowledge and the users of knowledge. Thus the relations between roles, documents and other information objects are analysed. This information is gathered using a matrix that reveals interrelations. To support an individual analysis of different situations a computer based matrix tool is used.

3.3 Network Knowledge

The element “network knowledge” describes the knowledge which exists within the network companies. An overview of the knowledge existing within the network provides the basis for a detailed analysis of the KM-processes. The focus lies on the knowledge relevant for the companies, i.e., knowledge that is actually used in business processes.

The key characteristic of network knowledge is the knowledge object. Knowledge objects can be separated into knowledge about products / services, business processes, technologies, further resources, methods, partners (customers, suppliers, cooperation...) and external factors (company surroundings). Each

knowledge object has several further characteristics which are summed up in Figure 5.

The selection of business processes for the analysis of the network knowledge depends on the basic goals of KM within the network: if the objective is the support of existing inter-organisational processes of the network companies, then only the cooperative processes involved will be taken into consideration; if, on the other hand, the target is to detect basic potentials for an exchange of knowledge within a cooperation in the network, then further processes should be included in the analysis. In this case a different approach for the analysis of knowledge should be used. This is described in chapter 6.

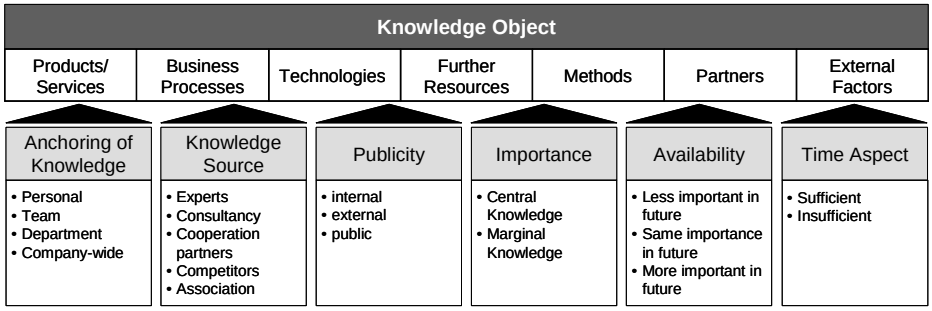

Figure 5: Classification of knowledge in networks

3.4 KM Culture in the Network

Especially in distributed networks, the impact of organisational culture on KM measures must be considered carefully. Thus, the model component KM Culture describes the aspects of organisational culture relevant for KM in distributed networks. In literature numerous measures for organisational culture can be found [Ashkanasy *et al.*, 2000].

A widespread instrument for measuring and analysing organisational culture is the Organisational Culture Profile (OCP), which measures the expressions of an organisational culture using seven dimensions and 54 items [Ashkanasy *et al.*, 2000]. This concept was used as a basis for developing a model for KM culture in networks into which concepts of network culture [Fraunhofer IML, 2002] and cultural success factors from KM literature where integrated [Rosenstiel, 1999] [Rümler, 2001].

The resulting measures of culture relevant for KM in networks have been divided into two categories: structures and norms on the one hand and values on the other. **Structures and Norms** describe elements of KM culture that can be specified by dealing with mistakes, structure/ organisation, leadership, goals / plans and communication. **Values** embrace further elements of the network culture, like employee orientation/ personnel development, network orientation, knowledge orientation, open-mindedness/ innovation, trust/ openness and team orientation. These elements of the corporate culture and their impact on KM in networks will now be specified more closely.

A certain *tolerance of mistakes* supports learning processes initiated by errors. Mistakes might be seen as a chance to learn for the future. *Structure/ Organisation* takes into account the influence of organisational structures, available resources, rules and behavioural norms on KM-activities within the network. *Leadership* considers the role of leaders regarding the support of cooperative activities, the network-wide exchange of knowledge and their exemplary function. *Goals / plans* describes the existence of generally known KM goals and the willingness to support these. *Communication* obviously plays an important role in the creation and the transfer of knowledge. Therefore this element of the model describes aspects like the formalisation of communication channels, the support of informal communication and barriers of communication. *Employee orientation/ personnel development* describes the extent to which the employee's interests beyond his functions within the company are present. Increased efforts in personnel development and consideration of employee's ideas and needs indicate the company's willingness to invest in the employees as the central source of knowledge. *Network Orientation* considers the extent to which organisational members accept that certain tasks can only be solved together with network partners and that cooperation leads to an advantage for all the companies involved. *Knowledge Orientation* takes into account the extent to which the targeted usage of knowledge is considered as a essential part of daily work. *Open-mindedness/ Innovation* describes the extent to which an organisation is prepared to take risks, to try out new methods and supports creativity and innovation. *Trust/ Openness* measures the willingness to trust network partners concerning their professional competency and the exploitation of informational advantages. Finally, *team orientation* depends on the extent to which company members recognize that certain problems can be solved more easily in a team.

