Supporting Business Processes through Knowledge Management – A Technology-based Analysis

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Competence Center Knowledge Networks

Supporting Business Processes through Knowledge Management – A Technology-based Analysis

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MANAGEMENT SUMMARY

The title of this project report is '**Supporting Business Processes through Knowledge Management – A Technology-based Analysis**'.

In the first chapter we give a short overview of the Research Project 'Knowledge Networks' and its theoretical background, especially the **reference model** of 'Knowledge Networks' and the building blocks of the methodology for developing knowledge networks.

In the second chapter, the **objective of the bilateral project**, the **project definition** and the **proceeding** are described. The **project team** and the **timeframe** of the project can also be found in this section of the report.

The third chapter about the project results is divided into two main parts. The first part deals with the topic of '**Knowledge Management Potentials in Business Processes'**. In this part of the report we give an overview of different business processes in the automotive industry and the potentials of supporting them with Knowledge Management (KM) measures. In particular, many examples from different companies illustrate the applicability and possibilities of Knowledge Management in business processes.

This first part of the report is divided further into **linear** and **non-linear processes**. The potentials of Knowledge Management are shown for the linear processes **Product Creation**, **Supply Chain Management** and **Service processes**. Also some examples for the more non-linear activities of the **Innovation process** and **Communities of Practice** are given. Another section of the report is dedicated to the topics **Knowledge Management in E-Business and in Collaborative Work**. What is discussed is the interrelationship between Knowledge Management and E-Business. Also some examples of Knowledge Management in worldwide collaboration which has to consider cultural differences are given in this part of the report.

In the second part of this project report a '**Technology and Market Monitoring**' has been carried out. The evaluation of different Information and Communication Technologies (ICT) in the field of Knowledge Management is a main subject of this report section.

According to the project definition, the technology part covers a rather broad range of topics. First, different **ICT architecture models for Knowledge Management** are discussed. In particular a **network-oriented KM architecture** has been elaborated within the project. This network-oriented architecture model is presented in this report and compared with a **process-oriented KM architecture model**.

Other research questions, which had to be answered, include **software**, **hardware** and **standards** for Knowledge Management and their (strategic) potential. In a first step the relevant technologies for KM have been identified. Then, in a next step, the concept of the **technology lifecycle** has been used to estimate the strategic potential of KM software, hardware and standards. The technologies (software, hardware, standards) have been assigned to one

of the phases of the technology lifecycle in order to classify them as **pace technologies**, **key technologies** or **base technologies**. In addition, for KM software a **technology forecast** has been carried out.

The **development of the vendor and user markets** is a further topic in this report. In particular, the different strategies of the KM software vendors **Lotus**, **Microsoft**, **Verity** and **SAP** have been evaluated. The chapter about market development identifies **market drivers** and **market barriers** for Knowledge Management. Further, some facts and figures from different research studies are presented in order to derive **trends in the KM market development**.

The last section in the technology part of this project report is dedicated to the topic of **Application Service Providing** (ASP) and its challenges and risks.

Last not least, the report finishes with some implications that can be made for DaimlerChrysler as well as for the Competence Center Knowledge Networks.

1 KNOWLEDGESOURCE AND COMPETENCE CENTER KNOWLEDGE NETWORKS

1.1 Research project Knowledge Networks

The Competence Center Knowledge Networks is a research project within the Research Center **KnowledgeSource**, a cooperation of the Institute of Management (Chair of Prof. Dr. Georg von Krogh) and the Institute for Information Management (Chair of Prof. Dr. Andrea Back) at the University of St. Gallen (HSG). Within the framework of an international research co-operation with business and research partners, the objective of KnowledgeSource is to develop an integrated approach to Strategic and Information Management in order to achieve lasting competitive advantage through Knowledge Management.

The **Competence Center Knowledge Networks** (CC KNN) of KnowledgeSource was established 1998 in cooperation with our partner corporations Hewlett Packard, DaimlerChrysler, Lotus Professional Services, and Unilever. It focuses its research activities towards an integrated view of Knowledge Management and networking. The main objectives of the Competence Center Knowledge Networks are to establish a shared understanding, a reference model and a methodology for high performing Knowledge Networks. 'High performing' means to support specific business goals through Knowledge Networks effectively and efficiently. These results aim to support our partner corporations in the process of establishing, recognizing, and facilitating Knowledge Networks within their organizations. To achieve this goal the reference model and the methodology are mainly based on academic research work, bilateral projects with our partner corporations as well as case studies from reputable organizations.

This paper will elaborate our understanding of Knowledge Networks, the findings of our first bilateral project with DaimlerChrysler and the contribution of the bilateral project to the overall research question on Knowledge Networks.

Before describing the bilateral project with DaimlerChrysler, our initial framework of Knowledge Networks should be introduced.

1.2 Research Framework

1.2.1 Knowledge Networks Reference Model

The initial framework of Knowledge Networks comprises the following components:

- *Actors* – individuals, groups, organizations *relationships between actors*, which can be categorized by form, content and intensity,
- *resources* which may be used by actors to network with other individuals, groups or organizations, and
- *organizational properties*, including structural and cultural dimensions such as control mechanisms, standard operating-procedures, norms and values, communication patterns, etc.

These components can be perceived from either a static or a dynamic point of view. From a micro perspective, we conceptualize Knowledge Networks on the following three building-blocks (see *figure 1*):

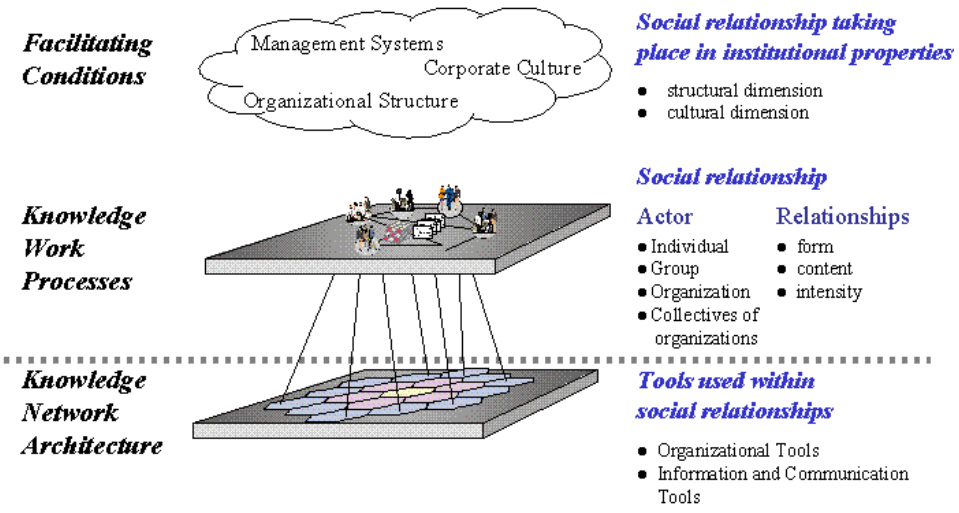

Figure 1: Framework Knowledge Networks - a micro perspective

A. Facilitating conditions

In our understanding Knowledge Networks are rather an additional, cross-divisional, dynamic layer than a new kind of organizational structure. In this regard, one needs to take into account the interdependence of Knowledge Networks as well as their role within their existing organizational units. In order to develop high-performing Knowledge Networks they have to be synchronized by facilitating conditions, which we divide into structural (e.g. organizational structure, management systems) and cultural (e.g. corporate culture, organizational behavior) dimensions.

From within Knowledge Networks (micro perspective) facilitating conditions comprise the network's internal structural and cultural dimensions in which knowledge work processes take place. Therefore, they define the enabling or inhibiting environment for knowledge creation and transfer.

B. Knowledge work processes

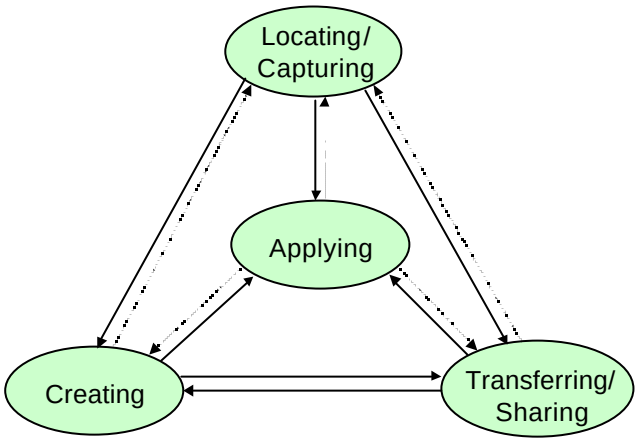

Figure 2: Knowledge process categories

In our reference model we define Knowledge Work Processes in terms of locating and capturing knowledge, transferring and sharing knowledge as well as knowledge creation (see *Figure 2)* as our main categories. The bottom line for all categories is the application of existing or new gained knowledge to create value for the customer and therefore for the organization itself. In our model of Knowledge Work Processes the application of knowledge takes the center role to indicate the knowledge should not be managed per se, but it needs to be tightly connected to business drivers.

C. Knowledge Network architecture

Knowledge Network Architecture, finally, comprises the tool-set used within social relationships. These tools include organizational tools, e.g., roles like the knowledge activists [von Krogh/Nonaka/Ichijo 1997] as well as information and communication tools (ICT), e.g., the groupware-enabled data warehouse concept [Seufert 1997] used to enable and improve knowledge work processes [Nonaka/Reinmoeller/Senoo 1998].

This architecture is not only a collection of modular tools. In the form of "solution frameworks" we want to link architectural designs that are a combination of ICT and organizational tools and methods with the knowledge work processes level.

1.2.2 Knowledge Networks Methodology

Whereas the reference model performs the basic understanding, the methodology provides a blueprint for developing knowledge networks. In the following we describe the building blocks of this methodology.

Our model consists of the following three building blocks:

- **Business Strategy**
- **Knowledge Network Types**
- **Knowledge Network Scorecard**

Knowledge is a key resource in order to achieve competitive advantage. Therefore our model comprises the **business processes**, which are derived from the **business strategy**.

Strategy serves in this perspective as a starting point for defining the requirements that have to be fulfilled by a Knowledge Network. Additionally, especially in practice a concrete task or process might serve as a starting point, too. Within our research we identified the business goals **risk reduction**, **efficiency improvement** and **increasing innovation**.

Knowledge Networks are the organizational environment in which Knowledge Management activities take place. They consist of 3 layers, the knowledge work processes, the knowledge network architecture to support these processes and the facilitating conditions, that is the environment in which the knowledge processes - embedded in business processes - occur. Research has shown that there are different types of Knowledge Networks that can be identified and described by different characteristics. These Knowledge Network Types may serve as blueprints for building a Knowledge Network.

Since Knowledge Networks are the organizational environment where knowledge processes take place in order to achieve the business goals derived from strategy there has to be a intersection between Business Strategy and Knowledge Network Types. One should bear in mind that this interrelation is reciprocal.

On the one hand, starting with a market based perspective, business strategy defines the business goals that have to be addressed by Knowledge Networks, on the other hand these business goals have to be achieved with a certain set of resources represented by the Knowledge Network (Knowledge Networks Types hereby serve as a blueprint in order to get an impression of the resources required). According to the business goals and the derived tasks that have to be executed, a **different cluster of Knowledge Networks** becomes relevant. This cluster can be seen as a **portfolio of network possibilities**, which have different characteristics (e.g. size, roles etc.)

Coming from a resource based perspective, one could also start choosing a Knowledge Network Type based on the company's available resources and adjust the Knowledge Network characteristics in order to meet specific business goals.

This leads to a **matrix of business goals and network types** [Enkel et al. 2000]. The following figure illustrates an example where Knowledge Network Type E1 would be the appropriate choice of a company.

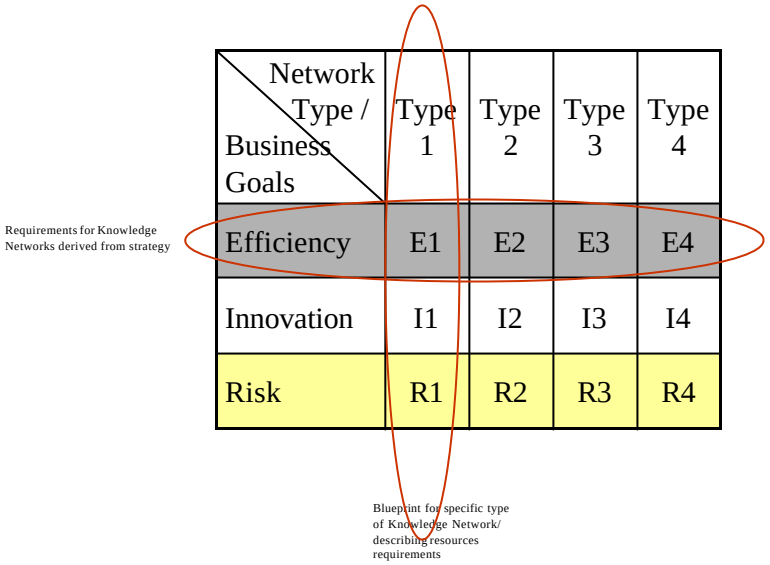

Figure 3: Interrelation between Knowledge Network Types and Business Goals

Based on this decision the company starts setting up the Knowledge Network and uses the Knowledge Network Type (in this example E1) as a blueprint.

The **Knowledge Network Scorecard** finally measures the impact of the implemented Knowledge Network. The Knowledge Network's performance is measured by the output of the business process, which in turn is determined by the degree of goal achievement. Hereby we suggest a system that measures the output of the Knowledge Network in respect to the initial business goal, integrating quantitative and qualitative factors.

The following figure gives an overview of the building blocks of the model and their interconnections.

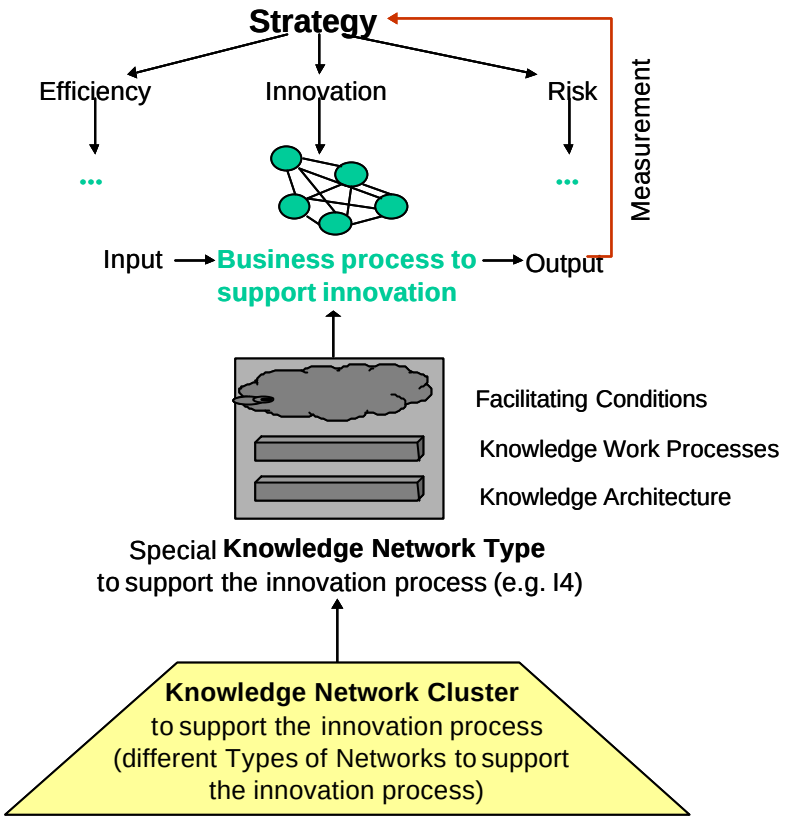

Figure 4: Building blocks of the procedural model

A. Business Strategy

Modern management doctrine has shown in theory as well as in practice, that it is especially middle- and long-term goals, like efficiency improvement, increased innovation and risk optimization [von Krogh et al., 1999], that lead to sustainable competitive advantage [Porter, 1985; Bleicher, 1991 and Prahalad; Hamel, 1990]. There are also many indications in the literature that the discipline of Knowledge Management is most successful, when it comes to middle- and long-term goals [Nonaka; Takeuchi, 1997; von Krogh; Roos, 1996; Senge, 1996 and von Krogh; Venzin, 1995]. The aim of the strategic goals is to give an orientation when developing and choosing a strategy, especially a knowledge strategy. Through the alignment of the knowledge advancement activities with the overall, for all the business units coherent strategic goals, it can be made sure, that the local efforts help fulfill the strategy of the company. It is also our aim to classify Knowledge Networks according to these business goals. In the following the three strategic goals: "*efficiency improvement*", "*increased innovation*" and "*risk optimization*" will be discussed.

The main focus at **efficiency improvement** is to reduce the costs in the existing business processes quicker than the competitors. On company level, it is about achieving higher efficiency by increasing the value of the output compared to the costs of the input. For many companies one of the biggest challenges is to improve their business processes and then transfer them to other parts of the company [von Krogh et al., 1999]. *Texas Instruments* was in the beginning of the 90's confronted with the problem of regular delays at delivering its products. In order to solve this problem, a project was established to search for best practices inside the company. Through the transfer of these best practices between the various units of the company, it was possible not only to minimize delays, but also to reduce the delivery costs [O'Dell; Grayson, 1998]. Increased efficiency in operation can also mean improving the speed of processes, getting the "right" types and amount of processes, having improved decision making and increased responsiveness to customers. It is also essential in this respect to learn from partners, competitors and oneself how to manage the business processes more efficiently.

The goal of **risk optimization** concerns mainly risk associated with investments and the running business. Many companies face at least two main risks: (1) political risk and (2) competitive risk [von Krogh et al., 1999]. The *political risk* is a result of uncertainty regarding political decisions. Especially for international companies, this can present a big challenge, since national governments can often take unexpected decisions, which cannot be influenced by the company. Competitive risks depend on the uncertainty surrounding the actions and reactions of existing competitors as well as the emergence of new competitors. Since many companies operate in more than one market and because of the erosion of the boundaries of these markets, it becomes increasingly difficult to anticipate such changes. In order to reduce its competitive risks, the German company *Aerospace* created a program for simulating possible scenarios for future environmental conditions in its core businesses. The managers in the company can learn this way to see and understand the complexity and interplay of environmental conditions that can have an effect on their business [Schüppel, 1996]. Thus, new knowledge about alternative future scenarios and the functions in the competitive environment is created, reducing the competitive risk of the company. Other risks a company might face are:

(1) Information risk, which is the risk of not having the correct information at the right place at the right time. (2) Knowledge risk, which is the risk of employees exhibiting knowledge deficiencies. (3) Financial risk, which is the risk of the business not managing its finances appropriately. (4) Human risk, which is the risk that the business does not employ the right people for the tasks and that the people with valuable knowledge leave. (5) Derived demand risk, which is the risk that the business either misunderstands or ignores potentially profitable new

technologies, or does not engage in sufficient innovation to offset future competition. (6) Communications risk, which is the risk that the business does not communicate its accomplishments to the market and to the other stakeholders. (7) Customer risk, which is the risk that customers are not correctly managed, that customer satisfaction decreases thereby resulting in lower repeat business and referred business. (8) Structural risk, which is the risk that the business cannot support current management initiatives due to a deficient structure. (9) Resource risk, which is the risk of not having the resources to implement your strategy. Managing the companies risk exposure can also mean capturing the knowledge of experts before retirement, avoiding over-taxing local resources by transferring key personnel on demand and learning from your projects in order to avoid repeated mistakes.

Increased innovation is about improving ones competitive position, through the development of product-, service- and process-innovations [von Krogh et al. 1999]. Innovations are mostly based on procedural knowledge and cultural conditions, which cannot be imitated directly by the competitors. Procedural knowledge is knowledge that has something to do with the generic innovation processes. Such a process consists of different phases, like concept development, evaluation and selection of alternatives or developing prototypes [Nonaka; Takeuchi, 1995]. Cultural conditions encompass shared values and modes of behavior within the company [von Krogh et al., 1998]. For bigger companies with many business units, there is the challenge of leveraging their procedural knowledge in developing different innovations throughout the company, thus achieving a sustainable competitive advantage. Ultimately innovation is about creating new sources of revenues through new products and services. In the long run companies ought to develop a culture that advances innovation. The innovation culture serves the development of many different products within a short period of time“ [Widmer, 1999]. Following the discussion of the strategic business goals, we will now turn our focus to the central knowledge processes and the evolution of Knowledge Management. For innovation it is essential to capture new business process and innovation ideas throughout the companies, to adapt a new product or marketing instrument to another part of the company and to create in depth knowledge to develop radical innovation and process improvements.

B. Knowledge Networks Types

Referring to Nonaka there are four Knowledge Network types that can be distinguished [Nonaka/ Konno 1998]. It should be noted here that we currently do not have decided yet how to name the network types and therefore use type 1-4 in the meantime. Starting from this framework it will be possible to provide a more detailed judgment regarding design potentials. For this purpose, the initial model of the knowledge spiral for networks has to be modified according to the needs of assigning a certain type of network to a specific task. Also the knowledge spiral becomes irrelevant, since we do not conceptualize the development of networks through the knowledge transformation phases. Building on the already introduced model of structuration theory, a differentiation can be made between the generic knowledge processes, meaning the interactive mutation of implicit and explicit knowledge (knowledge transformation), and the structuration of the institutional framework conditions, meaning the building and design of the network (network building).