We would like to emphasize that the dimensions of KM culture in networks as described above are based on several different concepts presented in literature. The topic of KM Culture as well as network culture have not been examined in depth so that the dimensions as described above have no empirical foundation.

As a rule, a KM-project will not go so far as changing the organisation or even attempt implementing a new corporate culture. In the course of designing or evaluating a KM system, however, the influence of the elements mentioned above should at least be taken into consideration.

3.5 Framework for KM-Analysis

Based upon all the attributes and related set of possible specifications for each of the four areas of the knowledge model, an appropriate standardized framework for the analysis of the current KM within distributed Networks has been developed. This analysis framework consists of questionnaires, guidelines for interviews, screen-plays for workshops and tools for each area of the knowledge model to help the knowledge manager during the analysis of the existing KM in the network. The analysis framework was validated in four networks of industrial partners within the consortium.

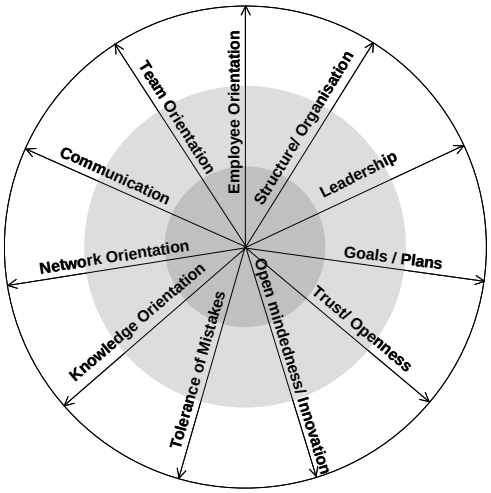

Figure 6: Measures of KM culture in networks

4 Map of KM Methods

A further major aim of the research project is the development of a map of KM-methods for Knowledge Management in distributed business networks. In order to develop this map, existing KM-methods were selected and arranged into a database. The map was realized as a software tool that supports the KM service provider with the selection of appropriate KM methods.

The development of the software tool was carried out in three steps:

1. Development of a classification scheme for KM-methods: analysis of requirements concerning content and functionalities for the KM method map and development of an appropriate structure for the method database.
2. Collection, evaluation and selection of KM-methods
3. Development of a web-based software tool which enables a problem-oriented selection of KM-tools

4.1 Classification Scheme for KM-Methods

To enable a structured search for KM-methods an appropriate classification scheme for the content of the map must be found. In order to develop such a classification scheme in a first step, an analysis of the requirements for a method map was carried out. These requirements were divided into general requirements concerning the purpose of the software tool and requirements for the contents of the KM-Map i.e. the methods themselves.

General requirements which result from the purpose of the map can be specified as follows: The main purpose of the Map of KM methods is to support the KM service provider with the selection of KM methods in order to solve certain problems within a network. To do so, the map must provide an appropriate classification

structure that allows for a problem-oriented navigation among the available methods. Within this navigation structure the map must provide access to the different methods using filters and sortings. Furthermore the tool should be expandable in the sense of providing the possibility to add new methods and edit the documentation of existing methods.

In addition to these general requirements of a method map further requirements for the methods integrated into the map can be named. Common requirements for KM methods are:

- Little expenditure for implementation
- Little expenditure for usage
- Usability

Since collections of KM methods as found in literature usually concentrate on KM within single companies and rarely within networks, the possibility of applying these methods in business networks must be assessed. Thus more specific criteria for the assessment of the application of methods in business networks are:

- The applicability of the methods in a spatially distributed context
- The possibility of separating cost and benefit of the companies involved
- The requirement of special resources within the companies involved (e.g. specially trained personnel)
- Consideration of critical information

Based on the requirements concerning the functionalities of the map a classification scheme for KM methods in distributed networks consisting of three dimensions was developed. The three dimensions of the classification structure are the KM task, the type of knowledge and the type of the method. The KM task describes the KM activities which are supposed to be supported by a method. KM tasks are separated into direct and indirect KM tasks. Direct KM tasks are those that directly influence the knowledge processes, like creation, transfer and development of knowledge. Indirect KM tasks have an indirect effect on these processes, e.g. by providing IT-infrastructure or training employees.

The type of knowledge describes whether a selected method supports the creation, development, transfer etc. of explicit knowledge or of implicit knowledge. Apart from this, the type of knowledge differentiates between internal knowledge, that is knowledge within a company, and external knowledge – knowledge within the network.

The final dimension – the type of the method – specifies whether a KM method is of technical, organisational or personal nature. Figure 7 shows an overview of the complete classification scheme for KM methods for business networks.

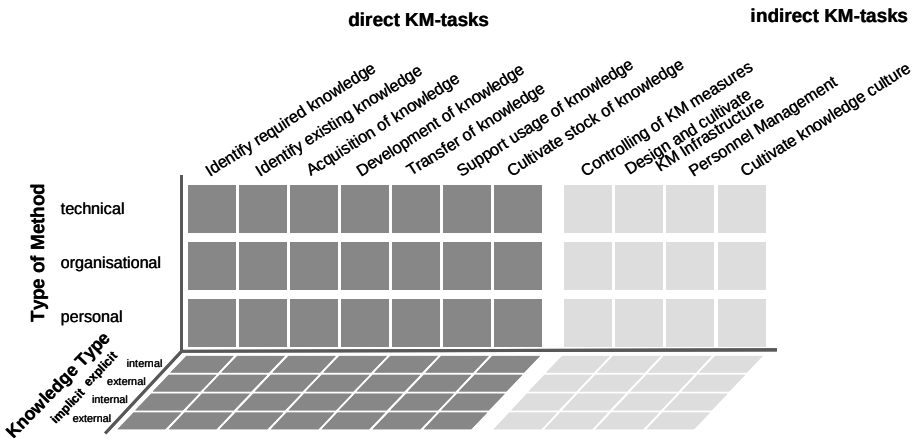

Figure 7: Classification Scheme for KM methods

4.2 Different Types of KM-Methods

In order to provide the content for the KM method map in a first step KM methods were collected from existing lists of methods in literature [Roehl, 2000] [Ilgen, 2001] [Eppler, 2002] [Hanel, 2002] [North, 2002] [Pawlowsky and Reinhard 2002]. The methods found in literature mainly refer to KM within companies. Thus an assessment of the methods using the criteria as listed above was carried out within the project team. Those methods fulfilling the requirements made up the preliminary list of methods for the KM-Map. This preliminary list of methods was then completed according to the special requirements of the project partners.

Examples for methods that can be found in the method map are:

- Organisational methods: knowledge fares, Communities of Practice, networks for new employees, Best Practice Sharing
- Technical methods: yellow pages, project databases, network wide Frequently Asked Questions
- Personnel methods: Action Learning, Coaching/ Mentoring, incentive systems for Knowledge Management

The methods selected for the map were described according to a unified structure. This description consists of the goals of the method, abstract, detailed description, process of implementation, requirements for application, success factors/ barriers, comparable and supplementary methods.

A further important aspect is the evaluation of KM-Methods according to the purpose they were implemented for. General instruments for evaluating the benefit of KM methods are difficult to define, since they depend very much on the method itself and the situation the method is applied in. Because of this each method described in the method map is supplemented by case studies which describe certain problems where the methods can be used and give examples for the evaluation of the methods in these situations.

Finally the methods were structured according to the classification scheme as described above.

Three aspects distinguish this collection of methods from existing method-databases for KM: firstly the methods listed in the map are suited for application in a network context. Secondly the map claims to offer more than the usual theory-based descriptions of methods. In addition to the description of the methods supplementary documents are provided, like checklists, guides, case studies, lessons learned etc., which were generated in practical application of the methods and aim at supporting an efficient implementation of the methods. Finally the map is tailored to the needs of the knowledge service provider and enables the service provider to select appropriate tools based on the outcome of the prior network analysis.

4.3 Tool for Selection of KM-Methods

With the selection of KM-methods for networks and their structuring within the classification scheme completed, the next step is the development of the software tool. The requirements of the software tool itself can be derived from the general requirements of the method map described in chapter 4.1.

To allow the application in distributed environments the tool should be internet based. Since the tool should not only offer the possibility to add new methods but also to revise the structure of the classification scheme, e.g. in the case of new requirements or insights from application and evaluation, the tool is based on a relational database model. Thus, the classification scheme can be adjusted in an administrator area.

The tool allows navigation by the three dimensions - the KM-task, the type of method and the knowledge type – and combinations of these through different filters. In addition to this, the search for methods in an alphabetical index and by keywords is possible.

With these functionalities the map of KM methods offers support for the KM service provider during the phases of conceptual design, implementation and operational management of the service (see chapter 5). Based on the results of the network analysis, which points out certain problems of the existing KM in a network, the map tool allows for a structured search for and selection of KM methods to tackle these problems. For the implementation and operational management of the KM measures the map offers guides, checklists as well as case studies for controlling the methods.