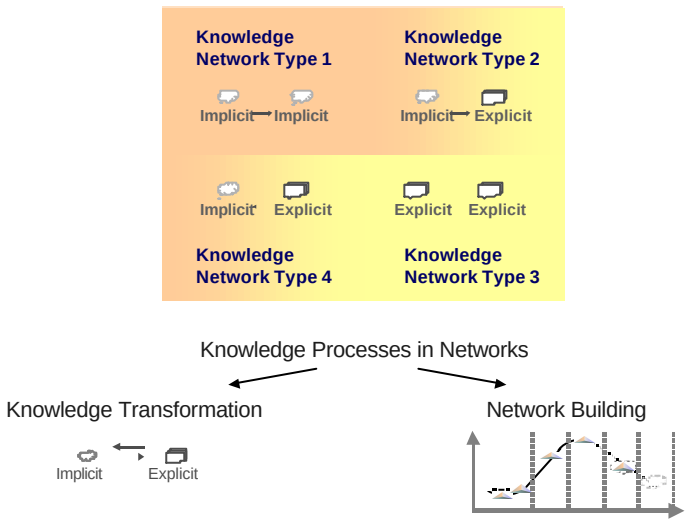

Figure 5: Knowledge Processes in Knowledge Networks

In the following we focus on the knowledge (transformation) processes since they can be used for identifying Knowledge Network Types. The four forms of knowledge exchange will subsequently be used to differentiate the Knowledge Network within the "business goal-clusters". In order for implicit knowledge to be exchanged, as in Knowledge Network Type 1, it first needs to be identified, so as to be internalized through adaptation and model-learning. Knowledge Network Type 2, in turn, deals with the process of identifying implicit knowledge, with its transformation into explicit knowledge being defined by concept- and model-learning and by the exchange of this explicit knowledge. Knowledge Network Type 3 focuses the

identification of already explicitly available knowledge that is interconnected and prepared for decision making, hence, (re-) organized and then distributed. Finally, Knowledge Network Type 4 can be thought of as a Network dealing with the identification of explicit knowledge and the internalizing thereof, in order to apply it in concrete circumstances.

As research has shown, knowledge processes build the heart of the Knowledge Network. In order to meet the goals of the business processes by supporting specific knowledge processes efficiently, appropriate facilitating conditions and tools have to be in place. This means that knowledge work processes, knowledge network architecture and facilitating conditions have to match. Serving as a blueprint, Knowledge Network Types can be used to identify "ideal" forms and arrangements in order to contribute to specific business goals, i.e. supporting key business processes and accordingly having the appropriate facilitating conditions and knowledge network architecture.

C. Knowledge Network Scorecard

The purpose of the Knowledge Scorecard is to measure the impact of the Knowledge Network on the achievement of the business goals risk reduction, efficiency and innovation. Based on performance indicators we are developing a measurement model that brings theses measures into a coherent framework. The following figure gives some examples of possible measures according to the aimed business goal.

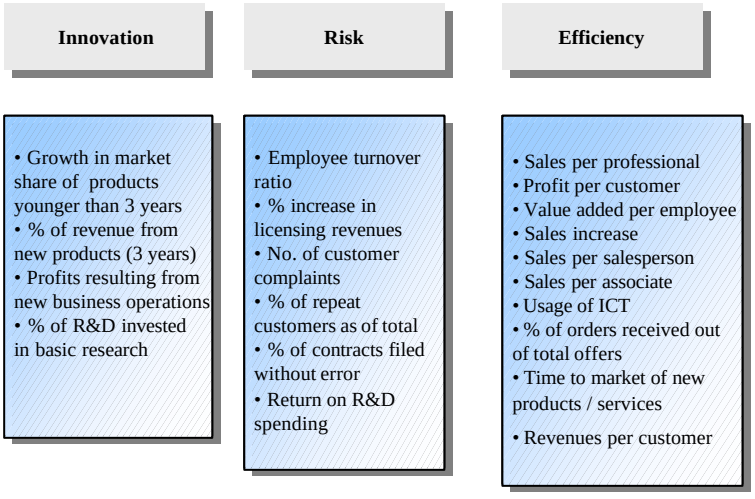

Figure 6: Examples of measurements

Performance measures should have a certain set of characteristics. It is very important to have *cause and effect relationships.* Every measure selected should be part of a chain of cause and effect relationships that represent the strategy. It is also very important to identify the *performance drivers.* Measures common to most companies within an industry are known

as “lag indicators”. Examples include market share or customer retention. The drivers of performance ("lead indicators") tend to be unique because they reflect what is different about the strategy. A good measurement system should have a mix of lead and lag indicators. Performance indicators help determine *how* something is achieved, and should be particular, context-dependent measurements, self defined by the networks. They should also be simple, understandable and use existing systems and processes rather than introducing artificiality or unnecessary complexity. They furthermore create a language for a shared understanding of local activities throughout the company, which is very important. A challenge, that has to be dealt with is that they also influence and shape behavior. Finally the measures should be *linked to financials*. With the proliferation of change programs underway in most organizations today, it is easy to become preoccupied with a goal such as quality, customer satisfaction or innovation. While these goals are frequently strategic, they also must translate into measures that are ultimately linked to financial indicators. Still, with performance indicators for intellectual capital, *direction* is more important than precision, since essentially *approximations* are valued.

In order to have a successful measurement system, one should follow certain steps. Firstly, it is important to develop a greater *awareness and understanding* of the role of knowledge and the nature of intellectual capital. Secondly, the creation of a *common language* that is more widely diffused within their company is necessary, e.g. using terms such as “human capital”. In addition to this, it is essential to identify *indicators* that are suitable and appropriate and to develop a *measurement model*, that brings these indicators into a coherent framework. Finally, one should introduce *measurement systems,* including the accompanying management processes that guide and reward managers and maybe use objective impartial consultants and surveys to carry out key aspects of the measurement process.

2 BILATERAL PROJECT WITH DAIMLERCHRYSLER

2.1 Project description

A first kick-off-meeting between DaimlerChrysler and the Competence Center Knowledge Networks took place at the beginning of September 1999. This meeting was located at the DaimlerChrysler headquarters in Stuttgart-Möhringen. Participants at this meeting were members of the research group KnowledgeSource St. Gallen and Andreas Wiechmann (Strategic IT department, Manager) and Michael Müller (DaimlerChrysler Corporate University, Knowledge Management) from DaimlerChrysler.
Since unfortunately the first idea of a bilateral project in the area of the Corporate University at DaimlerChrysler for some reasons could not be executed as it originally was planned, a redefinition of the whole project – initiated by DaimlerChrysler - took place later at the end of October 1999. Finally, after some bilateral refinements, the following project was defined:

"Im Rahmen der Zusammenarbeit mit der Universität St. Gallen soll ein Technologie- und Marktmonitoring durchgeführt werden. Ziel ist die Erabeitung von Handlungsempfehlungen für die Ausgestaltung der IT-Plattformen im DaimlerChrysler-Konzern. " (in original language)

In English this project definition means:

"In cooperation with the University of St. Gallen a technology and market monitoring should be carried out. Main goal it is, to work out recommendations for implementation and design of the ICT-platforms at DaimlerChrysler."

In detail, the project definition comprises two important parts: on the one hand, core processes of the enterprise (linear and non-linear business processes) and their potentials for Knowledge Management should be described. On the other side, Information and Communication Technologies (ICT) in the field of Knowledge Management had to be evaluated. Both parts taken together, the research results should deliver a contribution to the design of ICT systems at DaimlerChrysler from the viewpoint of Knowledge Management resp. Knowledge Networks.

2.2 Proceeding

According to the project definition, the proceeding of the bilateral project is divided into three main phases.

In the **first phase** of the project, an evaluation of the defined project topics should be carried out. The evaluation was guided by the defined contents of the project plan. This research and evaluation work mainly was done by the project members of the KnowledgeSource. The results of this first evaluation phase then were delivered to DaimlerChrysler and reviewed by the DaimlerChrysler part of the bilateral project team.

In the **second phase**, the results of the evaluation phase were refined considering the feedback from DaimlerChrysler. This phase can be characterized by several 'loops' of feedback. One important milestone in this phase was an event at DaimlerChrysler which took place on 26 of January, 2000 in Auburn Hills (USA) where (parts of) the project results were presented internally. Another feedback was given during a meeting at DaimlerChrysler in Stuttgart-Möhringen on 21th, February 2000.

Another source of feedback was a workshop of the Competence Center on 16th, December 1999, where parts of the project results – especially the developed architecture model - were presented.

Following, in the **third phase** of the bilateral project, recommendations for the implementation and design of the DaimlerChrysler ICT platforms should be given. Those final recommendations then should be presented at DaimlerChrysler headquarters in Stuttgart-Möhringen.

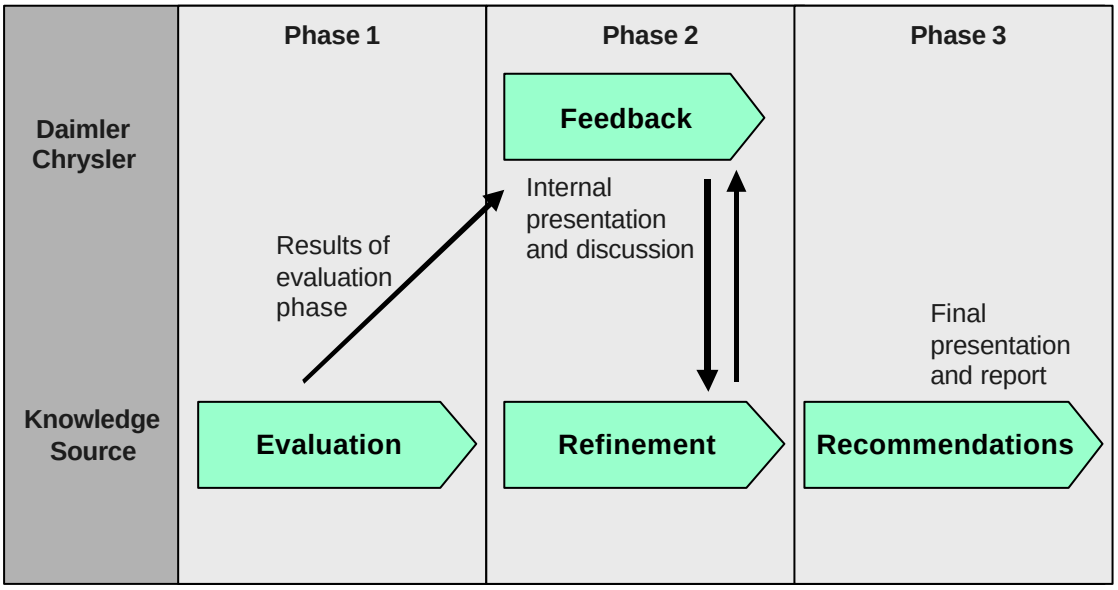

Figure 7: Proceeding

2.3 Team structure and timeframe of the project

2.3.1 Team structure

The team for the bilateral project between DaimlerChrysler and the Competence Center was composed by the following members:

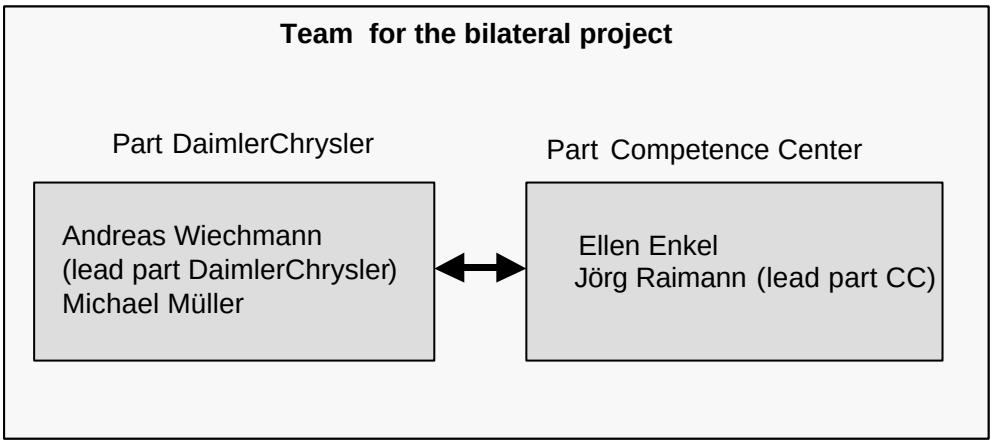

Figure 8: Structure of the project team

On the side of the Competence Center, Andreas Seufert, project manager of the Competence Center, also was involved in the project.

2.3.2 Timeframe

The bilateral project definitely started at November, 5th in 1999. It was agreed to realize the bilateral project within the timeframe of mid of November 1999 and January 1999. At the beginning of the project and also during the project, several milestones were scheduled in order to structure the tasks that had to be executed within the bilateral project. Table 1 gives an overview of the project plan:

Date	Project Task
November, 5th, 1999	Final project definition and start of evaluation phase
December, 10th, 1999	Delivery of results of the evaluation phase
December, 16th, 1999	CC workshop, presentation of the first results of the evaluation phase

January, 24th, 2000	Delivery of the final results of the evaluation phase for internal presentation in Auburn Hills/USA
January, 26th, 2000	Internal presentation of project results at DaimlerChrysler in Auburn Hills/USA
February, 21th, 2000	Feedback on project results, meeting at DaimlerChrysler in Stuttgart-Möhringen (Germany)
Beginning of March, 2000	Delivery of final project report
March, 13th/14th, 2000	Final presentation at DaimlerChrysler in Stuttgart-Möhringen (Germany)

Table 1: Timeframe of the project

3 RESULTS

3.1 Business processes and their support with Knowledge Management

3.1.1 Introduction

The following chapters are based on the building blocks of the methodology as described in chapter 1.3. In this context we first start with superordinated business goals which are generally trend-setting for the whole company as well as for any kind of KM activities respectively knowledge networks. We shortly describe the layer of business processes which represents the (operative) ‚environment' for knowledge networks or other organizational forms. Those processes build a ‚layer' where knowledge work processes as well as network lifecycle processes take place. Based on this short introduction, we align this result chapter with our basic model for the development of knowledge networks and show using examples of linear and non-linear business processes how knowledge potentials in automotive can be exploited.

One possibility can be the network option but in other environments it might be better to use other organizational forms. We tried to show several possibilities using examples of linear and non-linear processes.

3.1.2 Processes

Business processes in general own a high potential for Knowledge Management. This implicates, that KM activities should address single business processes directly, e.g. to provide a business process with the relevant knowledge. Further, KM might focus on the business process layer more indirectly, e.g. to improve knowledge transfer between different processes.

Generic processes in Knowledge Management which are described in chapter 1.2.2 are:

- Locating and capturing knowledge
- Transferring/sharing knowledge
- Applying knowledge
- Creating knowledge

Some business examples can illustrate this:

The capturing, transferring and sharing of e.g. product knowledge should take place between development and marketing. Customer knowledge can be transferred and shared between sales department and management. Further, technological knowledge should ‘circulate’ be-

tween research & development and production. Last not least, process knowledge (best practices) can be shared between the tasks of company development and process management.

Some short-term advantages and potentials of Knowledge Management in business processes are:

- *Knowledge distribution* over the Intranet reduces paper costs, distributing times and consistency problems.
- *Construction of Yellow Pages* (who knows what?) manages transparency and reduces double works (-> also see section about *knowledge base*).
- *Status information* in the Intranet manages progress transparency for any of the processes.

A. Knowledge Management potentials for linear processes

A main internal task within an enterprise is to provide different services. Those services are embedded into the context of business processes. Therefore, current reorganisation concepts like Business Process Reengineering (BPR) concentrate on the reorganisation and improvement of business processes. Further, Knowledge Management too stands in a close relation to the business processes of the enterprise, because knowledge is been created and used while carrying out business processes [Allweyer 1998; Petkoff 1998].

Not the possession of knowledge but the use of knowledge is decisive. Only knowledge which supports concrete tasks in processes can create benefit. The process decides which knowledge has to be provided in which form. Knowledge appropriation and use have to be integrated into the functional tasks of the employee and in such a way it supports its work.

The KM potentials we show in this paper exemplarily refer to three types of Core Processes: Product Creation, Supply Chain Management and Service-Processes.

Product creation process

In the evolution and production a third of working time was spent for activities in connection with information. An engineer is concerned for a third of its day alone with knowledge look-up. This was found out by the Stuttgarter Frauenhofer Institut. A further third is “lost” incorporating and passing knowledge on at procuring, evaluation, documenting, which help to get the products to market maturity [Seeger 1999].

Therefore, an effective Knowledge Management currently helps here to save important resources and to reduce the time-to-market drastically.

Example Knowledge Market Place BMW

BMW creates with the knowledge market place a specific platform for Knowledge Management which was planned with the aim to speed up vehicle evolution. The Knowledge Management- system for this purpose, accesses existing databases of different fields and sets up the required knowledge according to the aspects of experiment, test, construction, quality and so forth. Basic systems imagine a Meta-model, that similarly as a knowledge Map, lists the sources of knowledge. Via Search-Engines, information from all distributed sources of knowledge can be found. The BMW-Intranet includes all documents for processes and documents as well as different databases but also external sources like the Internet. With the aid of so-called eyes and agents, specific fields can be observed or through assigned code-calling requests, sources of knowledge can be localized. The customer is then informed automatically by Email about modifications and changed statuses of the observed objects [Seidel 1998, Seeger 1999].

Example Creation of the Honda City

At the example of Honda, the work and way of thinking of Japanese development engineers can be clarified especially well. The management initiated the evolution of a new car concept in 1978 under the motto "Let`s Gamble". The top management supported this slogan with the formation of a new evolution team, that consisted of young engineers and designers with an average age of 27 years. The management gave the team only two statements: They firstly should develop a product concept which distinguishes itself fundamentally from all the former products of the house and they secondly should develop an economical but not cheap car.

The project manager Hiroo Watanabe took the ambitious planning into a further motto: "Car evolution". This slogan described an ideal in which the question was embedded: If the car would be an organism, how should it develop itself?

Dealing with these guiding principles the team members came to an answer that they articulated in the form of a motto: "man-maximum, machine-minimum". In such a way, they expressed their conviction that the ideal car should exceed the traditional relationship of human being - machine, therefore not sacrificing comfort for the benefit of looking good.

The "evolutionary" trend finally ended in the picture of a sphere - a short and high car. Such a vehicle was for the team easy and cheap on the one hand but also more convenient and more solid than traditional cars on the other hand. The spherical shape offered more place to the occupants, occupied however less room on the street. Due to this the engine and other mechanical systems needed fewer space. Thus, the product concept "Tall boy" evolved, which eventually led to the Honda City.

The concept "Tall boy" stood in clear contrast to the at time valid attitudes regarding car design. The revolutionary styling and the construction of the City proved to be a break-through. The model allowed a completely new construction base in the automotive industry of Japan, that led under the specification "man-maximum, machine-minimum" to the prevailing high and short car models in Japan today.

The heart of knowledge procurement consists in Japanese enterprises in the transformation of implicit (e.g. metaphors and analogies) into explicit knowledge. Subjective ideas or presentiments have no value for the enterprise as long as the individual can not translate it into explicit knowledge in order to share it with others. In the above example, the managers provide their implicit knowledge to the evolution team, they build a Knowledge Network, this develops a vivid model from this and finally a new production concept (and therefore explicit knowledge) [Nonaka/ Takeuchi 1997].

Supply chain management

The relationships along the supply chain are rather complex. This results from the great number of the supplier - customer - combinations and the high number of process steps which are necessary concerning the many intermediate goods in the engaged enterprises. These relationships are difficult to coordinate because of the different cultures, goals and rules in each company.

Most cooperation between subcontractors and manufacturer are structured in the form of vertical networks. They can be led back to an upright division of labor and lead to pyramid-shaped supplier-structures, because sequential economical stages are combined. Characteristic for such structures is, that the core delivery with the manufacturer occurs and that it core supplier hands over as soon as, much in a graded manner, component suppliers. In this manner, a multistage classification emerges from supplier and sub-supplier.

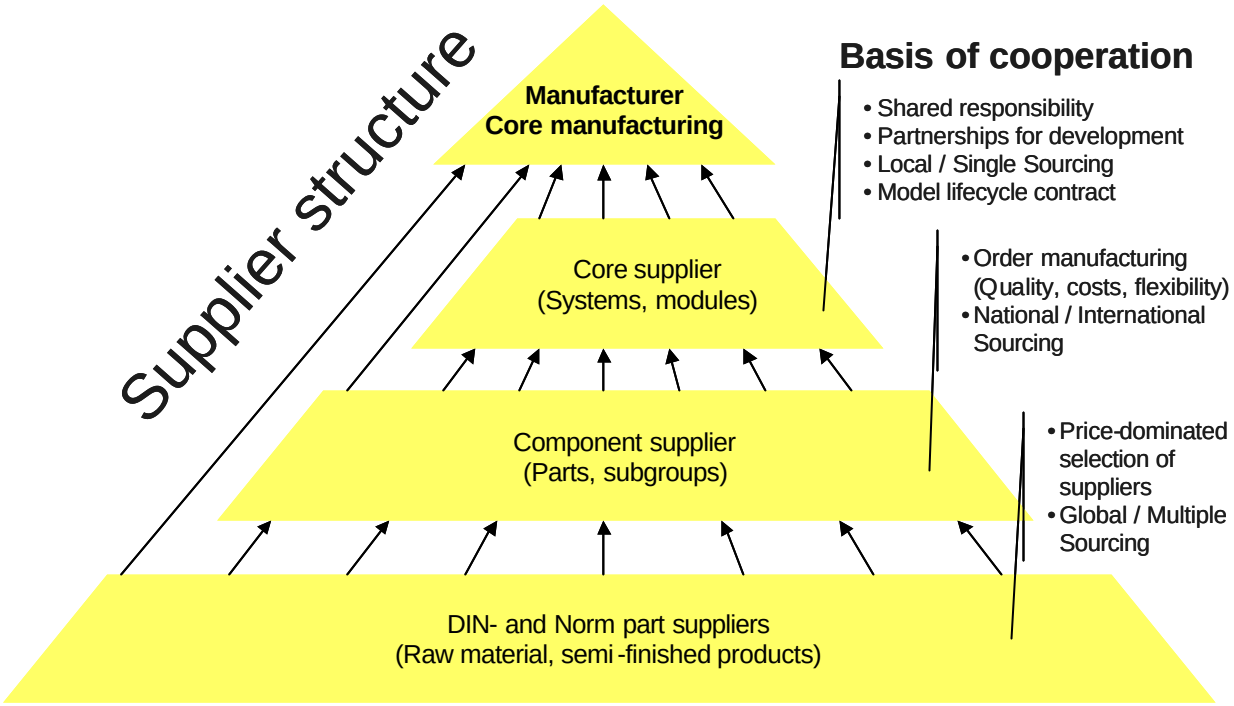

Figure 9: Pyramid-shaped supplier-structures [Wildemann 1998]

BMW has co-operated in such a way for example with Gema Voltstatik, Eisenmann, Dürr and BASF colors and enamels co-operate in turn with Nippon Oil & Fats. The aim of this is a comprehensive and intense cooperation with only few qualified suppliers who were carefully selected by the car manufacturer. The number of suppliers was reduced at BMW from 900 to 70 [Wildemann 1998].