The software tool was programmed as a prototype. Its application and evaluation within the project – methods and functionalities – will be outlined in chapter 6.3.

5 Methodology to Design KM within Inter-organizational Networks

A methodology to support the design of KM within inter-organisational networks is supposed to fulfil two essential requirements. On the one side it has to describe how KM in the considered network is structured and with which instruments the handling of knowledge can be organised in the network. On the other side, it has to describe

how KM has to be implemented in the network, i.e. the methodology has to support the KM-deployment along the complete KM life cycle [Forzi *et al.*, 2004b].

In analogy with the „Aachen PPS Model“ [Luczak and Eversheim, 1999], we structured the methodology into a description and a procedure model. In the *description model* all relevant elements to design and configure KM in business networks as well as their mutual relationships are described. In the *procedure model* it is explained how and in which phases KM can be implemented in the considered network. Within the methodology, also the interrelations between the two models have to be highlighted [Forzi *et al.*, 2004b].

5.1 Description Model

The description model has four elements, which represent the relevant views for the service provider within the design of KM, namely: KM-tasks, Network, Design Areas, KM-Methods and Instruments. As shown in Figure 8, the different views are strictly mutually interrelated.

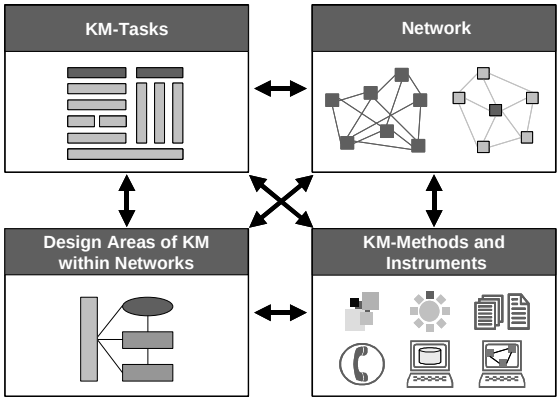

Figure 8: The elements of the description model

5.1.1 KM-Tasks

The KM-tasks that have to be dealt with are of the most different kinds [Nonaka and Takeuchi, 1995] [Davenport and Prusak, 1998] [Krcmar, 2000] [Eppler and Sukowski, 2001]. As already hinted in chapter 4.1, we distinguish between direct and indirect KM-tasks.

Direct KM-tasks involve directly the KM of the network; their fulfilment is of great influence on the whole KM process. To the direct KM-task group belong: a) definition of knowledge objectives, b) identification of knowledge, c) acquisition of knowledge, d) development of knowledge, e) distribution of knowledge, f) deployment of knowledge, and g) preservation of knowledge.

On the other hand, *indirect KM-tasks* involve functions that deal indirectly with the KM of the network, but which are nonetheless of great relevance within the conceptual design and implementation of KM within the network. Indirect KM-tasks

are: a) KM-controlling, b) management of KM-infrastructure (e.g. IT), c) personnel management, d) fostering / cultivation of knowledge culture and KM-vision, and e) management of knowledge structure.

All such tasks have to be taken into consideration while analysing the existing KM and especially in the following phase, in which the new KM-approaches are modelled and appropriate instruments are selected.

5.1.2 Network

Distributed entrepreneurial inter-organisational networks can be described according to a variety of characteristics, which have an even wider range of potential expressions [Gebauer and Buxmann, 1999] [Parolini, 2000] [Picot *et al.*, 2001] [Klatt and Kopp, 2004].

In order to structure the field, a set of clusters of network characteristics was identified: a) network size and demography (e.g. number of partners, number of active partners, size of partner enterprises, number of active individuals); *b) legal, contractual and financial characteristics* (e.g. network borders, kind of commitment, funding); *c) economic characteristics* (e.g. position within the value chain of the partners, competitive relations among the partners, industrial sector, network reach); *d) temporal characteristics* (e.g. development phase of the network, time frame of planned cooperation); *e) characteristics related to the network organisation* (e.g. coordination, organisational structure, organisational forms within the network); *f) characteristics related to the management of information and knowledge within the network* (e.g. type of information exchange, type of communication, KM objectives, KM phase).

Clearly, the clusters are open and can be amended with new characteristics and expressions. Based upon all the identified characteristics and related sets of possible specifications a standardized framework for network analysis has been developed.

5.1.3 Design Areas

The different design areas of KM within inter-organisational networks are presented within the description model of KM within distributed intra-organisational and inter-organisational networks [Forzi *et al.*, 2003a] [Forzi *et al.*, 2004a]. The four core elements of the Knowledge Management of organisational networks are: Network knowledge, KM Processes, KM Resources and KM Culture of the network. A more detailed description of the design areas was already done in chapter 3.

5.1.4 KM-Methods and Instruments

The KM methods and Instruments are of the most different kinds [Davenport and Prusak, 1998] [Probst *et al.*, 1998] [Bach *et al.*, 1999] [Eppler and Sukowski, 2001] [KPMG, 2001] [Forzi *et al.*, 2004a]. A vast number of KM-methods and instruments was collected and hence classified according to *a) related KM-Tasks, b) KM-design area of action, c) related form of knowledge representation, d) classification of method typology* (technological, organisational, personnel methods and instruments, see also Figure 9). Hence they have been structured into a tool map, which was implemented into a software tool, as described in chapter 4.3.

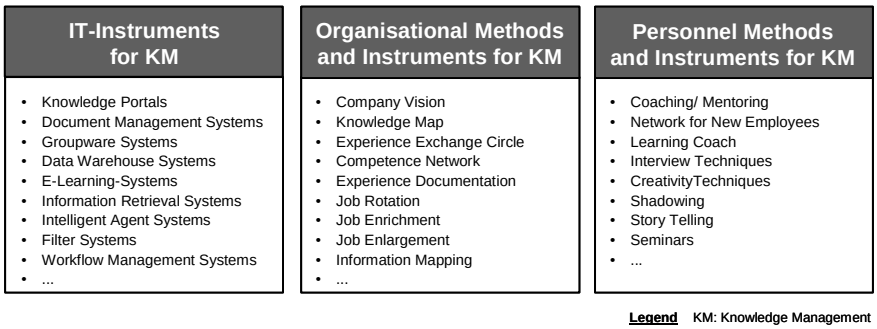

Figure 9: Classification of KM-Methods according to their typology

5.2 Procedure Model

The procedure model for the deployment of KM within entrepreneurial networks has six phases, which are namely: Initialisation, Analysis, Conceptual Design, Implementation, Operational Management, and Termination.

Figure 10 shows the rough structure of the procedure model for the service deployment. Clearly, the task of the Service Provider for KM within a distributed network accompanies the whole lifecycle of KM within the network.

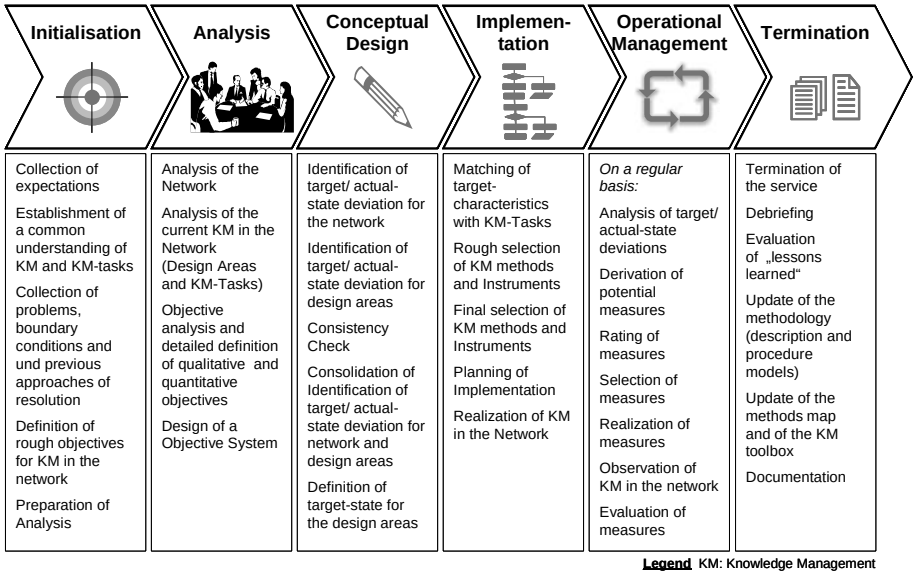

Figure 10: Phases of the procedure model

5.2.1 Initialisation

In the first phase, the initialisation, the Service Provider has to trigger the whole KM project within the involved inter-organisational network. After the collection of expectations of the different stakeholders, a common understanding of KM and KM-tasks within the considered network has to be established. Hence, current problems, boundary conditions and previous approaches of resolution of the KM issue in the considered network have to be collected, in order to be able to define rough objectives for KM in the network as well as the related evaluation criteria. Eventually, all the collected data and information have to be analysed and structured in order to prepare the following phase of analysis.