The pyramid-shaped construction of the suppliers structure leads to increasing demand on management and coordination competence. The optimal benefit results from a constant knowledge flow and by the transfer of know-how achieved, both sections of Knowledge Management. Two examples for the successful Knowledge Management effort in the supply chain were presented in the following:

In the enormous planning- and coordination assignments that result from the pyramidal structure, Knowledge Management is able to optimize relationships and lead to genuine competitive benefit through cost reduction and faster response times.

From the great number of the potentials to be achieved through KM, which are embedded in the supply chain following two examples are shown.

Example 'Supplier Cost Reduction Effort' (Score) by DaimlerChrysler

Score was introduced by Chrysler in 1989 as a kind of industry-wide proposition entity with its subcontractors. Through the direct integration of the suppliers into process optimization costs were reduced. It may be, that without doing this the expenses of the subcontractors rise. Aim of the program is either to achieve a cost reduction or process- resp. product improvements in the case of identical costs. The costs in the process of the entire value chain should be reduced on a long-term basis, including the suppliers. A costs reduction by 5% should be achieved per annum [Wagner 1999].

The success of the system is also supported by the creation of a 'Win-Win´ situation, because of the splitting of the cost savings.

The core of the Score concept is based on knowledge collection and know-how transfer with the suppliers and therefore based on Knowledge Management techniques. The subcontractors knowledge is linked directly by Score into the supply chain via process optimization. The subcontractor is rewarded for coming up with new ideas concerning costs reduction. This appears to be a best practice concerning the integration of the suppliers Know How for the optimization of business processes.

Example Company-wide teams by Toyota

The automotive industry of Japan has been characterized since a long time by complex, long-term replacement relationships between suppliers, external service providers and the car manufacturers. The long term contracts often control the nature of the contact to the suppliers. This must in itself guarantee the long-term mutual ties, which are based on stringent selection criteria. In the case of Toyota, suppliers are included in evolution and decision processes over decades, which increases the efficiency and effectiveness of the corresponding relationships.

Functional aim of this Knowledge Network is the optimization of the capacities of different participants of the value chain by focusing on and optimizing competencies.

Determining factors are the strong mutual dependencies between the enterprises and the narrow mutual replacement relationships which are necessary. In addition to standardized transaction relationships in the case of Toyota, personal relationships between the participants are of exceptional importance too as well as the work in company-wide teams. The company-wide cooperation overcoming organizational barriers, can be secured only by such supporting formal and informal procedures. In these teams there should also be transferred implicit, not codified knowledge in addition to explicit knowledge through the personal contact. Co-operations should operationalise new knowledge in the generated manner and so acting Knowledge Management. The company-wide teams create a forum for knowledge replacement and serve the optimization of the supply chain [Ward et al. 1998].

Service processes

Sale and service processes require comprehensive knowledge over customers and their problems but also about new products of the own and other enterprises. New knowledge results simultaneously through fulfilled customer expectations, product weak points and relevant market trends.

Only by the compilation and evaluation of data, new knowledge about the customer can be developed and influence the service processes. There are numerous possibilities to test customers satisfaction or marketing strategies and to extract knowledge from the collected data.

Example BMW Online Ordering

Marketing of the BMW cars works through a network of approx. 800 legally independent appointed retailers. Interested customers look up the appointed retailers and order the car over the trader by BMW. The complex process which begins with recording the customer needs was readjusted in 1998 by BTX to I-NET technology. This had the effect that the appointed retailer no longer used the telephone or catalogs to determine variants, which took at least 1,5 workdays. This speeds up and simplifies the whole process, increases customer satisfaction and is also less error-prone.

The system also offers the possibility to choose all the variants of the individual components to already existing similar types in production and to adapt to the customer preferences also at smaller volumes. The online Ordering system includes a research function which searches all the German appointed retailers for exhibition and resting vehicles.

In addition to the economical aspects, it was also found that with the adaptation to Online Ordering customers satisfaction increased since the customers completed the processing and ordering procedure faster and could configure their car individually [Bach/ Vogler/ Österle 1999, pp.234-240; Hudek 1998, pp. 198].

In the case of the sale process via the Online Ordering the appointed retailer can have a look at all necessary information. As a result the execution times, the total expenditures of the sale process as well as error rates were reduced dramatically and customer satisfaction increased considerably.

The information about model versions and availability enters the BMW Online Ordering system. Together with knowledge concerning the orders of the appointed retailers (detailed product information) and knowledge about the customers needs (individual design options, optical responsiveness and vivid representation, fast reaction times) resulted in the above described Ordering system.

Example the effort of the Toyota Lexus

Toyota brought out a car of the luxury class with the Lexus at the end of the 80's. Already at the beginning of the 90's, the model ranked in the customer satisfaction ratings of the agency J.D. Power & Associates at the top. Soon after this another manufacturer of luxury cars instructed the market research agency Custom Research Inc. (CRI) to find out why the Lexus owners are so satisfied. CRI compiled a series of focused groups in order to gather the comments of the Lexus owners in their own words. Most reported with eagerness, how they were handled considerately and attentively by their Lexus trader. It became clear that for the Lexus, though technically seen as a good car, customer satisfaction was very strongly influenced by the received attention at purchase and the later service. Lexus owners felt appreciated as customers, taken care of and respected. For example a woman in the course of a focuses group session said several times, that she never had any problems with her Lexus. She admitted only after repeated "questioning": „Well, I presume, one ought to mention the four-time replacement of the windscreen as a „problem". But they were so nice and gave me always a replacement car each time so that I did never feel the replacement was a problem, before you reminded me of it." The CRI study showed that the practice to give customers every time a replacement car, diminished every pain by the repair experience. The insights from the focus-groups helped to understand, why the Lexus satisfaction values were so high in the Powers ratings. And the principal of CRI could derive findings that could not have been taken from the pure numerical values [Berry/ Parasuraman 1998].

B. Knowledge Management for non-linear processes

In every enterprise, there are - in addition to numerous linear business processes – also non-linear processes which have strongly impact on competitiveness. Innovation processes in which a project group should develop a new product belong for example to these non-linear processes. Also a group that supports the information or knowledge flow between the different group (e.g. project groups, communities of practice) work in a non-linear process. There are so many expressions of non-linear processes that we cannot describe them all or identify some core processes for example. Therefore we describe the structures of one non-linear process – the innovation process – and a possible organizational form to act in non-linear processes – the Knowledge Network or Community of practice.

Innovation processes

In an innovation process new knowledge will be created. How is new knowledge created? According to Nonaka [Nonaka/Takeuchi 1997], this process takes place in a spiral, when knowledge first combines, then is externalized, socialized and finally internalized. How does this look like in detail?

First an individual or group combines pieces of explicit knowledge into a new whole and/or employs existing knowledge in order to solve a task. Then they convert tacit knowledge into explicit knowledge, they make their knowledge accessible to others. The next step is to transform individual tacit knowledge into organizational tacit knowledge, they learn by working together on a common task. The last step is to transform explicit knowledge into tacit knowledge, they reflect on key individual experience and start to practice.

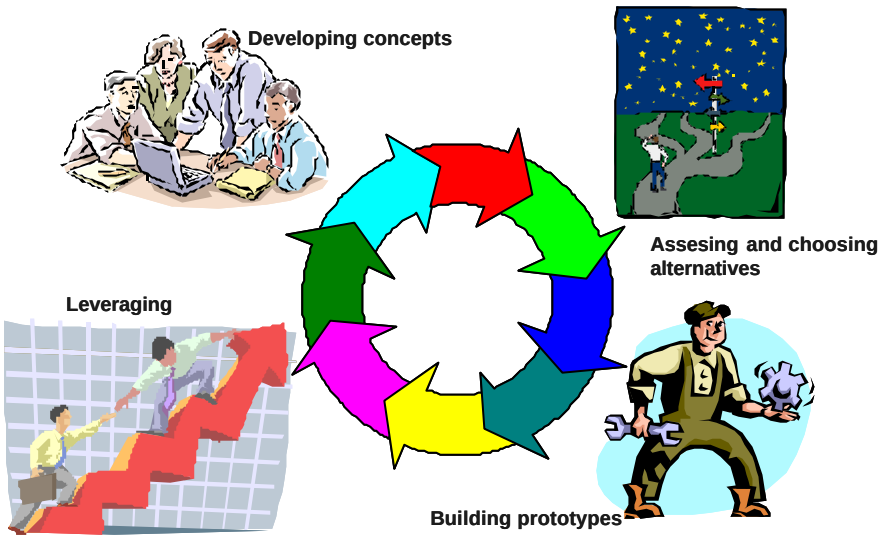

Figure 10: Innovation Process

What does this course of events look in practice? An innovation network, existing from developers ought to create new car models. In this case, they proceed in the following steps: developing concepts, assessing and choosing alternatives, building prototypes and leveraging. All are embedded in an high care culture [von Krogh 1999].

Developing concepts: Briefly in a described manner they work together on common tasks. They express tacit knowledge in language (new words, analogies, procedures, metaphors and models). They brainstorm around new concepts based on the transferred and shared knowledge. They develop products, process or service specifications in form of drawings, essays, list of requirements etc.

Assessing and choosing alternatives: They involve external parties into the process. List up criteria for concept evaluation and assess the potential value of the concept for the company, consumers and society by „testing“ it on different stakeholders. They select concepts that satisfy the criteria developed in the second phase.

Building prototypes: The network develop specifications, models and prototypes, convert selected concepts to a first scale form or model and develop and utilize tools. They utilize already existing components and check if the prototype fulfills the goals.

Leveraging: They visualize the created tacit and explicit knowledge and process outputs. They develop a catalogue of knowledge, community members, knowledge maps, concepts, documents, selection criteria and so forth. Now they document the key learning`s and what others could learn from them. They transfer knowledge into for example manufacturing, marketing and sales through product/service specifications. And at least they share knowledge through workshops and communities.

Communities of Practice

The organizational structure in which those non-linear processes happen can be (like in linear processes, see the examples upon) Communities of Practice or Knowledge Networks. Those groups often exist outside the line organization. Within them are people assembled, who have a common destination, e.g. the optimization of a business process.

Many people think, that knowledge is in the possession of individuals. However it is often acquired and received in a collective. Such knowledge results, if people cooperate in groups associated narrowly which are named Communities of Practice [see Lave/Wenger 1993]. Such a working method and communities exist in all organizations, therefore, company internal knowledge is of fundamentally social nature. An essential part of company work consists in controlling knowledge.

They can do this e.g. by the formation and promotion of Communities of Practice for very specific knowledge fields. Not only pure special knowledge, the "Know what" should be shared and transferred as but also the implicit knowledge, the "Know-how". This includes among other things the experiences and insights of a person. In this way, "Know-how" is the product of experience. A group, in which "know-how" and opinion pictures result as a group process and its members cooperate must in order to better share their knowledge, create a "Community of Practice”.

A study of Julian Orr showed, that even for individual workers with comprehensive special knowledge, collective know-how can be of great importance [Orr 1993]. Generally it is maintaining that common practice leads to forms of collective knowledge, common finding proc-

esses and the circulation of insights, which are not limited by what goes on in the individuals heads.

Example DaimlerChrysler Tech Clubs

One Example of these Communities of Practice are the Chrysler Tech Clubs. General Aspects of Knowledge Management at DaimlerChryslers Tech Clubs [Irish 1999] are:

⇨ "who" knows the "what, how and why" of the core competencies of the organization

To achieve relevant and useful knowledge, eliminating knowledge that is either non-value-adding (irrelevant or superficial) or damaging (obsolete or untrue) and allow the creation of new ideas, recognition of previously unseen patterns, the synthesis of separate disciplines and the development of new improved processes.

Core aspects are:

- Information access and sharing capability
- Expertise leveraging
- Controlling the level of information pollution

To do so, Chrysler created the first Tech Club in Nov`96. In the next years they defined / communicated a Knowledge Management model in June 98 and recommended guidelines for this (technology, measurement, processes, Roles an Responsibilities). These guidelines were publishes in the „Books of Knowledge" which are open to all employees. The members are individuals from across the organization and the participation is voluntary. The core group of 10-15 individuals who interacts on a regular basis meets once a month, gives presentations and advices. The DaimlerChrysler Tech Club serves the acquiring, storing and transferring of knowledge [Irish 1999].

3.2 Knowledge Management in E-Business and in collaborative work

Two aspects of Knowledge Management which are of special importance for the future evolution of a company will be discussed briefly at the following pages.

The Internet is seen by experts as the market of the future. How can Knowledge Management help to develop this market? How will this market develop?

Enterprises are forced more and more to entrust international teams with tasks which would could not have been able to be solved within the frame of a single culture. Can multi-cultural teams work? If yes, under which conditions? What must be considered?

3.2.1 Knowledge Management and E-Business

In most enterprises, Knowledge Management and e-business initiatives have been approached independently. This may be a sensible pragmatic approach to retain focus and avoid overextending each program. But there are important interrelationships: 1) Achieving KM objectives (improved utilization of expertise and knowledge) can be key ingredients in e-business success; 2) IT investments supporting KM and e-business transformation may be linked at the implementation level. The relationship of KM and e-business therefore challenges both strategic investment policy and IT programs.

Business knowledge and its exploitation is fundamental, independent of any e-business issues. However the transformation implied by e-business brings knowledge into sharper relief [Hayward/ Harris 1999]. Knowledge Management supports the following e-business goals:

- Capture, share and act on firm`s collective knowledge
- Build trust and collaboration among diverse business partners
- Quickly communicate precise, reliable knowledge across all processes and all stakeholders
- Provide all stakeholders with access to the right knowledge at the right time

Over the long term e-business will become simply business, and KM simply management, and the relationship between the two will cease to be questioned. In the future, the explicit focus on e-business and on knowledge will be crucial elements in business success. Those enterprises that best exploit the interrelationship will be at an advantage [Hayward/ Harris 1999].

3.2.2 Aspects of worldwide collaboration

In the seventies the figure Ronald McDonald which was at the center of McDonald`s advertising campaign in Japan had to stop. This mascot always comes with a face having white makeup, which in Asiatic cultures is a symbol for death.

Procter&Gamble started an advertising campaign in the middle of the eighties in Arabian countries, showing on the left a pile of dirty laundry, in the middle the detergent and to the right, as the result a pile of clean laundry. The campaign failed because the Arabs read from the right to the left [Wojatzek 1999].

These two unsuccessful experiments, western products with a western understanding of culture show very clearly, that the culture of a country has an influence on the understanding and also on the behavior of the persons who belong to it. In such a way, one needs not only to fall back upon cultural knowledge with the worldwide marketing of products but also upon worldwide cooperation between enterprises or between international teams.

The different examples regarding product design (evolution of the Honda City compared to the innovation process in "western" knowledge networks) show the cultural differences. In such a way, Asiatic enterprises e.g. work strongly with analogies and metaphors. The ethnic and cultural homogeneousness which so much favors the sharing of implicit knowledge between Japanese can turn out to be a cultural boomerang in that manifold world economy.

Cultural Differences

According to Nonaka [Nonaka/ Takeuchi 1997] there are some important cultural differences in knowledge procurement between japanese and western Models:

Japanese companies

- Alignment to the group
- Orientation on the implicit knowledge
- Fortes in the socialization and the internalization
- Emphasis on experience
- Danger of time consuming group thinking and of over-adaptation to last successes
- Necessary variety through inter-functional teams

Western companies

- Alignment to the individual
- Orientation on the explicit knowledge
- Fortes in the externalization and the combination
- Emphasis on analysis
- Danger of too much analysis
- Necessary variety through individual differences
- Clear company intention

Regarding the represented differences, it is by no means simple to work successfully in worldwide teams. As successful projects show, international projects with multicultural teams are only possible under three conditions . The management firstly must show a strong commitment for the project, to achieve all the more a real motivation on the project team. Secondly the encouragement of competent managers as knowledge engineers for the project plays a decisive role. The project participants thirdly should develop a sufficient measure of confidence in each other. A language understandable for all sides and intense dialog which clears doubts and supports mutual respect are also preconditions for success [Nonaka/ Takeuchi 1997].

The successful evolution of the Nissan Primera demonstrated that in an international team by adaptations, mainly in the form of an intense socialization and an externalization, human beings from different cultures exchange their knowledge and develop confidence in each other so that effective cooperation is possible .

3.3 Information and Communication Technology for Knowledge Management

3.3.1 Knowledge Management Architecture

In the literature about KM, different approaches are described how Knowledge Management can be supported with ICT systems. E.g. KM can be understood as 'Knowledge Engineering' as 'Business Process Modeling' or KM might follow a 'system approach' [Petkoff 1997]. Depending on, which approach is chosen, different ICT architectural models will result out of it.
What has been done within the bilateral project is to describe two of those general possibilities how a generic **KM architecture** resp. **KM framework** from an ICT perspective can look like:

1. The first possibility which is described in the next paragraph, can be characterized as a **business process-oriented KM approach**.
2. The second possibility of a KM architecture has been developed within the bilateral project. It follows the 'paradigm' of a **network-oriented KM approach**, on which the Competence Center Knowledge Networks is based on.

Both approaches, which are described more in detail in the next paragraphs, do not exclude themselves mutual. Rather, they complement each other and can be combined in a suitable way.

A. Business Process-oriented Knowledge Management architecture

The first suggestion of a KM architecture can be characterized as the 'architectural design consequence' of a KM approach that focuses on certain business processes. According to this approach, (single) business processes should be supported with Knowledge Management and related activities. A main goal of this KM approach is, to **provide a business process with the relevant knowledge** that is needed to perform the business process as good as possible. This KM approach stands in the tradition of ‚Information Management' as well as Business Process Reengineering (BPR). Another characteristic of this approach is, that it mainly focuses on already existing, explicit knowledge.

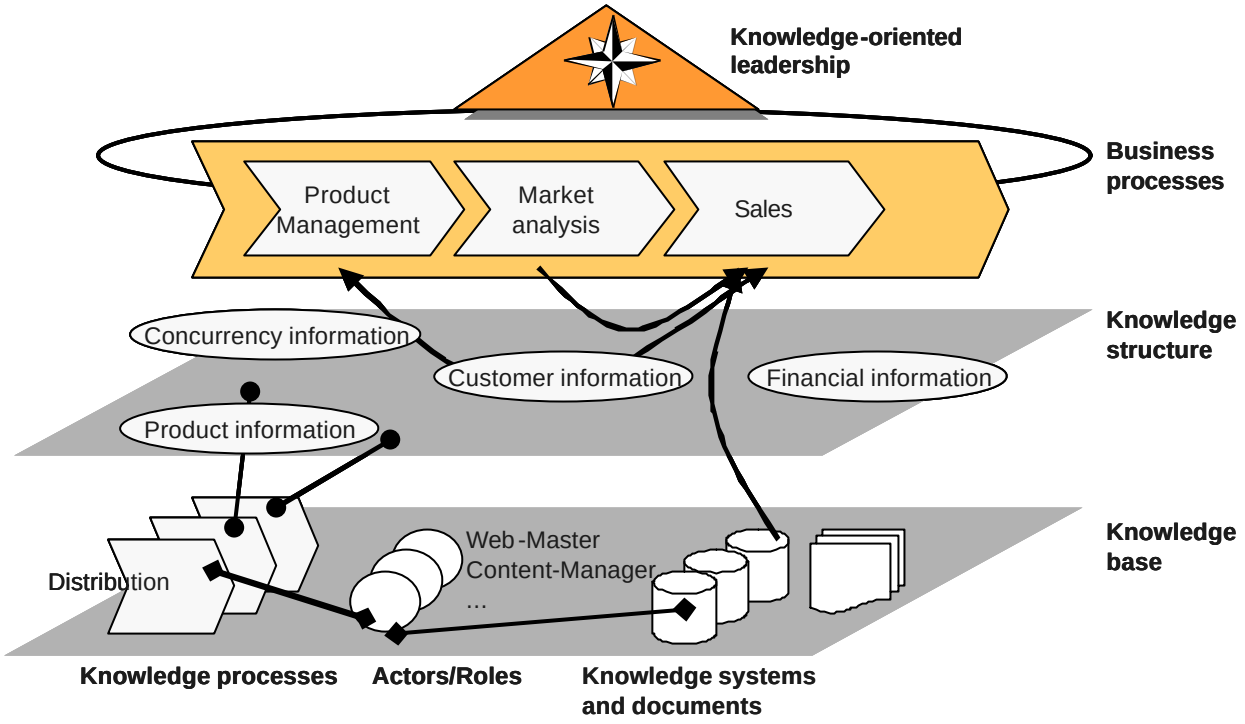

Figure 11: Architectural Framework for process-oriented KM approach: Functional model [Bach/Österle 1999]

It is obvious, that this KM approach requires an existing business process to be put into practice. The process-oriented KM approach in particular seems to make sense and therefore can be used for **well-structured and linear business processes**. E.g., the KM strategy of the ERP vendor SAP follows this KM approach.

Central within the process-oriented functional architecture model is the **layer of business processes**. Each business process has to be provided with the relevant knowledge. Knowledge only then is useful, if it can be applied within the business process and its tasks that have to be executed. The **knowledge should be structured** to support the business process (e.g. product information, customer information). **Knowledge flows** within and between business processes have to be designed adequately. On the level of the knowledge base, **knowledge processes** have to be organized. This requires the establishment of certain **roles** (e.g. web master, content manager). People as **actors** are also part of the knowledge base, since they act as ‚carriers' of implicit knowledge.

Traditional leadership is complemented with **knowledge-oriented leadership** within this architecture model, which also implicates the **usage of new measures** (e.g. the Balanced Scorecard). [Bach/Österle 1999]

B. Network-oriented Knowledge Management architecture

The second architecture possibility follows the ‚paradigm' of the network-oriented Business and KM approach. In the center of this approach stands the ‚network' (and not primarily a business process!) which simplified can be defined as a number of people and their relationship (e.g. based on a common characteristic). The main goal of the network-oriented KM-approach it is to provide a network or a network-like structure (team, community, project task force, knowledge network) with an appropriate Knowledge Management environment in order to increase and maintain the ‚performance' of networks. The network-oriented KM approach can be used for linear business processes as well as the support of network-oriented work. A certain business process is not necessarily required (in many business areas there often exists no such structured business process!). Rather, this approach also can be used in areas of **less-structured, non-linear work** or **also to link different business processes or business units** with each other (think of Communities of Practice as an example). It is important to recognize, that the Network KM approach is **people-oriented**. Furthermore and in contrast to the process-oriented KM approach, the Network KM approach also includes the **creation of new knowledge**.

Architectural framework

The network-oriented KM approach is a primarily **people-oriented approach**. What has to be supported by the network-oriented KM architecture model is in the first place the network itself and the people involved in the network. Each network has to fulfill certain functions or tasks. To execute this functions and/or tasks a network and its members have to be provided with the relevant knowledge. The **knowledge demand** might be induced by a business process (like it is in the business process-oriented KM approach), but there might also exist other reasons for the demand of knowledge.

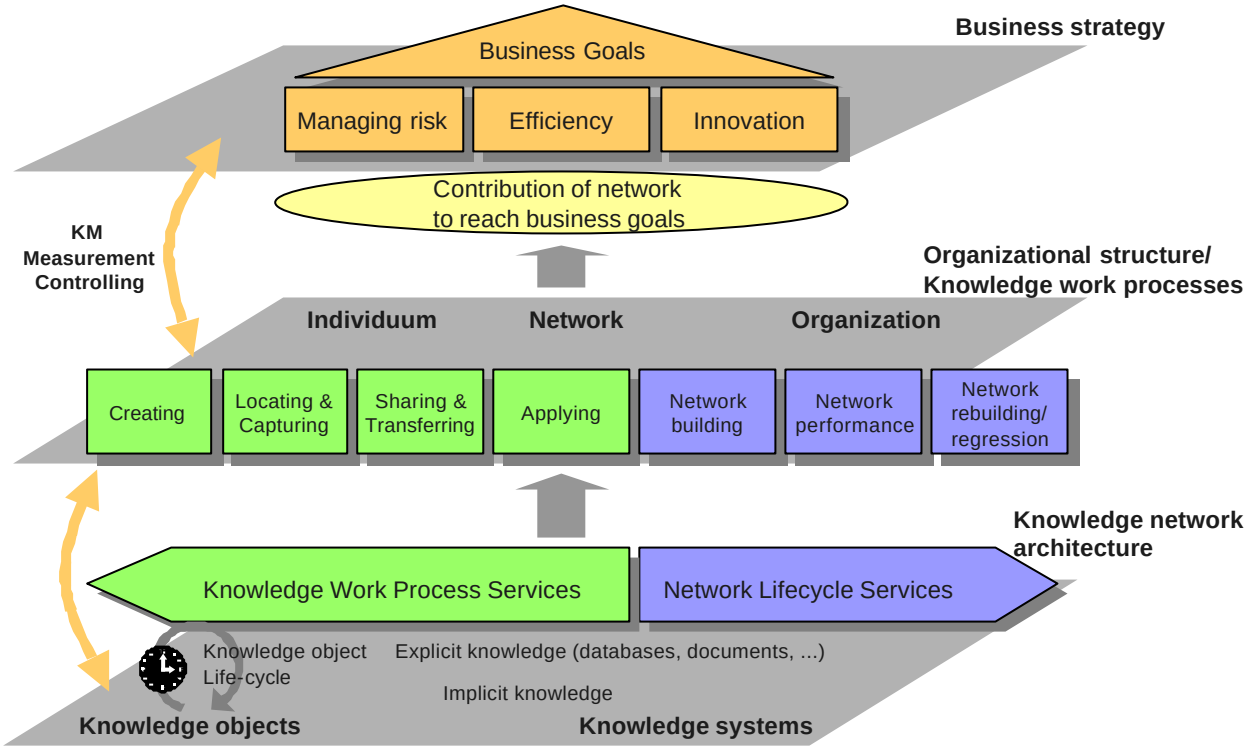

Figure 12: Architectural Framework for network-oriented KM approach: Functional model

The suggested network architecture model includes a **strategic layer**. In our Competence Center Knowledge Networks we distinguish three basic business strategies: **managing risk**, **improving efficiency** and **increase innovation**. Each network supports directly or indirectly one ore more of these business goals. The suggested network architecture model – which is a generic model – can be used to derive more specific reference architecture models for the support of each business goal. E.g. a network to support the business goal ‚Innovation' has to be configured in another way as a network to support the business goals ‚efficiency' or ‚risk management'.

To control the success/contribution of a network to reach the business goals, some kind of **KM measurement** also has to be part of the network-oriented architecture model.

It is important to recognize, that a network does not only work with already existing knowledge. An important element of the network KM approach is, to support all knowledge work processes with so-called **knowledge work process services**.

A second category of services are so-called **network lifecycle services** that support the lifecycle of a network. E.g. those services have to provide check-in/check-out mechanisms for the network members. Collaborative tools and functions are important for network building, and so forth. Additional services might be services to **control the network** and also to **visualize the network**.

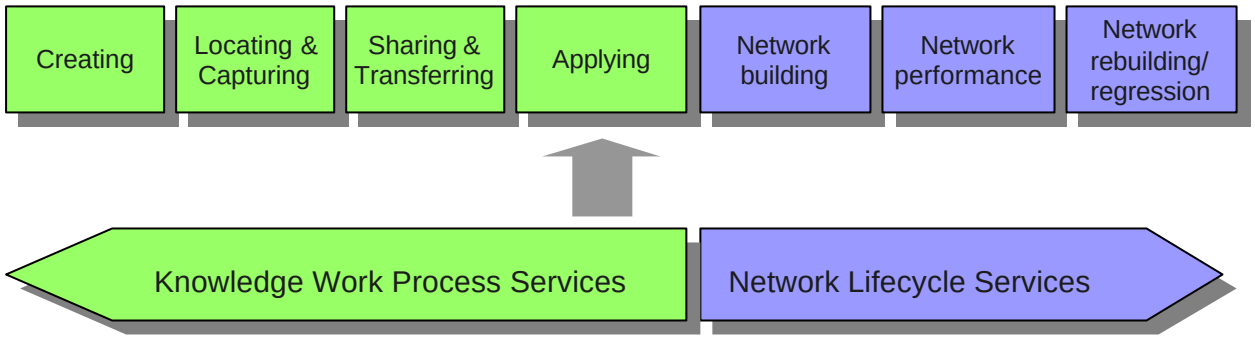

Figure 13: Services of the network-oriented KM approach

A network should not act isolated from the rest of the organization. That's why the support through a knowledge network architecture has to address **individuals** as network members, the **network** itself and the surrounding **organization** with appropriate services. To enable knowledge exchange between the different organizational levels, the architecture **provides different ‚work spaces' for individual, network and organizational level.**

Knowledge Base

A knowledge base as part of the knowledge network architecture layer provides access to all kinds of **knowledge objects** as well as to **knowledge systems**. It is important to recognize, that those knowledge objects are not static, but rather **dynamic**. This means that each knowledge object, starting with its creation goes through a certain **knowledge object life-cycle** in which it has a specific, well-defined state at every moment. This has to be considered when designing and implementing a knowledge network architecture.

The knowledge base within a (enterprise-wide) KM architecture includes and integrates all kinds of **explicit** as well as (‚pointers' to) **implicit sources of knowledge** and also different types of knowledge systems (e.g. ERP systems, groupware systems).

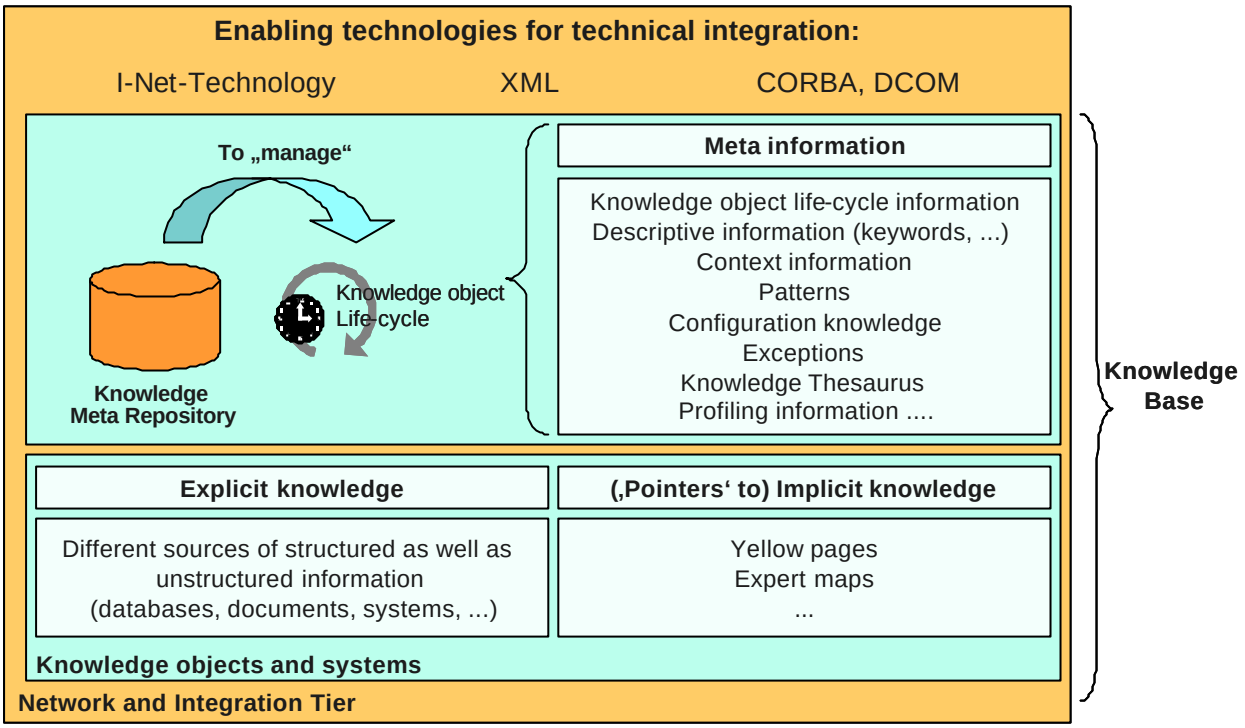

Figure 14: Knowledge Base

A main implication of KM on the data tier is **increased use of meta-information**. In KM, meta-data e.g. is used to categorize, define, and describe other data. Examples are maps and data to unify the access to disparate data sources [GartnerGroup 1999a].

Meta-information also helps to

- manage the ‚dynamic‘ knowledge object lifecycle
- deal with **different contexts of knowledge,**
- **reuse knowledge** through the **use of patterns**,
- configure knowledge for **different application purposes,**
- ‚handle‘ **exceptions,**
- establish **knowledge taxonomies,**
- build **profile-based applications** (e.g. knowledge portals, CRM).

Technical aspects

The figure on the next page shows some aspects how the suggested functional network-oriented KM architecture model can technically be realized. The suggested technical architecture model is realized as a typical **3-tier-architecture** (without the network and integration tier). The background for this architecture is represented by the **network and integration**

tier. Today, **open and standardized I-Net-Technologies** (= Internet/Intranet-Technologies) are the mostly used technologies to realize enterprise-wide or world-wide accessible applications. An intranet as the existing ICT infrastructure in a company can be used to build on it the suggested technical architecture.

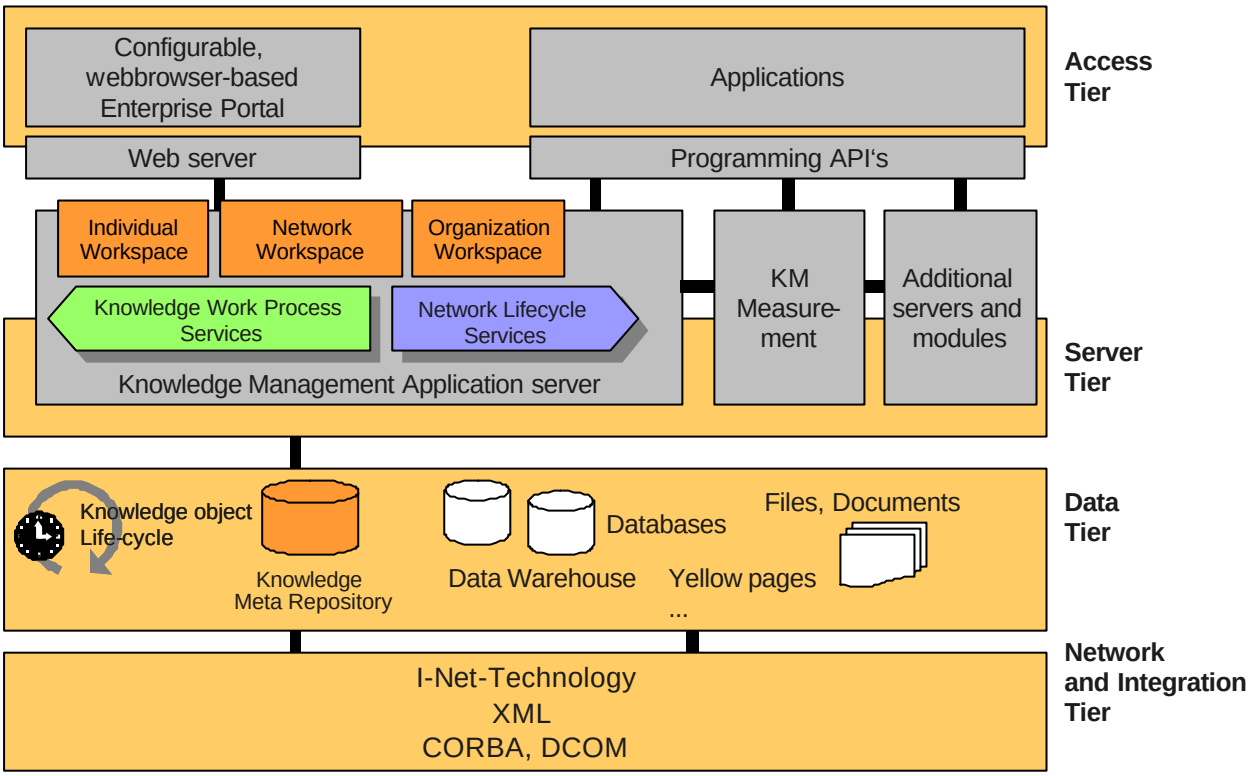

Figure 15: Architectural Framework for network-oriented KM approach: Semi-technical model

Concerning integration, I-Net technologies help to realize a consistent KM architecture. It is very probable that among others the language **XML** (Extensible Markup Language) in the near future will play an important and central role to integrate the different architectural tiers.

An important part of the data tier is the **knowledge meta repository** in which information about the different information sources is stored. The knowledge meta repository among others helps to manage the life-cycle of the different knowledge objects.

On the server tier, the **knowledge work process services** and the **network lifecycle services** have to be provided by one integrated product or several appropriate products. E.g. the knowledge work process services can be covered by a ‚Knowledge Management Suite'. The network lifecycle services e.g. can be implemented with collaborative ‚Community Software'.

A **Knowledge Management application server** should offer different **workspaces** for the individual network members, the network and the organization. **KM measurement** also can be realized on the server tier (e.g. as implementation of a balanced scorecard).

For the access tier, the suggested technical architecture model recommends the usage of **portal technology** to realize a ‚**single point of access**' to different knowledge objects and also to different applications. This ‚portal' should be configurable to meet the needs of different networks and its members. Configuration should be possible on the individual level and on the network level too. E.g. it should be possible to configure the portal for a network that is primarily an ‚innovation network'.

3.3.2 Knowledge Management Technology

A. Introduction

According to the project definition, the technology part of the project covers a rather broad range of topics concerning **strategic decision making** in the field of ICT. The therewith related research questions, which had to be answered, include **software**, **hardware** and **standards**, the relevant **trends** for each of those areas as well as a **technology forecast**. Further topics were the **development of the vendor and user markets** and **Application Service Providing** (ASPs) with its challenges and risks.
The results for each of this topics will be described in the following chapters. Before that, a short introduction into the method, which has been used to derive the technology forecast, should be given.

B. Applied method

In this section of the report, the common concept of the **technology lifecycle** (also known as **S-Curve** concept) should be introduced shortly. Due to this concept, technologies and their capacity – similar like products – underlie a certain lifecycle. What usually can be observed is the development of technologies from slow initial growth, followed by a rapid rise of approximately exponential growth, which after some time slows down because of the upper limit set by some (physical) limit of possible capacity [Burgelman/Maidique/Wheelwright 1995]. Regarding the **market potential** of technologies, according to the technology lifecycle concept, four phases can be distinguished: **development**, **growth**, **maturity** and **age** [Sommerlatte/Deschamps 1986].
In relationship with the technology lifecycle – from a more user- and market-oriented viewpoint - stand the terms **pace technology**, **key technology** and **base technology**. Those terms describe the **strategic potential of a technology for competition** [Sommerlatte/Deschamps 1986] and can be defined as follows:

- **Pace technologies** stand at the beginning of being employed and at the beginning of the technology lifecycle.
- **Key technologies** are technologies that have a high competitive potential for the company, if their use can be managed and controlled.
- **Base technologies** can be managed by all competitors, so their potential for development and competition is rather low [Sommerlatte/Deschamps 1986].

The relationship between the concept of the technology lifecycle and the terms pace-, key- and base- technology illustrates the following table [see Michel 1988]:

Exhaustion of competitive potential	**Pace technology**	**Key technology**	**Base technolgy**	
Phase of technology lifecycle	**Development**	**Growth**	**Maturity**	**Age**
Indicators	**Characteristics**			
Uncertainty about technological capacity	high	middle	low	very low
Investment for development	low	very high	low	very low
Potential for applying	unknown	high	very high	decreasing
Development Requirements	scientific	application-oriented	application-oriented	cost-oriented
Effect on Cost-Efficiency-Relationship	indirect high	very high	low	very low
Number of patent applications	increasing	high	decreasing	decreasing
Patent types	Concept patents	Product patents	Process patents	Process patents
Access barriers	Scientific potential	Staff	Licenses	Knowledge
Availability	low	middle	high	very high

Table 2: Technology lifecycle

The technology lifecycle concept not only can be used *ex post* to describe the development of technologies over time. Rather, it also can be used *ex ante* as a **technology forecasting technique** or **method to estimate the strategic potential of different technologies** [see Sommerlatte/Deschamps 1986, Burgelman/Maidique/Wheelwright 1995].

What has been done in the concrete case of the bilateral project is to use the in this paragraph introduced terms and concepts, **to estimate the technological resp. competitive potential of software, hardware and standards which are seen as relevant for Know-**

ledge Management. In a second step the attempt was made, to derive a **technology forecast for relevant software tool classes** in the field of Knowledge Management.

Of course, the concept of the technology lifecycle and in particular the issue of technology forecasting raise many questions which can not be discussed here at all. In general, a technology forecast only can be an approximate estimation, since many influencing factors exist. Moreover, forecasting always implies a certain **degree of uncertainty** (just think of the weather forecast). To keep the uncertainty as low as possible, quite a lot of literature and diverse market reports have been evaluated in order to estimate the stage of development of the different technologies.

Furthermore, the herewith presented forecast is tailored to the ‚mainstream' of companies. In reality, one also has to consider, when a company is ready to adopt a new technology. Some companies (so called 'early adopters') might implement the mentioned technologies earlier than others. Other companies ('followers') might wait longer as the mainstream. These differences in behavior also have an impact on the derivation of ICT strategies in the individual case.

C. Software

As a first step in the evaluation phase of the bilateral project relevant software tool classes/application concepts for Knowledge Management respectively knowledge networking have been identified.[1]

To be aware of the ability of tool classes to support the different knowledge work processes is one important step to take the right actions and to build the right toolset in the company. Therefore, it has been clarified, which knowledge processes are supported primarily by each tool class/application concept as the following table illustrates:

	Creation	**Locating & Capturing**	**Transferring & Sharing**	**Applying**		**Integration of knowledge processes**
ICT tools						
Intranet						
Groupware						
Community Tools						

[1] The relevant tool classes also have been described in another working paper of the Competence Center [see Raimann et al. 1999]. This working paper also gives examples of software products within each tool category.

Search and retrieval						
(Intelligent) Agents						
Knowledge Management Suites						
Video/Audio Conferencing						
Data Conferencing						
Video/Audio Streaming						
Messaging/E-Mail						
Visualization Tools						
Personal Information Management (PIM)						
Data Warehousing/Business Intelligence						
Push Technologies						
Archiving/Document Management						
Text mining						
Learning platforms						
Enterprise Portals						
Simulation and modeling tools						
Workflow Management						
Summarization tools						
Clustering						
Skill mining						
Categorization						
Collaborative filtering						
Expert representation						
Problem solving tools						

Table 3: Software tool classes and knowledge processes

In addition to the knowledge processes creation, locating and capturing, transferring and sharing as well as applying, the additional column 'Integration' has been inserted. Here, integration concerns the **integration of different knowledge work processes**. Tools which are pointed out to be helpful for integration support on the one hand all knowledge processes. On the other hand, they can integrate the varying knowledge processes by e.g. giving standards etc.