5.2.2 Analysis

In this phase the relevant elements of KM in the network have to be thoroughly analysed, in order to define a concrete basis for the conceptual design of the striven KM approach. In particular, a detailed analysis both of the Network and of the practiced KM in the Network (in particular with the help of the views “Network”, ”Design Areas” and ”KM-Tasks”) has to be conducted. Thus, within an analysis of KM objectives of the network, a set of detailed qualitative and quantitative objectives have to be defined in order to structure an objective system for the KM of the network. Eventually, appropriate evaluation criteria have to be defined.

5.2.3 Conceptual Design

Within this phase, the striven KM approach within the network has to be designed conceptually. First of all, the target/ actual-state deviation for the network as well as for the KM design areas has to be identified. Hence, such deviations have to be compared and, if necessary, harmonized in order to assure consistency between the network and the design areas. Eventually, after a consolidation of target/ actual-state deviation for network and design areas, a target state for the design areas can be derived.

5.2.4 Implementation

Within the implementation phase, with the help of the appropriate KM methods and instruments, the KM has to be implemented within the whole network. After a matching of the target states of the design areas with the related KM-Tasks, an initial rough selection of KM Methods and Instruments with the help of the tool map will be undergone. Thus, from all the methods and instruments potentially suitable for the considered network, a final, more restricted tool set will be selected. With this information the KM implementation will be hence planned and eventually realized.

5.2.5 Operational Management

The KM has to be then operationally deployed over the whole time the considered network is active. This phase, the operational KM, is the most time-consuming. On a regular basis, following steps have to be conducted within a control loop: basis target/ actual state deviations have to be analysed, potential measures, if needed, have to be consequently derived and rated. Thus, appropriate measures have to be selected and

realized. The behaviour of the network has to be then observed over time, in order to be able to eventually evaluate the implemented measures.

5.2.6 Termination (of Service)

When, for whatever reason, the network terminates to operate or the network management decides not to make use of the offered services anymore, the Service Provider will terminate the service. After the official termination of the service, a series of debriefings with the involved key players will be conducted; hence, the gained „lessons learned“ will be evaluated. If necessary, the methodology (description and procedure models) will be updated, according to the gained inputs. The same applies to a possible update of the methods map and of the KM toolbox. Eventually, a final documentation will conclude the project.

5.3 Interrelation between Description and Procedure Model

In order to be able to make use of the methodology, the Service Provider needs a further instrument, that shows which view of the description model (KM-tasks, Network, Design Areas, KM-Methods and Instruments) as well other potentially relevant views (e.g. Objective Model or Evaluation Model) has to be used in a specific phase of the procedure model (Initialisation, Analysis, Conceptual Design, Implementation, Operational Management, and Termination).

Figure 11 shows the basic idea of the interrelation between the two models. Clearly, the extent of such an interrelation, here merely sketched, was specified with the needed detail.

6 Case study

In the following chapter a case study of an inter-organisational network, in which the presented methodology is currently being applied, will be presented. The considered case involves the VIA-Network, a regional inter-organisational network of 20 small and medium enterprises (SME) in the automotive industry located in the German Federal State North Rhine-Westphalia (NRW). In this case study, the role of the service provider is deployed by the VIA-Consult GmbH, one of the network companies, that was founded by other network companies as a consultancy firm for the network.

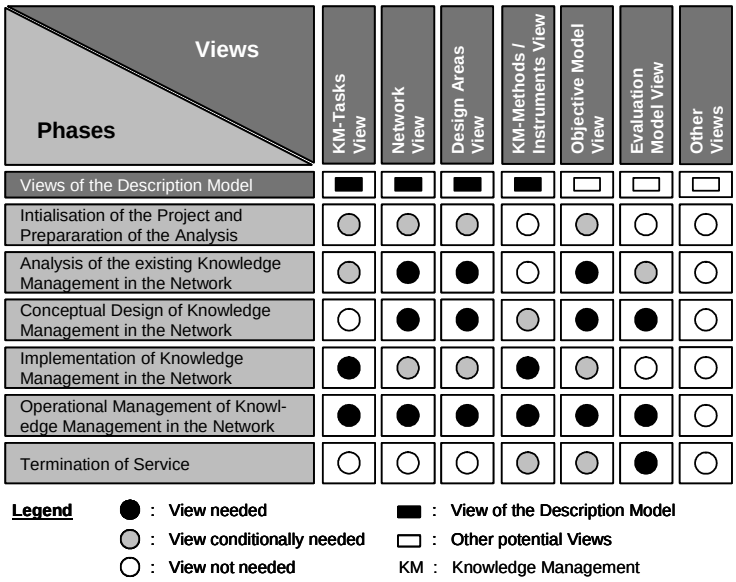

Figure 11: Interrelations between the models

6.1 Project Initialisation

During the initialisation phase, a series of workshops with five selected companies[2] of the VIA-network was conducted. Within this phase, the different expectations of all stakeholders were collected and a common understanding of KM was established. Since up till then no Knowledge Management projects had been conducted, no specific problems could be identified in the field.