In a next step, the introduced technology lifecycle concept has been applied to the software tool classes being of relevance for KM. This means, that each software tool class has been assigned to one of the phases of the technology lifecycle. The result shows the following table:

Technology lifecycle phase / Tool	Development	Growth	Maturity	Age
	Pace technology	**Key technology**	**Base technology**	
Intranet				
Groupware				
Community Tools				
Search and retrieval				
(Intelligent) Agents				
Knowledge Management Suites				
Video/Audio Conferencing				
Data Conferencing				
Video/Audio Streaming				
Messaging/E-Mail				
Visualisation Tools				
Personal Information Management				
Data Warehousing/Business Intelligence				
Push Technologies				
Archiving/Document Management				
Learning platforms				
Enterprise Portals				
Simulation and modeling tools				
Workflow Management				
Summarization tools				
Clustering				

Skill mining				
Categorization				
Collaborative Filtering				
Expert representation				
Problem solving tools				

Table 4: Software tool classes and technology lifecycle

Derived from the estimation made above, a **technology forecast** for the different relevant software categories has been made. This forecast considers the degree of maturity of the different software classes. The technology forecast is divided into 3 parts:

1. Today
2. Near future (next 1-2 years)
3. Medium-term/Long-term (> 2 years)

The technology forecast tries to answer the following questions: How will the ICT landscape in companies look like in the future? Which technologies will become relevant? When will certain software technologies be adopted by the mainstream?

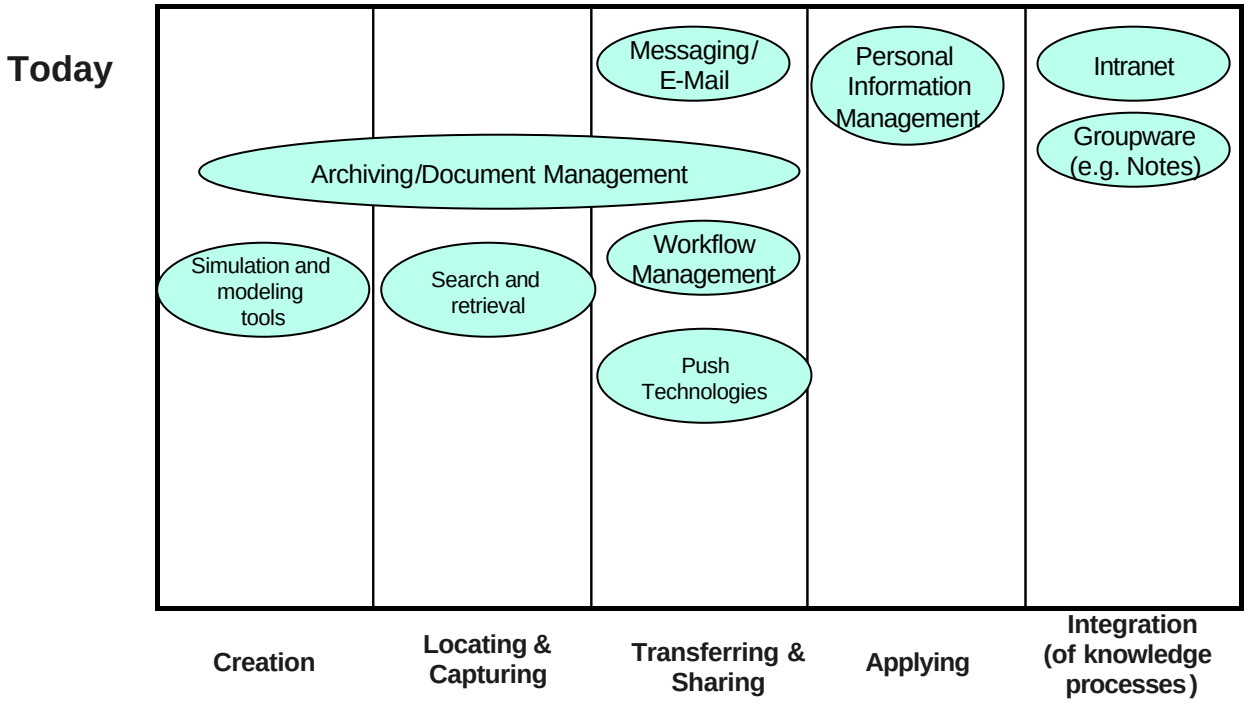

Figure 16: Today's software tool classes

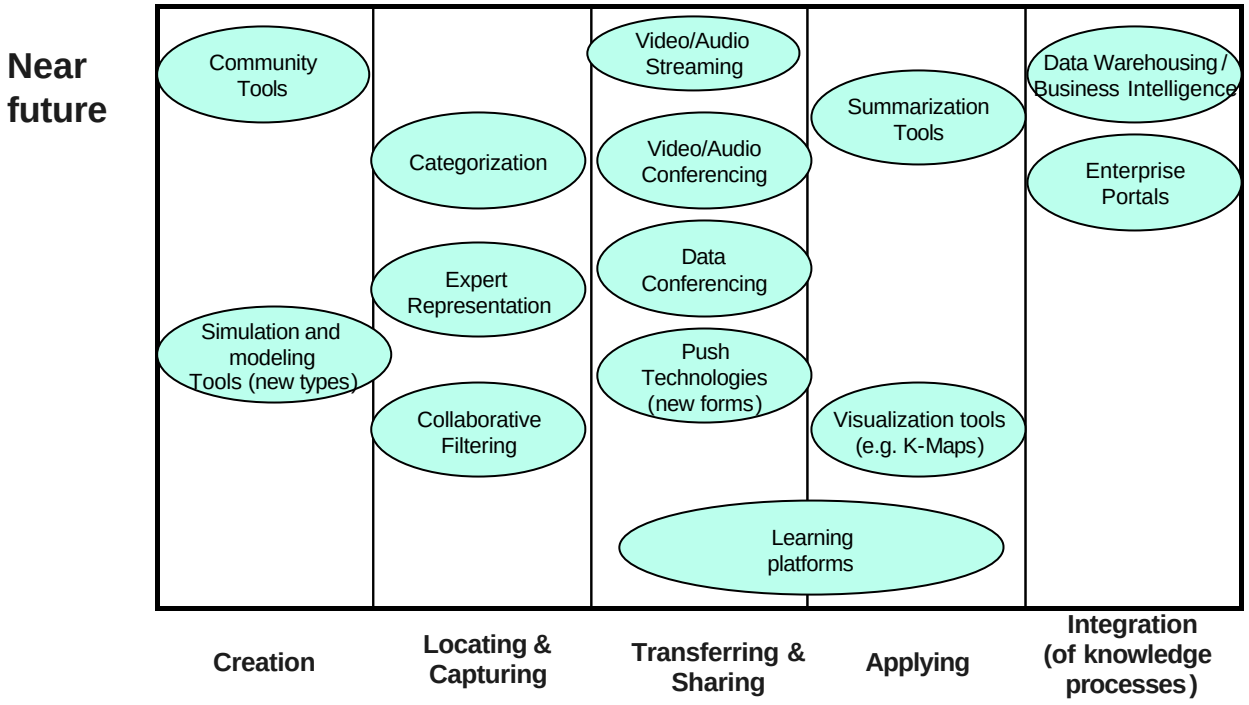

Figure 17: Software tool classes in the near future

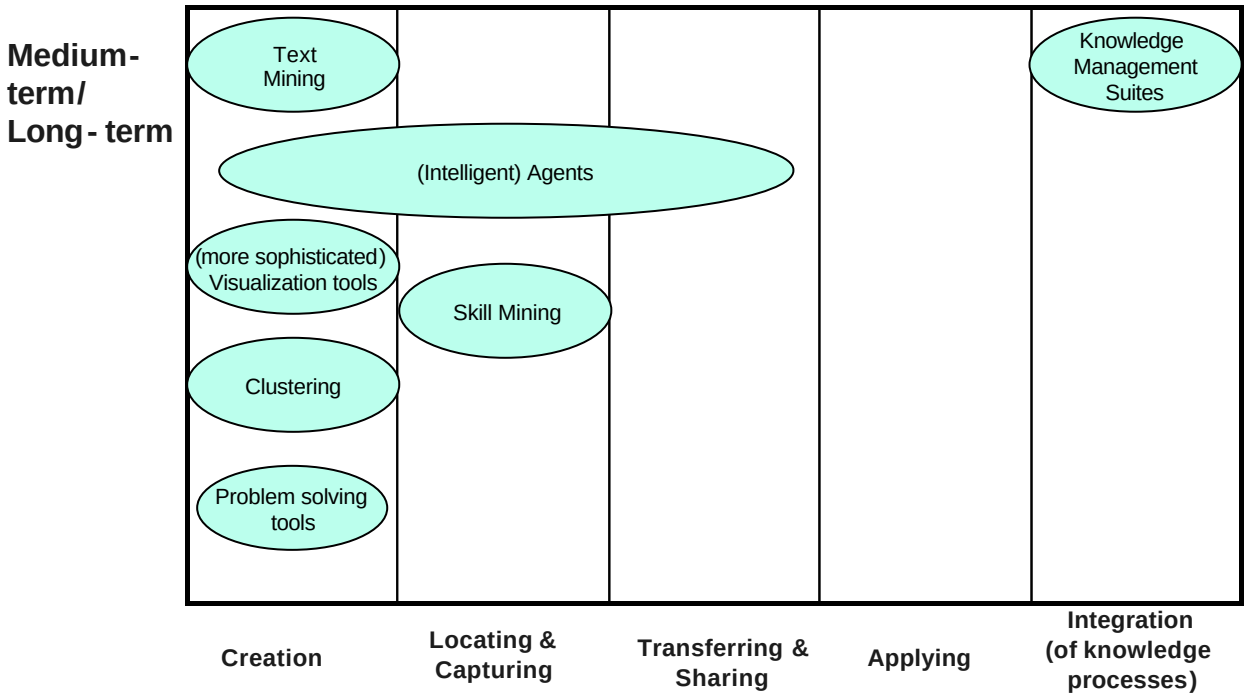

Figure 18: Medium-term/long-term deployed software tool classes

As already said, such a forecast implies some uncertainty. Furthermore, it depends on many more factors inside and outside a company, weather and when a decision for or against the employment of a technology is made.

D. Hardware

Subject of this paragraph is the ICT hardware which is seen as relevant for Knowledge Management. Knowledge Management does not require a completely new ICT infrastructure. Rather, Knowledge Management can be build on already existing or – in the future – on emerging ICT systems.

As it has been done for KM software, the technology lifecycle concept was used to estimate the strategic potential of different hardware technologies. Technological main areas which have been identified as in particular relevant **driving industries** for KM and the development of KM applications are: **I-Net Technologies, Telecommunications** and **Multimedia.**

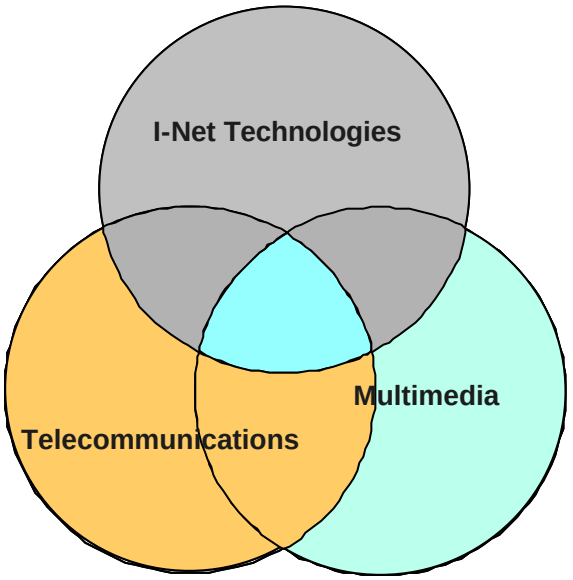

Figure 19: Driving industries for KM hardware

About **ICT standards**, which we discuss in the next paragraph of this report, can be stated the same: the trend-setting, for KM relevant standards mainly arise from the areas I-Net technologies, telecommunications and multimedia.

The emerging technologies within those areas and also technologies which are a combination of those areas can be designated as **pace technologies** or **key technologies**. In the future those areas will merge more and more with the consequence that **new types of KM applications** will arise (e.g. mobile I-Net, TV-based I-Net). Of course, today (and tomorrow

too) KM will also be based on other more established technologies like databases, storage technology, etc. (**base technologies**).

In the following paragraphs an overview of emerging technologies and ICT concepts that now and in the future will have strong influence on Knowledge Management is given. In many cases the implementation of new ICT concepts requires a dedicated hardware infrastructure.

A few examples: e.g. if a company wants to implement speech recognition for Knowledge Management this requires computers in the company with audio devices.

Another example are network-enabled smart appliances (e.g. PDA's, portable multimedia) which also have a strong influence on the necessary hardware infrastructure (new devices, new I/O's).

New business concepts like the emerging electronic services, customer process support, Inter-Business-Networking, E-Business also have a strong influence on the hardware infrastructure, since in particular an appropriate technical network infrastructure (connectivity to customers, suppliers, technical bandwidth, etc.) is needed to perform the therewith related business processes.

The chapter about hardware technologies is divided into the following 5 sections:

1. **Networking/Telecommunications**
2. **Devices**
3. **Multimedia**
4. **Knowledge-based Collaboration**
5. **Business concepts.**

The following table gives an overview of the relevant hardware and their strategic potential, derived from the marked position in the technology lifecycle:

Technology lifecycle phase / **Hardware/ Business concept**	**Development**	**Growth**	**Maturity**	**Age**
	Pace technology	**Key technology**	**Base technology**	
Networking/Telecommunications				
Digital Television (DTV)				
I-Net based Network Computing				
Interactive/Internet TV				
High speed, I-Net-based Networking				

Mobile I-Net				
IP telephony, Voice-over-IP				
Devices				
Personal Computer (PC)				
Network Computer (NC)				
Mobile Computing				
Network-enabled smart appliances				
Wearable computers				
Biometrics				
Electronic Books				
Smart cards				
Multimedia				
Web-based Audio/Video Streaming				
3-D I-Net				
Speech recognition				
Audio/Video Conferencing				
Knowledge-based Collaboration				
Realtime Collaboration				
Text recognition				
Digital forms and documents				
Business concepts				
Inter-Business-Networking				
Customer Process Support				
Electronic services				
E-Business				

Table 5: Hardware, influencing business concepts and technology lifecycle

E. Standards

In this paragraph for Knowledge Management relevant standards are discussed. Like in the sections about software and hardware, the concept of the technology lifecycle is used to derive statements about the competitive potential of the particular standard.
The standards have been clustered as follows:

1. **Networking/Telecommunications**
2. **Messaging**
3. **Multimedia**
4. **3-D I-Net**
5. **I-Net/WWW**
6. **Security**
7. **Database Connectivity**
8. **Application development**
9. **Application standards**
10. **Operating system standards.**

The following table gives an overview of the relevant standards and their position in the technology lifecycle:

Technology lifecycle phase / **Hardware/ Business concept**	**Development**	**Growth**	**Maturity**	**Age**
	Pace technology	**Key technology**	**Base technology**	
Networking/Telecommunications				
VoIP Services (Voice over IP)				
Wireless transmission standards				
I-Net standards (e.g. TCP/IP, mobile IP)				
VPN standards (Virtual Private Networks)				
EDI standards (e.g. X12, EDI-FACT, web-based EDI)				
High-Speed-Networking standards (e.g. DSL/ADSL, ATM, Internet2, vBNS)				

Realtime protocols (e.g. RTP, RSVP)				
Messaging				
E-Mail standards (e.g. SMTP, POP3, IMAP4, LDAP, MIME, X.400, X.500)				
Unified messaging standards				
Multimedia				
Audio/Video conferencing standards (e.g. T.120, H.320)				
Audio/Video formats (e.g. MP3)				
Audio/Video streaming formats (e.g. RealAudio, RealVideo, MS Advanced streaming format)				
Other multimedia formats (e.g. SMIL, VoxML)				
I-Net graphics formats (e.g. GIF, JPG, PNG, VML)				
Animation standards (e.g. Shockwave, Flash)				
3-D I-Net				
VRML				
Others (e.g. OpenGL, D3D, Fahrenheit)				
I-Net/WWW				
Common I-Net standards (e.g. HTTP, FTP, SMTP, IRC)				
WWW-Languages (HTML, CSS, dHTML)				
XML and XML specifications (e.g. WML)				
WAP				
JVM				
Browser-Plugin-Standards (e.g. PDF)				

Security				
P3P				
SSL				
SET				
Database Connectivity				
ODBC/JDBC				
OLE DB/ADO				
SQL standards				
Object Database standards				
Application Development				
Java (incl. Javabeans, EJBs)				
Script languages (e.g. CGI, Javascript, JSP, ASP, Perl)				
DOM (Document Object Model)				
Distributed Architec-tures/Middleware				
Application standards				
Data Warehousing standards (e.g. Meta data standards, OLAP stan-dards)				
Document management standards				
Workflow standards				
Others				
Operating system standards				
PC Operating system standards				
Mobile Operating system stan-dards				
Server Operating system stan-dards				
Others				

Table 6: Standards and technology lifecycle

The palette of standards that has been taken into account is rather broad. Some of the named standards are of higher relevance for Knowledge Management than others. E.g. XML

currently is estimated as a standard which is highly important for future Knowledge Management systems.

3.3.3 Vendor strategies

In this chapter an overview of the KM software vendors **Lotus**, **Microsoft**, **SAP** and **Verity** and their KM strategies is given. Those vendors were chosen due to the definition of the bilateral project.

Today, generally the trend can be observed, that the different vendors out of different areas (Enterprise Resource Planning, Business Intelligence, Collaborative Tools) move into the field of Knowledge Management. Furthermore, from the viewpoint of the software vendors and from the viewpoint of the users, there exists a **trend towards integrated KM solutions which are covering all knowledge processes**. Nevertheless, in practice **usually more than one product is necessary to build a complete KM architecture**. Generic **key components** of such a comprehensive KM solution are shown in the following figure:

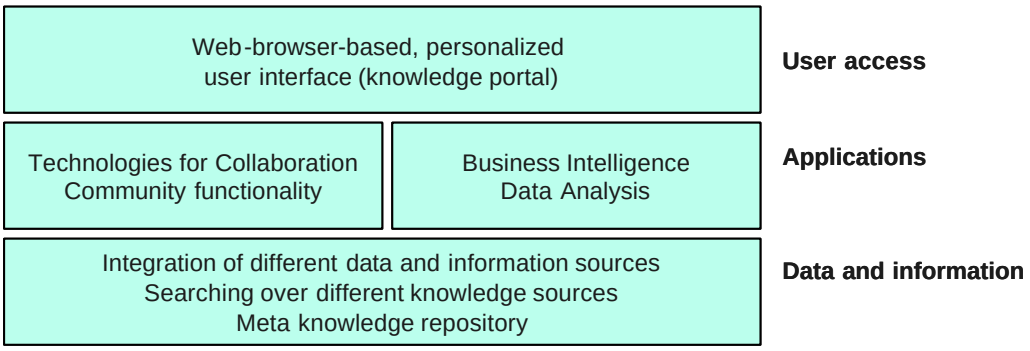

Figure 20: Key components of KM solutions

Vendor solutions for Knowledge Management today are based on **open and standardized I-Net technologies**. The software products that have been examined for this project report confirm this trend.

The following sections about vendor strategies, are mainly based on the available information material of the vendors websites (including white papers, and so forth). Most of the text is – except for little changes, emphasizing formatting and some summaries – directly taken from this information sources, with the intention to give an outline of the KM strategy of each vendor.

A. Lotus

Lotus/IBM offer a large palette of tools which can be used for the purpose of KM. The most well-known tool from Lotus is of course Notes/Domino. Other KM tools from Lotus are Lotus LearningSpace, Lotus SameTime, Lotus Workflow and Document Management software. These collaboration technologies are the cornerstone of a Lotus-based Knowledge Management system [Lotus 1999c]:

Lotus Notes and Domino R5

Lotus' newest generation of Internet products -- the Notes integrated Internet client; Domino server platform for messaging, collaboration, and Internet/intranet applications; and Domino Designer, the Web and intranet application development tool -- comprise a powerful basis for enterprise-wide collaborative activity. Explore the proven results accrued to organizations that enable people to collect and share ideas and information: enhanced customer responsiveness, improved cycle times, and streamlined business processes.

Lotus LearningSpace

The Lotus LearningSpace Solutions family brings rich content together with the essential elements of technology-based distance learning: live, asynchronous, and self-paced delivery. Use LearningSpace to improve education and training while generating significant cost savings, reaching the entire enterprise with timely information transfer while providing a flexible framework that can respond to individual styles and changing priorities.

Lotus Domino.Doc

The distributed document management software built on Domino's secure foundation, Domino.Doc helps organizations and individuals manage content development from authoring through review, approval, distribution and archiving, and to manage content from diverse sources -- from email to discussion databases to formal documents and even video clips -- in support of Knowledge Management initiatives.

Lotus Sametime

The Sametime platform allows developers to incorporate network-based, real-time communication and collaboration into their Notes and Domino applications, and users to quickly, easily and securely identify and connect to colleagues; work simultaneously on documents or whiteboards; and pass control of applications, Web pages and even their desktops to others in private discussions or meetings with up to 100 people.

Domino Workflow

Workflow is integral to Knowledge Management because it helps leverage expertise and information to improve productivity, competence, responsiveness -- and ultimately innovation and competitiveness. Lotus' workflow software extends Domino object services and design tools, making it possible for users and partners to implement dynamic and compelling processes to help them meet their business objectives.

Domino Extended Search

Domino Extended Search enables distributed, heterogeneous search across Notes domains, enterprise and relational data stores, and the Internet, from a single point of access.

QuickPlace

Allow teams and workgroups to create an instant shared workspace -- on the Web or on their corporate intranet -- where they can centrally communicate, share, and manage and organize information, documents and schedules any project or initiative.

InterCommunity

A Domino-based solution for managing large-scale professional on-line communities, InterCommunity offers any group with the same aims -- such as a trade association or a company and its suppliers -- the ability to expand and optimize business opportunities and partnerships via a secure and customizable Web-based environment for sharing information and applications. All community members benefit from more timely and more efficient communication, information sharing and processes.

The Lotus Knowledge Management Family of Solutions enables companies to:

- Provide a single point of access to all the forms of information crucial to a business.
- Extract rich expertise from talented, geographically dispersed employees.
- Create a virtual 'war room' where worldwide employees can brainstorm, learn, and project manage together.
- Empower the people who use knowledge to also create and maintain it without direct IT involvement.
- Leverage existing investments in people, skills, tools, and back-end systems to define a competitive and sustainable advantage.

People, Places & Things

Lotus/IBM is using the metaphor of people, places and things to frame the concept of Knowledge Management and the technologies that support it:

People. These are the individuals, such as colleagues, experts, customers and friends who are online and available for conversation. The technologies that support, locate and promote communications with these people include corporate yellow pages, people-finder systems, and skills inventories.

Places. These are the communities in which people share information. In most cases, communities will interact in physical and virtual places. The latter can be created by collaborative applications that people use to interact, share ideas, ask questions, and find answers. These places are where the "right conversation" can occur, and, ideally, they include techniques and methodologies to foster and promote the appropriate interaction for the task at hand. For example, the type of interaction required for a rapid response "war room" is different from the interaction required for a brainstorming session. The former might include a team leader, calendar, milestones, mission statement, and document library, while the latter might include features that encourage risk taking, such as anonymous entries.

Things. These are the structured and unstructured bits of content that people create, capture, classify, and share. Things encompass the content, rules, processes and procedures that a company uses. In fact, they are the focus of most Knowledge Management tools and technologies that help people work with data in virtually every conceivable manner, from search and mining to visualization and contextualization [Lotus 1999a].

For IBM/Lotus **Knowledge Management means solving problems and meeting goals**: Knowledge Management solutions bring to life communities that solve business problems and meet business goals. Through an array of Lotus and IBM products and services, companies around the world are creating a single point of access to all forms of information crucial to business.

The **Lotus and IBM foundation for Knowledge Management** focuses on five major technologies: expertise, knowledge transfer, collaboration, knowledge discovery, and business intelligence.

Lotus/IBM have developed a **Knowledge Management Framework** where they explicitely refer to four basic business goals that lend themselves to improvement through Knowledge Management: **innovation**, **responsiveness**, **productivity** and **competency**.

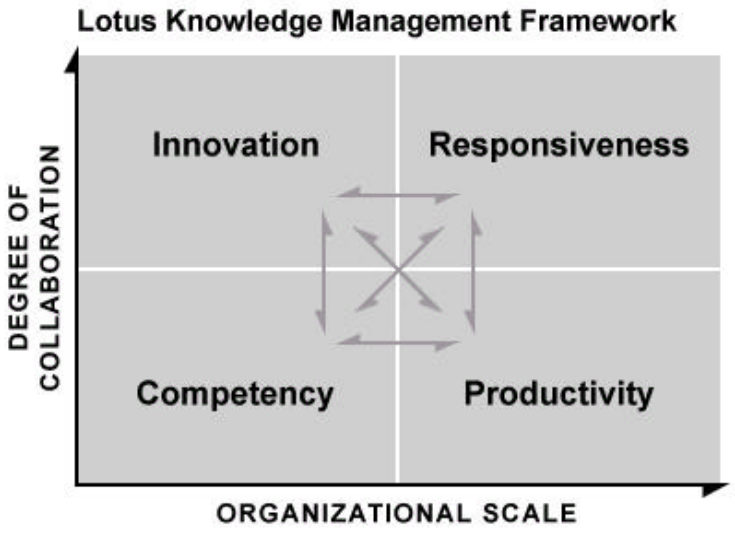

Figure 21: Lotus Knowledge Management Framework [similar Lotus 1999a]

Innovation. In businesses characterized by rapid technological changes and compressed cycle times, innovation is often the primary source of sustained competitive advantage. The challenge for many companies is bringing employees together across the boundaries of time and geography to brainstorm, share ideas, and co-create new products and services.

Responsiveness. Decades of technology investments have helped companies build systems that manage well-known and well-understood business events. But today's business environment seems to present more unanticipated events -- such as the recent turbulence in the Asian financial markets, dramatic changes in technology, or the sudden appearance of nontraditional competitors -- for which traditional information technology is necessary but insufficient.

Productivity. A common lament of executives is "we don't know what we know." Employees are forever re-creating the wheel, failing to leverage learned lessons, best practices and expertise that exist elsewhere in the company. Clearly, productivity depends on how well the knowledge created by individuals and groups can be captured and packaged for reuse by others inside (and outside) the company. More than that, however, Knowledge Management technologies must provide individuals with the tools to discover and mine corporate knowledge that has already been created. Once people find the corporate knowledge assets they need, they can improve upon those assets by applying them to new processes and problems.

Competency. A company that wants to remain competitive must develop its people -- both new hires and existing employees. New hires need to learn not only new skills, but also "how things get done around here." Knowledge Management tools and techniques can enhance

the discovery and delivery of critical information and training to employees, so that a company can continually improve the skills of its people as a regular part of doing business.

The newest KM product from Lotus is called **Raven**. Raven is a single integrated server product aligned under the Lotus theme of "People" (expertise location), "Places" (portal) and "Things" (content catalog). [Lotus 1999b]

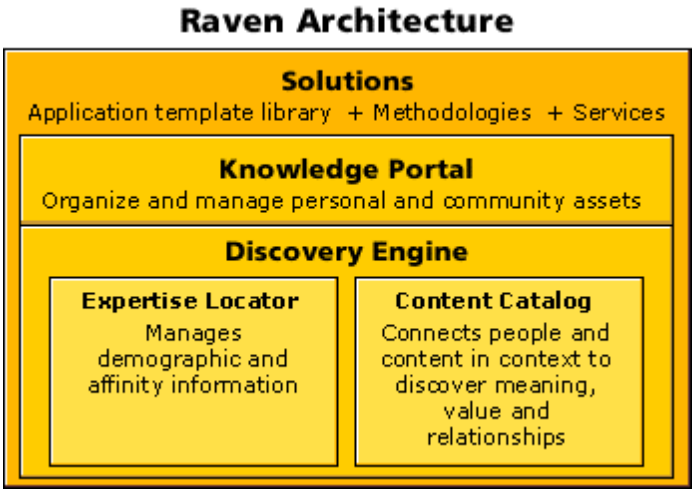

Figure 22: Lotus Raven Architecture [Lotus 1999b]

Raven is described by Lotus as follows:
“It contains a portal, which organizes assets by community, interest, task or job focus; and a discovery engine, which categorizes content and organizational expertise into a browsable and searchable catalog. Lotus recognizes that Knowledge Management goes far beyond mere technology. In this spirit, as a knowledge platform, Raven includes a written methodology on how to map technology to personal, team, cultural and organizational dynamics; and application templates that directly incorporate that methodology.
As a KM platform, Raven fully leverages the Domino messaging and groupware platform. Where messaging and groupware bring people together to collaborate and create content, Raven helps to identify the appropriate candidates for a team, creates specialized places that foster productive collaboration, and gathers the content relevant to the project at hand. Lotus captures these broad collaborative functions in the theme "People, Places & Things." That is, Raven not only delivers the right information to the right people at the right time, but also creates the places where the right people can work together at the right time.
Raven is a layer of infrastructure that sits on top of an existing messaging, collaboration and information infrastructure. Raven fully leverages Lotus Domino, Lotus Sametime and DB2. For example, Raven's authentication and roles-based security is based on Domino's access

control lists. Anywhere a person's name is listed, Lotus Sametime's awareness capabilities allow an end user to see if that person is currently on-line and available. From within any knowledge window or document, and end user can initiate a Sametime instant messaging session simply by clicking on the person's name. DB2 is embedded to provide the scalability needed to support millions of documents and hundreds of thousands of users. When installing a Raven server, Domino, Sametime and DB2 are installed and configured as part of the product. The Raven server is accessible from Microsoft and Netscape browsers, as well as Notes clients." [Lotus 1999b]

Core Functionalities of Lotus' KM product Raven

Discovery engine
Knowledge portal
Content catalog
Expertise locator
Application templates

Table 7: Core functionalities of Lotus' KM product Raven

Discovery Engine: The discovery engine crawls through documents to infer meaning, value and relationships between people and content. On the basis of what the Raven engine discovers, it creates a browsable catalog of content and expertise. The catalog is a "table of contents" of all the written information and internal expertise that exists within an organization. The engine constantly refreshes the catalog by tracking user characteristics and usage activity. The result is a system that reflects a great deal about an organization in terms of where things are, who knows what, what is important, and what subjects generate the most interest and interactivity. The discovery engine has two main components: an expertise locator and a content catalog [Lotus 1999b].

Knowledge Portal: Raven's knowledge portal organizes all of a user's information, applications and contacts by community, interest, task or job focus. It is a shell environment that builds and manages portals for each individual and all his or her community affiliations. Users create a personal portal by selecting from a list of pre-configured Knowledge Windows (e.g. mail, calendar, discussions, to do items, team rooms, custom applications, Web sites). Knowledge windows are extensible and can support any Domino or non-Domino applications. One of the knowledge windows is the Hotlist, which displays the status of a user's most

important information and applications. (e.g. mail from a list of important people, documents awaiting approval, new or updated tasks in a team room). The portal includes multiple "places." These places can be user-defined, created by departmental or enterprise IT departments, or developed and shared by colleagues. Each user's portal provides access to a list of other authorized places, or communities, in which users can enroll. Community places (e.g., a "personnel review place" or a "new product brainstorming place") represent an *occupational-based user interface* where the user spends time monitoring status and participating in action and decision making. For example, a "personnel review place" might include an HR reporting application, a job posting application, a manual on policies and procedures, a list of employees under review, and a list of HR staff available for consultation. This is especially useful for new employees or for people switching jobs within an organization. The portal saves end users' valuable time by "introducing" them to the people, applications and information assets that they need to be productive in their job [Lotus 1999b].

Content Catalog: The Content Catalog crawls text sources (including text about people) to identify subject matter topics. It analyzes content by looking for frequency, proximity to other topics, relationship to people and a host of other measures. From this information the content catalog groups similar content into browsable categories, called a content map, which it constantly maintains and updates as it receives new content and usage data. Raven's content catalog then derives people's skills from content they have authored or read and maps them to the categories alongside documents. The catalog continually analyzes new content to calculate usage patterns and relationships to determine the value and relevance of people and content to one another. By subscribing to specific categories that interest them, users can direct their knowledge portals to deliver to them relevant information about news, projects, people and organizational structure. Raven uses IBM's DB2 Universal Database as the underlying technology to manage the catalog and the complex analyses required to sift through millions of documents [Lotus 1999b].

Expertise Locator: The Expertise Locator builds and maintains profiles in a repository that can be queried directly by users to locate experts by skill, experience, project, education, job type and many other attributes. The profiles are created through a variety of measures: drawing demographic data drawn from any LDAP directory; field mapping from specific applications such as team rooms, discussions, and project tracking. The expertise locator also uses a metrics tool to determine affinities between subject matter and user activity to infer interests and expertise. Before adding this discovered content to an individual profile, Raven pre-

sents the end user with the update, which must be approved by him or her before it can be published and searched by the departmental or enterprise population [Lotus 1999b].

Application Templates: With Raven, Lotus promises to provide the keys of KM. These "keys" are broad, practical solutions that illustrate Raven's functionality. They are comprised of application templates that will usefully apply the features of Raven, and printed methodology covering organizational tips on deployment. They will include such applications as a Reuse Repository for capturing knowledge, a Project Place for managing projects, a New Idea Generator for doing Collaborative Brainstorming, a Rapid Response Place for responding to unexpected events and opportunities. Beyond these there are complete end-to-end solutions and offerings focused on particular business opportunities that incorporate services [Lotus 1999b].

B. Microsoft

The modules of a KM evolution

According to Microsoft a 'Complete Intranet' and 'Messaging and Collaboration' are the two prerequisite technologies that are the foundation for all KM systems to build an infrastructure that supports the efficient transport, structure, access, and collaborative management of electronic data. The remaining KM-Enabling Modules extend that basic infrastructure to a sophisticated KM system that includes services like Content Management, variations of Information Delivery and Data Analysis. Automated services such as Data Tracking and Workflow processes are also included as part of the Community and Team competencies.

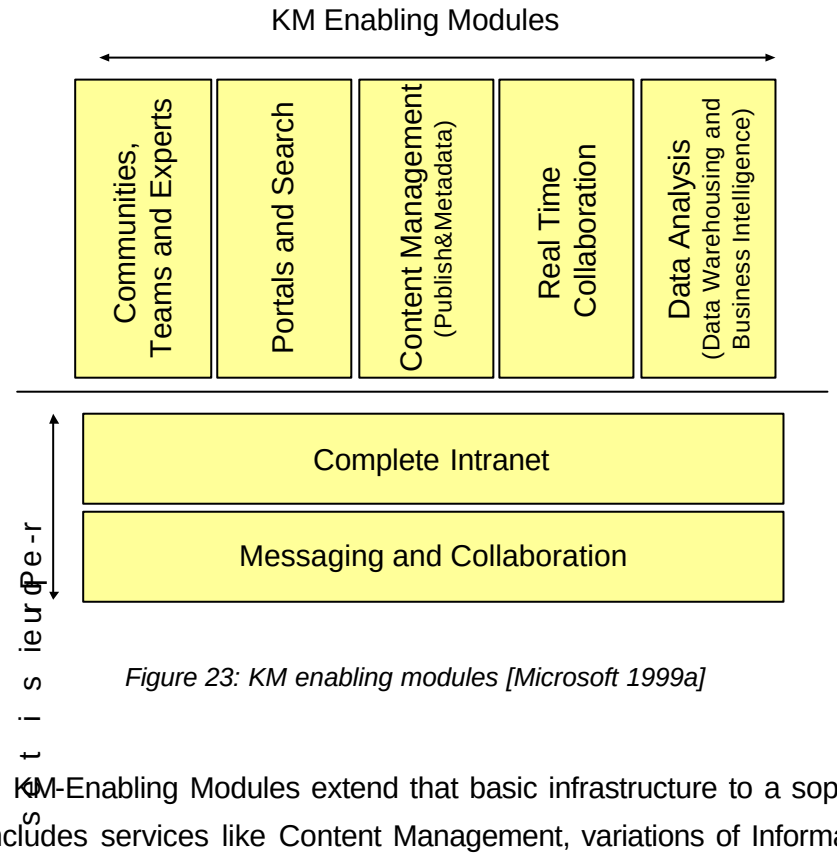

Figure 23: KM enabling modules [Microsoft 1999a]

The remaining KM-Enabling Modules extend that basic infrastructure to a sophisticated KM system that includes services like Content Management, variations of Information Delivery, and Data Analysis. Automated services such as Data Tracking and Workflow processes are also included as part of the Community and Team competencies.

The implementation of Microsoft's KM-Enabling Modules should have a true 'plug-and-play' character. Although some of the modules profit from the implementation of a previous module, they can be chosen in any order related to the specific business case that needs to be accomplished. For example Real-Time Collaboration services, such as video conferencing,

can be easily included on top of the prerequisite technologies, but are enhanced by the Meta data services provided in the Content Management Module [Microsoft 1999a].

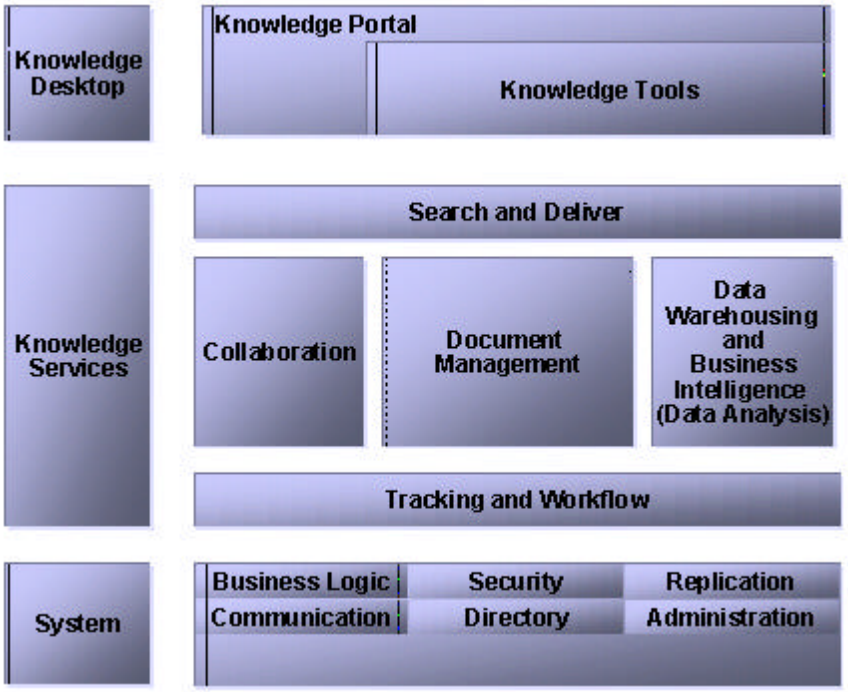

Figure 24: Possible layers of a KM platform [Microsoft 1999a]:

Microsoft's KM Platform

The KM platform's components enable great KM systems to be supported across all the KM-Enabling Modules. The KM platform provides a typical, but extended, three-layered architecture that allows the building of flexible, powerful, and scaleable KM solutions.

The **Desktop Services layer** consists of familiar productivity tools, and integrates tightly with the Application or Knowledge Services layer that provides important KM services such as collaboration, document management, and search and deliver functionality, and components for Tracking, Workflow, and the Analysis of data.

The **System layer** is a foundation that includes administration, security, and directory for managing the KM platform. All KM services run on the System layer and benefit from the integrated communication services that connect with external solutions, platforms, and partners.

The **Development layer** allows the Platform services to be optimally customized to a specific KM solution. The Platform provides the components to start the out-of-the box building of a KM system; the Platform's flexibility comes into play with the Development layer.

Microsoft's Current KM Platform

Microsoft's current KM Platform is the **Microsoft BackOffice® Family** that provides the services to build the KM prerequisites (messaging and collaboration, and complete intranet) and to extend them to KM solutions by implementing all KM-Enabling Modules (Content Management, Communities and Teams, Portals and Search, Data Analysis, and Real-Time Collaboration). Besides these services, Microsoft BackOffice provides interfaces for connecting and integrating with legacy information or knowledge sources (for example, RDMS systems, SNA data-sources, or KM-enabling technologies like Lotus Notes or Lotus Domino). [Microsoft 1999a]

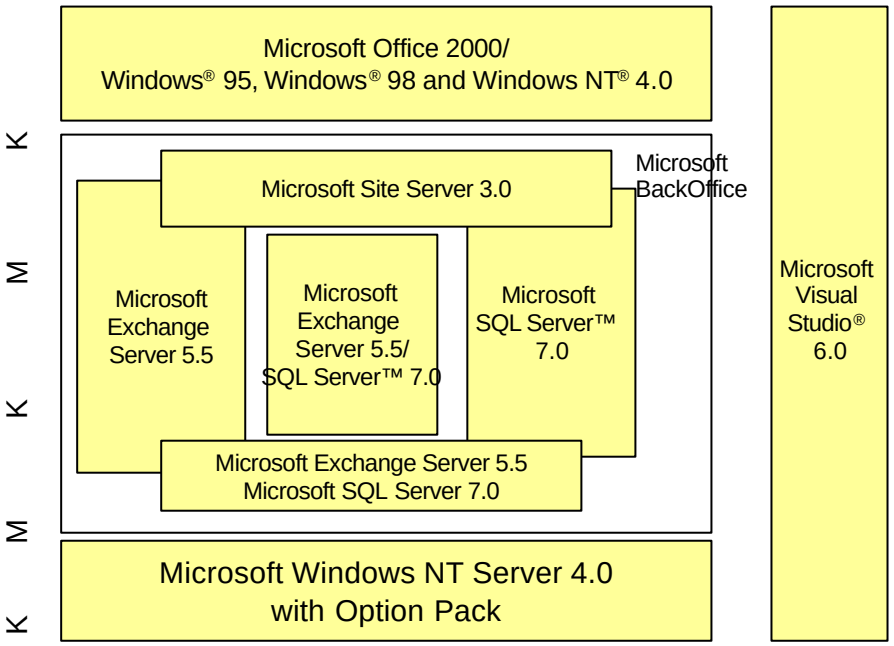

Figure 25: Microsoft's KM architecture [Microsoft 1999a]

The use of Microsoft BackOffice provides a platform that is scalable without the need for changes in the solutions that run on top of Microsoft BackOffice. This makes it easy to **set up departmental solutions with the Microsoft BackOffice platform, and extend or connect them later to enterprise-integrated solutions**.

New Microsoft BackOffice features to be added in the near future will speed up the process of generating departmental or branch office solutions, because new scenario-based setups of the Microsoft BackOffice Family will make it unnecessary to know how the several BackOffice services interact together. With the setup of the Microsoft BackOffice suite, a solution is built that fits a specific requirement. This solution can be put to work right away, or it

can be further customized for specific needs with the Microsoft Development Tools [Microsoft 1999a].