Objectives of co-operation in the VIA-network are among others combined sourcing, know-how-exchange in working groups, joint projects and joint ventures. Since no specific area of cooperation or business processes could be specified for a support by KM beforehand, the main goal of the analysis of the network knowledge was the identification of potentials for knowledge transfer. Furthermore, the collected data was to be used for the development of a detailed map of the network knowledge in order to assist network partners in finding sources of knowledge for specific topics within the network.

6.2 Analysis of the VIA Network

Since the target of the analysis was not the identification of knowledge used in cooperative processes but the identification of basic potentials for an exchange of knowledge, a wide range of business areas in the network companies was included in the data collection. In order to collect the required data, interviews were carried out in

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[2] *Fischer & Kaufmann GmbH & Co. KG, Kirchhoff Kutsch GmbH, Heinrichs GmbH & Co. KG, Heinrich Huhn GmbH & Co. KG, Krah RWI GmbH. VIA Consult GmbH & Co. KG acted as intermediary between the research institutes and the network companies and carried out the data collection to a large extent.*

each department of the five companies, which meant 8 to 20 interviews per company. Interviewees were chosen at head of department level. Because the highly detailed, business process-oriented approach was not necessary in this case, the interviews were structured according to a work system approach [Luczak, 1998], see also Figure 12.

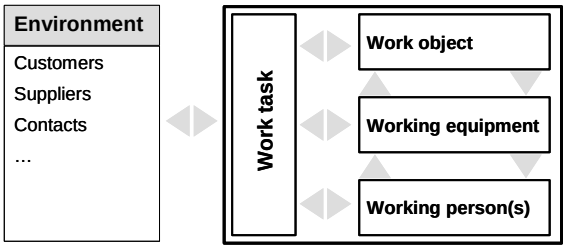

Figure 12: Work system [Luczak, 1998]

Following this structure the interview consisted of questions about:

- The work tasks of every department including sub tasks
- The working objects used in each sub task
- The working equipment used in each sub task
- Key persons and persons to turn to for each sub task
- Environment: customers, suppliers, contacts etc.

Assuming that the existence of work system elements represents the knowledge needed in order to perform in the work system, the work tasks, working objects and working equipment stand for specialised knowledge and the work system environment stands for knowledge about partners. Thus direct questions concerning knowledge required for certain business processes or tasks, which had proved misleading in former studies, could be avoided. Furthermore the interviews could be carried out in a reasonably short time, while still providing adequate detail. This was especially important for the data collection in the productive areas, since absence time of the interviewees had to be reduced to a minimum. The collected data was documented in tables for a first analysis and then implemented in a database as basis for the knowledge map.

6.3 Conceptual Design

The overall goal of the following phase, the *conceptual design*, was to select appropriate KM approaches for the support of inter-organisational business processes.

The identification of appropriate KM measures took place in three steps. First a pre-selection of potential areas of knowledge exchange was carried out. Second the identified areas were discussed with a group of key persons from the network companies in order to select pilot areas for the establishment of a structured knowledge exchange within the network. Third, appropriate KM methods were chosen using the map of KM methods described in chapter 5.

The pre-selection of potentials for knowledge exchange was based on the comparison of the work system elements. A pre-condition for the transfer of knowledge in a sense of best-practice-sharing is the existence of at least partially similar work tasks. From a process point of view this implies that companies have similar business processes and thus an exchange of best-practice concerning these processes might prove profitable. During the validation phase of the concept and model and because of the limited number of network partners the work system comparison was carried out manually. In further analyses a more automated procedure assisted by databases could be used.

Since the pre-selection of potential areas for knowledge exchange is based on a simple rule – the similarity of work tasks - and does not take into account such factors as the actual necessity of knowledge exchange in certain areas or the existence of critical knowledge that can not be transferred, a further step is required. In this second step the pre-selected areas for a potential knowledge exchange are presented to a group of key figures from the network partners and pilot areas for knowledge exchange are identified.

Using this methodology, several potential areas for knowledge exchange could be identified. Work tasks that appeared to be suitable for an exchange of knowledge could be found mostly in non-productive areas. In the productive areas, mainly organisational topics were identified. Examples for the identified areas of potential knowledge sharing are: organisational concepts for the flow of goods within the firm, organisational concepts for reducing interfaces within job processing, analysis of customer satisfaction, and establishment of performance figures. As far as work tasks in the productive areas are concerned, the sharing of knowledge used in comparable technical processes should offer advantages. In the study at hand, however, the network companies involved appeared to focus on the potentials in non-productive and organisational topics. Several possible explanations for this were identified: on the one hand in spite of technical work tasks, which appear to be similar on the level of abstraction analysed in the study, the companies manufacture specific products, so that they are not directly comparable. On the other hand, the companies' core competencies are concentrated in the productive areas. This implies that the exchange of knowledge concerning these areas is more likely to be regarded as critical. A further explanation lies within the fact that the companies' core competencies are considered highly developed, so that an exchange of knowledge and experience is sought in other areas.

Having identified the thematic areas for a KM support between the five network companies, the final step of the conceptual design phase was the selection of appropriate KM measures. For this task the method database described in chapter 5 was used. The input information for the selection of methods were the identified topics for KM support as described above, the prevailing type of knowledge that is being considered, the KM task that is to be supported (e.g. transfer of knowledge, development of knowledge, identification of existing knowledge) and the general conditions for implementation within the network companies, such as the number of persons involved, IT-hardware and organisational structures. With this input information several KM-methods from the method database were chosen for implementation within the five network companies. The following KM-measures were chosen: Communities of Practice, knowledge fares, networks for new

employees, best practice sharing, project reviews, case studies, frequently asked questions as well as Yellow Pages and database-solutions.

6.4 Implementation

During the next phase the selected KM measures were implemented in the chosen pilot areas. The objective of such pilots was to initiate and support the transfer of knowledge and to generate best practices for the whole VIA-network. Thematic areas in which such measures are being implemented are: remuneration, emergency planning, treatment of surface, performance figures/ controlling, analysis of customer satisfaction, and total productivity management. The procedures for the implementation of the methods is described in the method database and complemented by supporting documents like templates, checklists etc. As already described above, the method map also contains suggestions for the evaluation of the applied KM methods, which have to be adapted to the respective circumstances. Communities of Practice for example can be evaluated using qualitative and quantitative measures. Examples for quantitative measures are numbers of participants, number and frequency of meetings. Possible qualitative measures are acceptance among participants, quality of knowledge and information exchanged and generated in the communities, general benefit and sustainability of the communities. These qualitative measures can be assessed using questionnaires. The findings of the evaluation of the methods will be used directly to improve and supplement the documentation of the methods in the method database in order to reach a high level of usability.

At the current stage, the thematic working groups and the Communities of Practice are being initiated, while the technical solutions for the Yellow Pages and the databases are being selected.

7 Conclusions and further Need for Action

The main achievements of the project presented in this paper are the development of a description model of KM in business networks, a map of KM methods for networks, the integration of these into a methodology for designing KM within business networks and finally the application of the methodology as presented in the case study. A further step that will be carried out within the research project is the development of the service “Knowledge Management for inter-organisational networks” and the prototypic application within the VIA network.

The description model presented in this paper provides a framework for a holistic analysis of KM in entrepreneurial networks by taking all the relevant entities - network knowledge, KM Processes, KM Resources and KM Culture – into consideration.

For each of the four areas of the knowledge model an appropriate standardized framework for the analysis of the current KM within networks – consisting of questionnaires, guidelines for interviews and screen-plays for workshops – has been developed in order to support the KM service provider with the network analysis.

As a further tool for the service provider a map of KM methods was developed as a software tool which offers support for the selection, implementation, operation and evaluation of KM methods based on the results of the network analysis.

The methodology for designing KM in business networks presented in this paper provides a complete framework for the analysis, conceptual design, implementation and operational management of KM within inter-organisational networks. The methodology integrates the description model, in which all the relevant elements (i.e. KM-Tasks, the network itself, KM Design Areas, KM Methods and Instruments) of KM within networked organisations are included, as well as a procedure model, in which the different phases of the KM life cycle in the network are introduced.

The application of the methodology in the VIA-network was also presented; in particular the phases of initialisation, analysis, conceptual design, and implementation were discussed. The next step will be the operational management while the selected KM measures are being applied. In a final step the implemented KM-measures will be evaluated in the VIA-network and hence extended to the other 15 enterprises of the network.

The remaining work package within the research project is the development of the service "knowledge management for business networks". According to the phases of Service Engineering [Luczak *et al.*, 2000] [Liestmann, 2001] – planning of the service, conceptual design, realisation planning, pilot implementation – a concept for the KM service provider is currently being worked on. The concept will be applied and evaluated within the VIA network in 2005.

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