The Digital Dashboard

A digital dashboard is a customized Microsoft Office 2000–based solution for knowledge workers that consolidates personal, team, corporate, and external information with single-click access to analytical and collaborative tools. It brings an integrated view of a company's knowledge sources to an individual's desktop, enabling better decision-making by providing immediate access to key business information. A Microsoft Certified Solution Provider or an in-house development staff can tailor a digital dashboard solution to the specific needs of a company, integrating its existing systems with the analytical and collaborative tools in products such as Office 2000, Microsoft Exchange Server 5.5, and Microsoft SQL Server™ 7.0 Digital dashboard solutions are designed specifically to solve the problem of information overload by pulling together key information sources into a consolidated view. Because a digital dashboard is built with Office 2000, it also provides the tools to further analyze data and to collaborate with co-workers wherever they are [Microsoft 2000].
The following figure shows a digital dashboard solution which should provide an integrated view of key business information for knowledge workers:

Figure 26: A digital dashboard [Microsoft 2000]

Creating a digital dashboard involves customizing the Outlook Today page of Outlook 2000 and providing the following capabilities to help individuals work quickly and more efficiently:

Access to multiple information sources. Digital dashboard solutions can be designed to integrate closely with an organization's existing business systems, pulling multiple data sources together in one easy and accessible place. A digital dashboard can make information from virtually any source—legacy systems, Exchange Server 5.5, SQL Server 7.0, or Web servers—accessible for both online and offline use.

Integration of information. A digital dashboard provides a unique integration of personal, team, corporate, and external information. Because it takes advantage of Office 2000, knowledge workers can view personal information such as e-mail, calendar, tasks, and personal files—essential capabilities not generally supported by server-based intranet portals. Digital dashboards also promote collaboration and an easier flow of knowledge. Utilizing the team-oriented capabilities of Outlook 2000 and Exchange 5.5, knowledge workers can easily create shared documents, discussions, project tasks, and other collaborative solutions. Vital corporate information such as sales and customer data can be intelligently filtered into a digital dashboard to alert knowledge workers of potential problems or opportunities. Knowledge workers can also get a wide range of work-related information found outside their companies on the Web such as research material, news and stock tickers, and targeted news feeds covering specific industries.

Interactivity with information. A digital dashboard provides interactive capabilities that enable individuals to quickly obtain specific or more in-depth perspectives on business conditions. For example, knowledge workers can further analyze high-level sales and competitive data in business reports or applications that use the Microsoft PivotTable® Web component or Microsoft Excel 2000 and SQL Server OLAP integration to enable individuals to interact directly with data. A digital dashboard can also incorporate tools such as Microsoft NetMeeting® conferencing software, which allows people to share applications and collaborate face-to-face over an organizational intranet or the Internet, and Microsoft Windows Media™ Player, which enables people to access dynamic streaming media content such as company communications, online training materials, and business broadcasts from the Internet [Microsoft 2000].

Microsoft's KM services

Based on its technical architecture, Microsoft develops the following functional scenarios and gives recommendations how to realize them:

- Messaging and Collaboration
- Complete Intranet
- Communities, Teams and Experts
- Portals and Search
- Content Management
- Realtime-Collaboration

These KM services should be the enablers for 'Enterprise Knowledge Management' [Microsoft 1999a].

Enterprise KM Challenges

The challenge for an enterprise company is to build upon these services a comprehensive KM infrastructure that can be managed so that it continues to reflect the needs of the enterprise. It includes the ability to make information and services accessible from all organizations, divisions, business units, and departments in that company. Chief Knowledge Officers or Knowledge Architects have a major role to play in the way KM is built, located, and related.

Major KM Challenges are:

- **Complete Integration of Knowledge**
  How Knowledge is built, located, and related to maximize the spectrum of the KM system (make knowledge and services from all units within the enterprise accessible)?
- **Technical Integration**
  Where are the infrastructures that need to be included into the enterprise KM system?
- **Central Manageability**
  What technologies are used for KM in the enterprise and where are the connection or integration points to make the KM system manageable for a central IT? [Microsoft 1999a]

Requirements for an Enterprise KM System

Furthermore, Microsoft sees the necessity of the following requirements for an Enterprise KM System:

- A CKO or Knowledge Architect who is responsible for the political, strategic, and technical implementation of KM in the enterprise.
- Culture for technology usage is set up (Electronic Publishing, Collaboration, Virtual meetings, and so forth).
- All KM Islands are well connected (intranets or departmental solutions).
- Collaborative processes are established (Workflow, Approval, Information tracking).
- Enterprise KM Information Base is multi-hyperlinked.
- Processes are running to keep the Enterprise KM Information Base healthy.

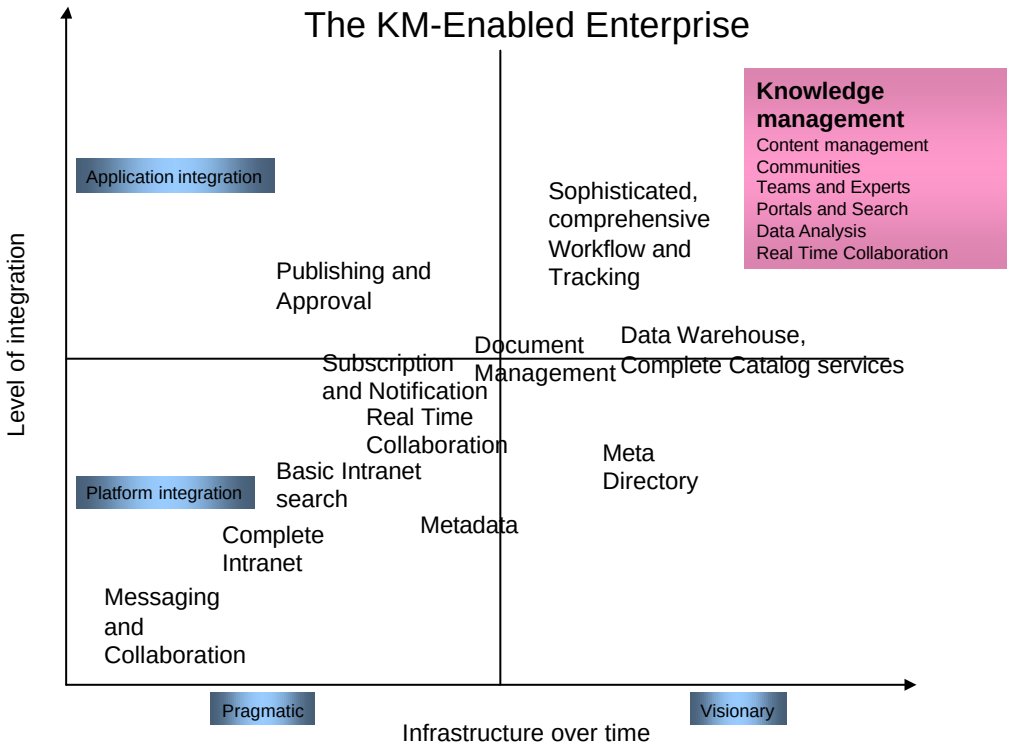

Figure 27: The KM-enabled enterprise [Microsoft 1999a]

Building an Enterprise KM System

After the identification of the KM services that need to be implemented to improve specific business processes, the technology necessary to support these goals is evaluated.

This can be a complex procedure and a summary of system or infrastructure requirements, measured against the services the KM system should provide, and will help to scope the project appropriately. The figure above shows one example of how to develop such a sum-

mary by looking at the evolving technology and KM services from the following principle perspective:

Graph of evolving technology and KM over time: This can be built from a feature list that provides functionalities that need to be added over time to improve the services of a KM system. The graph should help to determine what level of technology and infrastructure need to be implemented [Microsoft 1999a].

One way to tackle the enterprise KM challenge is a **bottom-up approach** with building intranets or departmental solutions. In this approach small **pilots** are built that implement some functionalities of the KM-Enabling Modules. These pilots should be locally controlled and should include the information needs of a specific department that's not widely scattered throughout the enterprise, to keep the pilots of manageable size.

With the start of the pilots, the **big picture** should never be lost when combining all KM or information fragments together into one enterprise KM system. Choose the right technologies and vendors that are able to deliver a both sophisticated solution in itself, and also able to deliver the interfaces and scalability an organization needs to bind its existing and new information infrastructure and services together.

After the successful deployment of the KM pilots, the **implementation of the central junction point of all KM pieces** should be started as a proof of concept. This central KM hub must succeed in integrating the just-built pilot systems. It is the first step in extending the information infrastructure to a centralized controllable KM system.

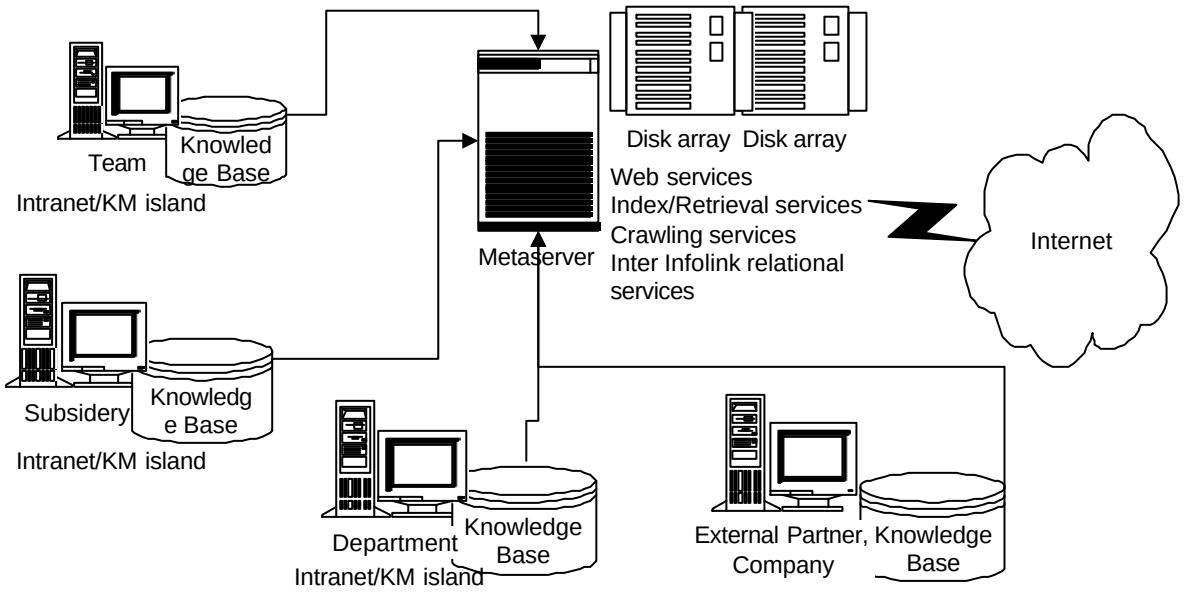

Figure 28: The central KM backbone [Microsoft 1999a]

An enterprise KM system builds on the back end an equivalent to the KM portal for the user. As the KM portal concentrates all information that is of value to a specific knowledge worker, the **central KM backbone** will concentrate all information that is of value to the whole enterprise. After all KM islands are built and integrated this will be the entry point for all enterprise-related information. In terms of KM, this central KM hub or KM backbone is also called a "Metaserver". [Microsoft 1999a]

Core functionalities of Microsoft's KM products

The core functionalities of Microsoft's KM products are listed in the following table and described below:

Collaboration—Sharing Tacit Knowledge Across Time and Distance
Content Management—Capture and Manage Explicit Experience
Analysis—Turning Business Data into Knowledge
Search and Deliver—Bringing Knowledge to Teams and Communities
Tracking & Workflow—Capture and Enforce Best Practices

Table 8: Core functionalities of Microsoft's KM products [Microsoft 1999a]

Collaboration—Sharing Tacit Knowledge Across Time and Distance: The integrated collaborative capabilities of Microsoft Office and Microsoft Exchange Server allow users to innovate together within their familiar productivity tools. Exchange and Office include capabilities such as shared calendars and tasks, threaded discussions, easy application creation, and folder home pages to help groups collaborate. In addition, Microsoft NetMeeting® conferencing software contains tools such as white boarding, video, chat, and application-sharing that allow users not only to communicate, but also to work together on knowledge assets as they collaborate

Content Management—Capture and Manage Explicit Experience: Content-management technologies allow people to capture, codify, and organize experiences and ideas in central repositories that enable seamless, intuitive access to an entire organization. Exchange, Microsoft Site Server, and Office integrate to provide the ability to categorize, publish, and manage documents and content. Microsoft's knowledge-management platform also supports workflow around content, such as versioning, approvals, routing, and locking.

Analysis—Turning Business Data into Knowledge: Being able to quickly spot trends in financial and line of business data allows decision-makers to plan better strategies. The data-warehousing and business-intelligence features in Office and Microsoft SQL Server™ enable

knowledge workers at all levels of a corporation to better understand their markets. Data Transformation Services bring together information from accounting, manufacturing and process systems to present a transparent view of an entire organization. Microsoft OLAP Services, PivotTable® dynamic views, and Office Web Components allow users to easily analyze vast amounts of data in their familiar Office or browser environment.

Search and Deliver—Bringing Knowledge to Teams and Communities: Building teams and communities across a dispersed organization is possible with portals built on personalized, cross-enterprise search and delivery technologies. Site Server 3.0 searches across databases, public folders, Web sites, and file shares. In addition, it is also able to deliver personalized information to either community portals or directly to users' desktops.

Tracking & Workflow—Capture and Enforce Best Practices: Tracking services allow companies to identify best practices by measuring successes, while workflow tools enable the creation of process-based applications to ensure that the practices are followed and measured. Exchange Folder Agents and Routing Objects combine to provide a powerful and flexible system for building workflow applications. [Microsoft 1999a]

C. SAP

Training and documentation play a central role the SAP Knowledge Management Solution in order to provide various user groups with the knowledge they need to efficiently implement and use the R/3 System. In addition, a number of products complement and extend these solutions by providing flexible opportunities for self-study, the ability to interact with other users and with SAP experts, and the ability to integrate with other R/3 components [SAP 1999a].

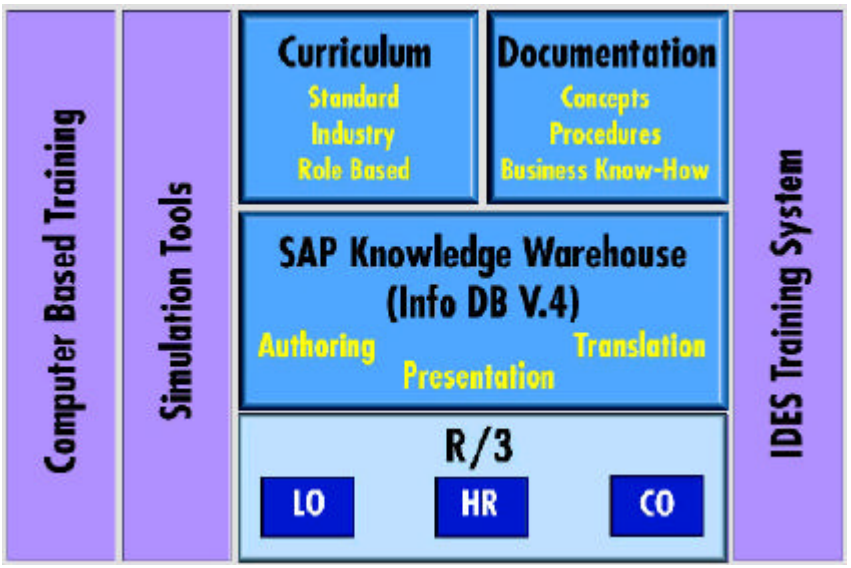

Figure 29: SAP's KM solutions [SAP 1999a, SAP 1999b]

The **SAP Knowledge Warehouse** (Info DB V.4) is the cornerstone of the SAP Knowledge Management Solution. Formerly called the Advanced Training Solution (ATS), it provides the infrastructure and the front-end tools that support the processes required for knowledge development and transfer, as well as the ability to integrate these knowledge assets with information in key components in the Human Resources, Financials, and Logistics modules [SAP 1999d].

The following figure gives an overview of SAP's KM approach:

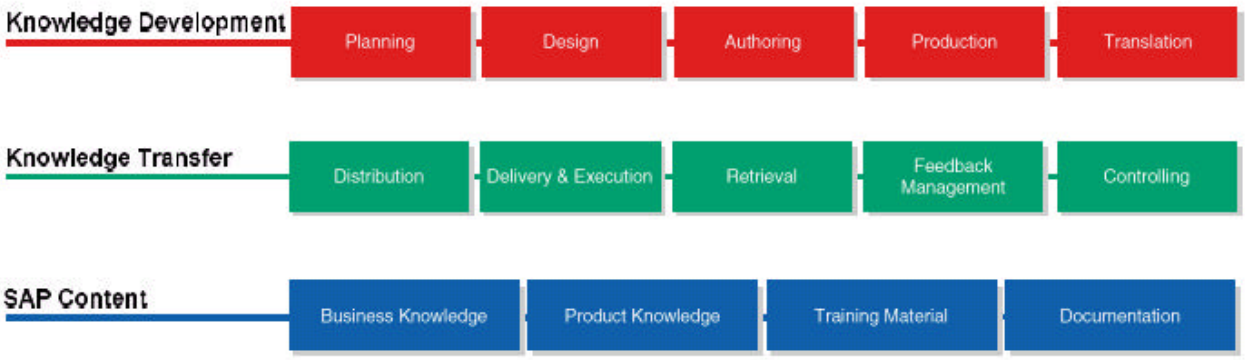

Figure 30: SAP's Knowledge Management Map [SAP 1999c]

Knowledge Development

Planning is essential for any information project. Unless projects are based on a comprehensive needs analysis and carefully defined priorities, they can easily slip out of control.

During the **Design phase**, the product's appearance and interface is defined, as well as strategies for navigation, searches, and error recovery. SAP and its partners offer comprehensive consulting services to help you in the Planning and Design phases of any project.

To facilitate the **Authoring phase**, SAP provides Drag & Drop structuring of existing materials, editing capabilities in native applications such as Word and PowerPoint, and simulation tools for developing system demonstrations and interactive exercises.

The authoring tools also provide hyperlink management for creating links within various types of content. In the **Production phase**, the tools automatically convert documents to the appropriate presentation format – for example, Word documents are converted to HTML and PowerPoint files to GIF. Print support is available for creating handouts, documents, and manuals.

In the **Translation phase**, tracking different versions and translation workflows is essential. The SAP Knowledge Warehouse tracks the status of translations and makes it possible for translators to work in the native application, with direct access to SAP terminology. In addition, the tools provide check-out functionality to facilitate working with external translation agencies [SAP 1999a].

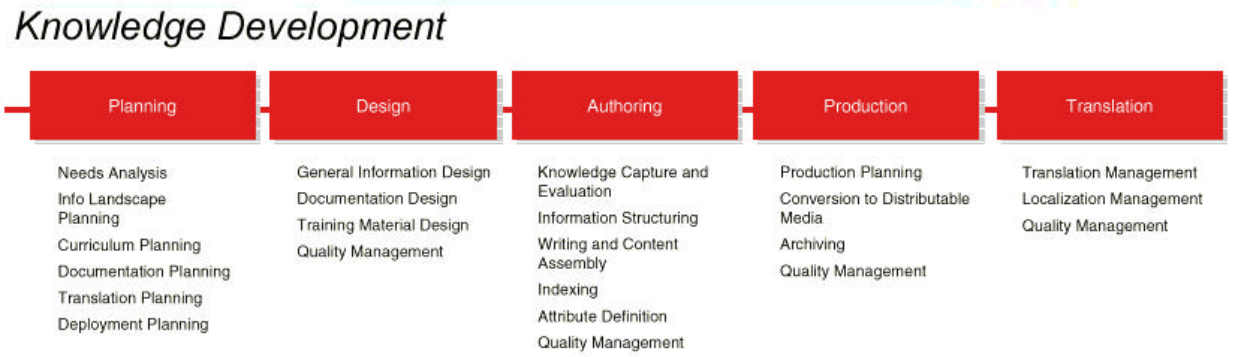

Figure 31: Knowledge Development [SAP 1999c]

Knowledge Transfer

Once the materials have been developed, managing the various stages of knowledge transfer becomes a central concern.

In the **Distribution stage**, the tools in the SAP Knowledge Warehouse provide for the instant, worldwide replication of information. No presentation tool is required; all courses and documentation are displayed in a standard Web browser. It is possible to display only the specific content that matches a user's language, version, industry, or other characteristic.

In the **Delivery and Execution phase**, the assessment and tracking tools help ensure that learning goals are met and that individual users can track their progress. In addition, integration with the HR Personnel Development component makes that information available to those who monitor employee qualifications, while integration with the HR Training and Event Management component automates training administration.

Of course, information is only as good as the user's ability to find it. For that reason, the SAP Knowledge Warehouse includes full-text and keyword searching (**Retrieval phase**). In addition, authors can greatly assist their users in finding related information by linking between training materials, documentation, and the SAP glossary. To achieve and maintain a high level of usability requires the efficient incorporation of feedback during the **Feedback Management phase**. The SAP Knowledge Warehouse provides the means to incorporate both factual corrections of content as well as trends in the overall strategy and design. Finally, **integration with R/3 Controlling** will make it possible to analyze project costs and to incorporate that information into future planning for resource requirements and for scheduling [SAP 1999a].

Figure 32: Knowledge Transfer [SAP 1999c]

SAP Content

To facilitate the exchange of knowledge in general and to optimize the implementation and use of the R/3 System specifically, SAP continually extends the following types of content:**Business knowledge**, which includes data, process, and implementation models that customers can use as a basis for shaping their models. By making information queries into a Solutions database via SAPNet, customers can access and contribute to a pool of information that grows with their experience. And by accessing materials that provide specific business knowledge, customers can gain the perspective that puts information into the necessary business context.

Product Knowledge for matching business needs to R/3 functionality include Fact Sheets, which provide product overviews, White Papers, which include technical details, and Success Stories, which show how other customers solved their business problems with SAP solutions. In addition, the “Functions in Details” booklets provide detailed functional information about how particular technical topics, R/3 modules, or SAP Industry solutions affect business processes. The SAP Development News provide information about future functionality.

Training Materials, which include SAP’s core curriculum, as well as training that provides for the specialized needs of various industries and for over 40 predefined end-user roles. For flexible and independent learning, SAP also offers self-study options in various delivery formats. These materials include the R/3 Basis Knowledge Products to extend the knowledge of SAP’s technical training courses, the Delta Study Guides for learning new release functionality, the “Made Easy” guidebooks for facilitating R/3 implementations, and a series of CBT courses for as-needed access to end-user training.

Documentation, which provides both the conceptual information needed to customize the R/3 System and procedural information to use as the basis of end-user materials. In addition, context-sensitive help is always at the user's fingertips. A glossary that defines unfamiliar terms is available as well. Because consistency is a key usability factor in documentation, the Knowledge Warehouse will contain the supporting tools we use for the quality control of our own materials [SAP 1999a].

Figure 33: SAP Content [SAP 1999c]

To help you customize and manage the contents in the repository, the SAP Knowledge Warehouse provides a suite of tools for handling various types of content and for satisfying the needs of various groups of users. This includes authors, translators, administrators, and the end users who view the content.

Tools for Authors

Authors can use the tools to set up and modify course structures and content, and to add their own content to the SAP materials. The actual authoring of content is done in the native applications, such as Word and PowerPoint. Integration with MS Office applications provides additional usability benefits.

- Drag & Drop structuring of existing materials
- Check-In / Check-Out support
- Handling of any Windows media type
- Workflow control based on document status
- Links into the SAP Glossary and other documentation
- Reliable hyper-link management based on logical information objects
- Integrated authorization setup of R/3 standard authorization profiles

- Delivery of content and links between systems through standard transports
- Support of content consolidation paths
- Export services for static content delivery, including HTML Help or Plain HTML
- Full control over the worldwide SAP Knowledge Warehouse infrastructure [SAP 1999d].

Tools for End Users

End users can view the contents within the familiar browser environment and conduct searches of that content. There's no need to install special presentation tools. Users can also create off-line versions of the content to view it without access to a live R/3 System.

- Automatic display of context-specific information, depending on language, release, industry, company, etc.
- Fully web-enabled viewing, with alternative access from within the SAP GUI
- Integration with SAP´s context-sensitive help
- Search functionality that includes full-text search and keyword search
- Offline presentation tool for local access to content, without having to rely on the network
- Print support for creating hand-outs, documents, and manuals
- Version management according to different contexts, e.g. release-specific, country-specific, industry-specific, customer-specific
- Easy-to-use PC front-end or SAP GUI integration through Office Desktop integration
- Automatic conversion services, e.g. Word to HTML, PowerPoint to GIF
- Access control through standard R/3 authorizations [SAP 1999d].

Tools for Translators

Translators can simply translate within the native applications. In addition, the SAP Knowledge Warehouse displays information about a translation's current status.

- Easy translation within native applications
- Language versioning
- Translation workflow support
- Check-out functionality to facilitate working with external translation agencies
- Access to SAP terminology
- Administration tool that provides overall translation status statistics [SAP 1999d].

Tools for Administrators

Administrators can set up and maintain navigation structures, using the same interface used by content developers to set up course or document structures. Administrators also benefit from being able to use existing authorization profiles and other R/3 features [SAP 1999d].

SAP's Knowledge Repository

SAP's documentation contains more than 14,000 step-by-step procedures that cover every application area. These procedures can be easily modified to accommodate any customization. In addition, the documentation provides the comprehensive conceptual information needed to understand the relevant technical or business context, while concrete procedures deliver the necessary know-how.

In addition to the savings possible by reusing existing information, your organization can save considerable costs by leveraging the benefits of a single information repository, including:

- Consistent information management
- Minimal redundancy
- Common access to all types of information
- Worldwide distributed access [SAP 1999d].

Core functionalities of SAP's KM products

The core functionalities of SAP's KM products are listed in the following table:

Knowledge development
Planning
Designing
Authoring
Production
Translation
Knowledge transfer
Distribution
Delivery & Execution
Retrieval
Feedback Management
Controlling

Content
Business knowledge
Product Knowledge
Training Material
Documentation

Table 9: Core functionalities of SAP's KM products

D. Verity

Verity is a leading provider of knowledge retrieval solutions. Verity's product suite provides support for corporate portals, e-commerce sites, online publishing and media sites, customer care applications, and products from market-leading OEMs and ISVs. Verity solutions simplify the management and use of information by indexing, classifying, organizing, searching and retrieving data, as well as providing personalized information delivery and hybrid online and CD publishing [Verity 1999a, 1999f].

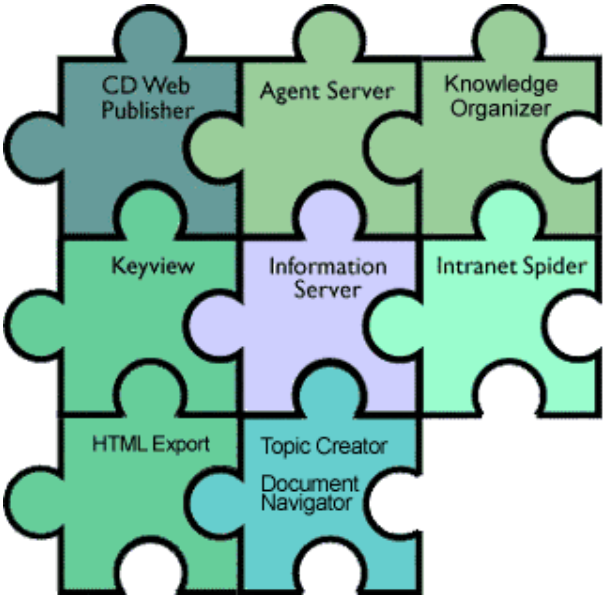

Figure 34: Verity's integrated KM products [Verity 1999]

Verity's products are used by more than 1,000 corporations, e-commerce sites, government agencies, on-line service providers, Internet publishers and software developers worldwide. Verity alliances include Adobe Systems, AT&T, CDNOW, CNET, Cisco, Compaq, Dow Jones, Easy Software, EarthWeb, Ernst & Young, Financial Times, Globe and Mail, IBM, MD Consult, NewsEdge Corporation, Informix, Lotus, NEC, SAP, Siemens, Snap.com, Sybase, Tandem and Time New Media. During the last quarters in 1999, Verity saw significant sales

activity in key markets, including Intranet information access solutions for major retail, telecommunications, banking and financial services, pharmaceutical, business services, consulting and high technology companies. The Company had significant sales to e-commerce sites, online publishers and government agencies, and developed new strategic OEM agreements with major technology vendors.

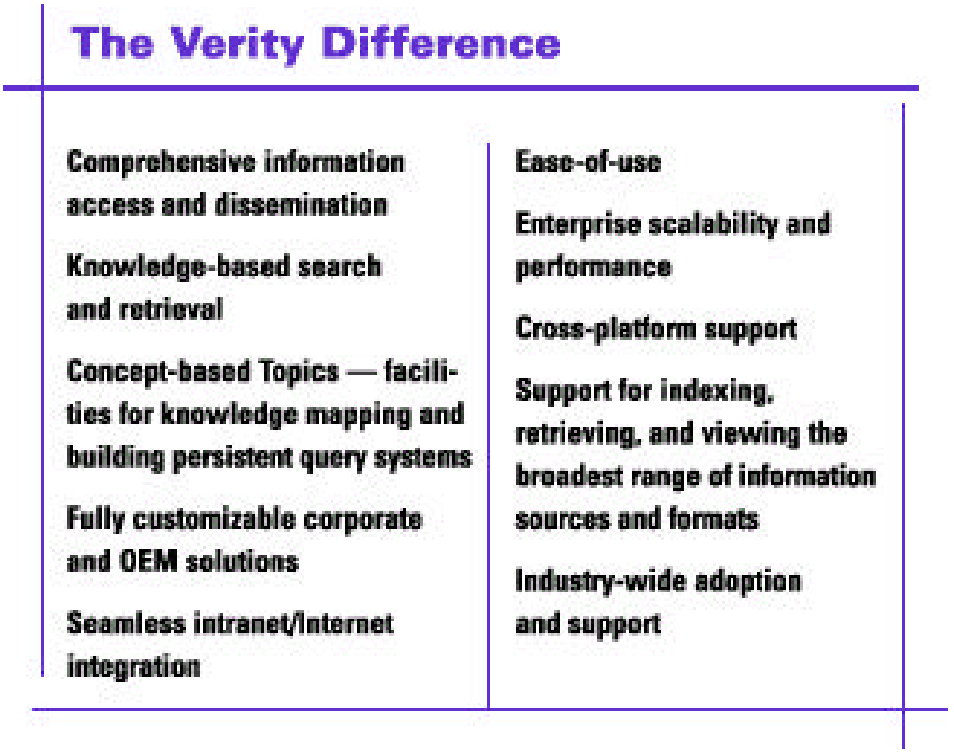

Figure 35: Verity's KM competencies [Verity 1999]

Originally being a vendor of search and retrieval solutions, which still is the core competence and main strength of Verity, the company with its latest products currently focuses on the following areas [Verity 1999b, 1999c, 1999d, 1999e]:

- **Corporate Portals**
- **Electronic Commerce**
- **Customer Care**

Corporate Portals

Beyond searching, intranet users need the ability to browse information directories organized by familiar business categories. Every organization thinks about its business in terms of its products, services, markets, customers or partners. **Verity Knowledge Organizer™** uses

these natural ways of organizing to bring order to the corporate intranet. Verity Knowledge Organizer is the foundation of a well-designed corporate portal. Verity Knowledge Organizer enables an organization to build a directory-driven intranet—and organize corporate content by project, product line, customer or partner. It categorizes and cross-references information automatically, using simple classification rules or corporate metadata. With Verity Knowledge Organizer, data from different systems and sources can be grouped together logically and navigated visually—reducing content management costs and increasing the usability of corporate information assets.

Portal Requirements	Verity Solutions
Enterprise Search	Verity Information Server, Verity Developer's Kit, Verity K2 Toolkit
Directory Browsing	Verity Knowledge Organizer
Links to Internal Web Sites & Information Sources	Verity Information Server, Verity Spider, Verity Gateways, Verity HTML Export
Real-Time Information	Verity Gateways, Verity Agent Server
Links to External Web Sites	Verity Spider
Personalization	Verity Agent Server
Automated Content Classification	Verity Profiler Kit, Verity Knowledge Organizer

Figure 36: Portal requirements and Verity's solutions [Verity 1999b]

Features of Verity's Knowledge Organizer

- Organizes information stored on intranets, extranets, Internet Web sites, file servers, and networked repositories into hierarchical directories of categories, i.e. Knowledge Trees.
- Classifies documents automatically into one, or more, Knowledge Trees based on business classification rules, file system hierarchies, document metadata, Topic® based structures and URLs.
- Brings the power of popular Internet Portal navigation to the corporate intranet by integrating Verity's powerful, advanced search capabilities with category based navigation and browsing.

- Enables many kinds of information navigation interfaces including those modeled on popular Internet Portal sites, file folder explorers and keyword directories.
- Maintains multiple Knowledge Trees, each providing a different view of the same underlying information.
- Provides an open user interface that can support custom corporate styles and integrate with third-party visualization tools.
- Supports category management through a full featured Knowledge Tree editor and standards based taxonomy import/export facility.

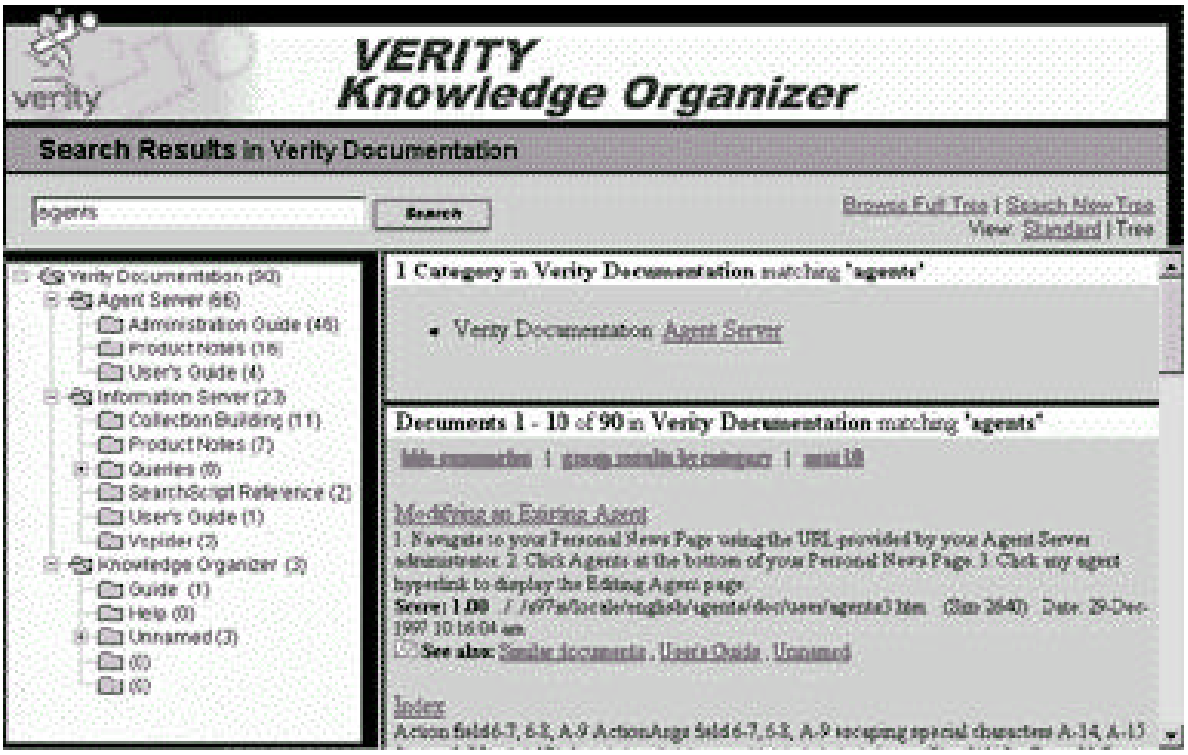

Figure 37: Verity's Knowledge Organizer [Verity 1999d]

Electronic Commerce

Verity's E-commerce customers are using Verity solutions today to:

- Convert browsers to buyers by matching people with products
- Cross-sell and upsell customers by analyzing keyword searches and customer interests
- Develop new personalized information products using agents
- Customize search results lists to promote specific product options
- Communicate regularly with customers through personal agent news pages.

Verity sees its value in providing search and retrieval software with a proven ability to match people to products.
Additionally, merchants are able to monitor customer questions and a gent choices to better understand their customers and the products they desire. The expected results are the conversion of more site visitors into buyers, and more buyers into repeat customers.

Verity K2 Technology: The Verity K2 Toolkit ™ provides a scalable architecture for online stores. Verity K2 Toolkit scales linearly to support the largest online stores or publisher content inventory. Compatible with existing Verity indices, Topics and retrieval engines, Verity K2 Toolkit enables Web-based businesses to evolve to meet expanding demand and product listings.

Customer Care

In today's highly competitive business environment successful enterprises know that superior customer service is critical in maintaining a competitive advantage as an effective way to attract and keep customers.
The foremost concern in the customer care industry is the escalating cost of providing support, due mainly to an increasing volume of incoming calls. Support automation is the key to reducing costs at external and internal help desks. Factors that are driving the support software tools market include the development of knowledge retrieval applications; web-based self-help applications, and help desks becoming proactive versus reactive.
Verity's product solutions and development software offer unequaled capabilities for locating, organizing, and managing textual knowledge-make it the ideal choice for deploying knowledge retrieval, self-help support, proactive notification, and electronic document routing applications at support centers and internal help desks.
Verity's products enable support organizations to deploy the following types of solutions:

- Knowledge Retrieval for support personnel
- Self-help Support for customers and internal employees
- Proactive Alerts or Notifications to both support personnel and customers
- Routing Electronic Problem Statements to job queues or support personnel

OEM Partners: Many of the leading customer support application providers have embedded the Verity search technology. Verity's products in many cases can extend and expand the functionality of an existing support solution.

Core functionalities of verity's KM products

Verity's product palette offers the following core functionalities:

- **Index and Classify** information with the Verity Developer Kit (VDK) designed for programmers; Verity Information Server for corporate users and the companion Verity Spider and Verity Profiler Toolkit.
- **Search and Retrieve** enterprise information with a brokered search architecture designed for symmetric multiprocessing systems using the Verity K2 Toolkit.
- **Organize and Navigate** through information quickly and efficiently with the Verity Information Server and VDK.
- **Notify and Disseminate** information with Verity Agent Server and Verity Agent Server Toolkit.
- **Publish and View** information with the Verity CD-Web Publisher, see it stored in any format with KeyView Pro and KeyView HTML Export.

Figure 38: Verity's KM core functionalities [Verity 1999a]

To realize those core functionalities, Verity offers a number of products which are sold as single components or bundled all together as a 'Knowledge Retrieval Product Suite'.

E. Summary: Vendor strategies

The following table summarizes the findings concerning the vendor strategies:

Microsoft	• Mainly well-known products (e.g. Office, Exchange) combined to a KM architecture • KM strategy identifies **Messaging and Collaboration**, **Complete Intranet, Communities, Teams and Experts, Portals and Search, Content Management** and **Realtime-Collaboration** as important elements
Verity	• Originally being a vendor of **search and retrieval solutions**, Verity now focuses with its latest products on **Corporate Portals, Electronic Commerce** and **Customer Care**
SAP	• The main areas of SAP's KM strategy are **training** and **documentation** (primarily for their SAP/R3 system) • Key elements are **knowledge development, knowledge transfer** and **SAP content** which is stored as reusable knowledge in the **SAP Knowledge Warehouse**
Lotus	• The KM strategy of Lotus strongly focuses on **people** and their **implicit knowledge** (‚people, places and things') to support the business goals **innovation, responsiveness, competency** and **productivity** • Major technologies focus on **expertise, knowledge transfer, collaboration, knowledge discovery** and **business intelligence**

Table 10: Overview - Vendor strategies

3.3.4 Market development

In this section of the project report, some answers should be given, how the market deals with the topic of Knowledge Management and in particular with KM applications. Questions that have to be answered are: What applications are used today? Which applications are planned to be used in the future? What are market drivers and barriers? What are the applications with the highest benefit?

A. Knowledge Management Market Drivers

First we give some reasons, why companies are getting active in the area of Knowledge Management at all. According to the GartnerGroup, those market drivers for KM are (GartnerGroup 1999e, GartnerGroup 1999f):

KM Market Drivers
Improving knowledge sharing across operating units
Improving competitive response
Accelerating rate of innovation
Reducing/controlling costs
Reduce loss of intellectual assets
Increased need to operate globally
Emergence of Internet/internets
Better integration of mergers
Information overload
ROI on intellectual capital
Competitive environment
Response-time compression
Knowledge-based business
Resource crisis

Table 11: KM Market Drivers

B. Knowledge Management Market Barriers

On the other hand, there are many reasons, why companies have not implemented Knowledge Management yet. Market barriers for KM are the following [GartnerGroup 1999f]:

KM Market Barriers
Other priorities are more pressing
Lack of vision or leadership
Cultural resistance to change
Lack of clear ROI
Inadequate infrastructure
Security risks

Table 12: KM Market Barriers

In addition, their exist typical KM barriers which often foil KM projects. Those barriers also have a negative backlash on KM market development:

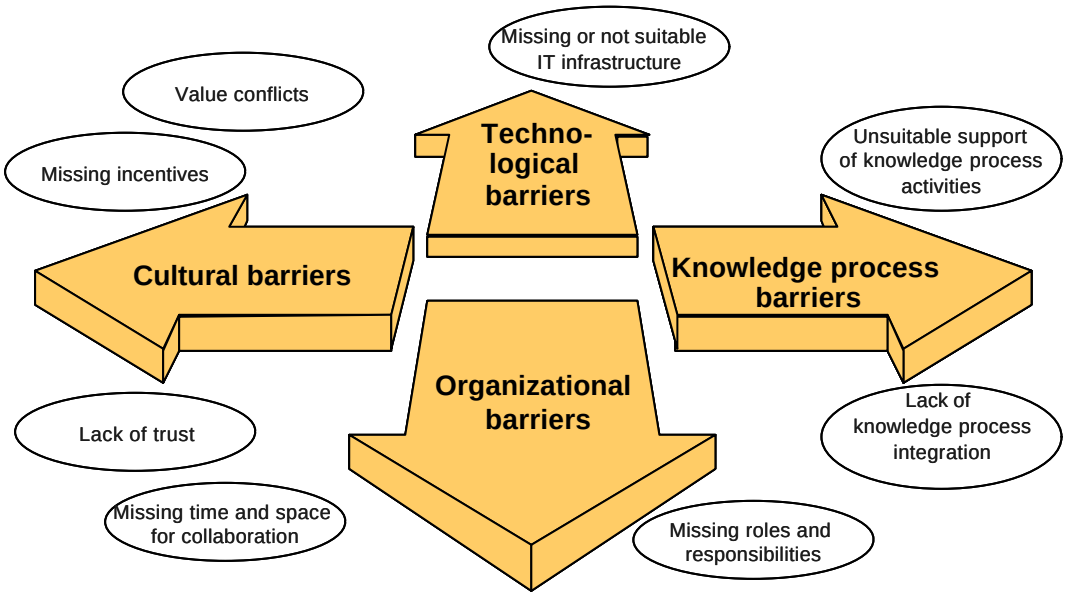

Figure 39: Types of KM barriers

C. Use of Knowledge Management applications

In this chapter the results from several research studies about the use of KM applications should shortly be presented in order to derive trends in market development.

Research study from Nextera Enterprises

This study points out, that

- at present, most organizations invest in platforms for their Knowledge Management initiative like Intranet (55 percent), Document Management (45), Data Warehouses (40), Extranets (35), Groupware (35), Decision-support (30) and Contact Management software (25).
- Within the next 18 months, 81 percent of the IT managers want to introduce real-time technology for document sharing, 70 percent have Push technologies, 50 percent Internet discussion forums as a further priority [Nextera Enterprises 1999].

Research study from Meta Group

Another research study from the Meta Group asks the question: **Which Knowledge Management applications will be implemented until 2001?**

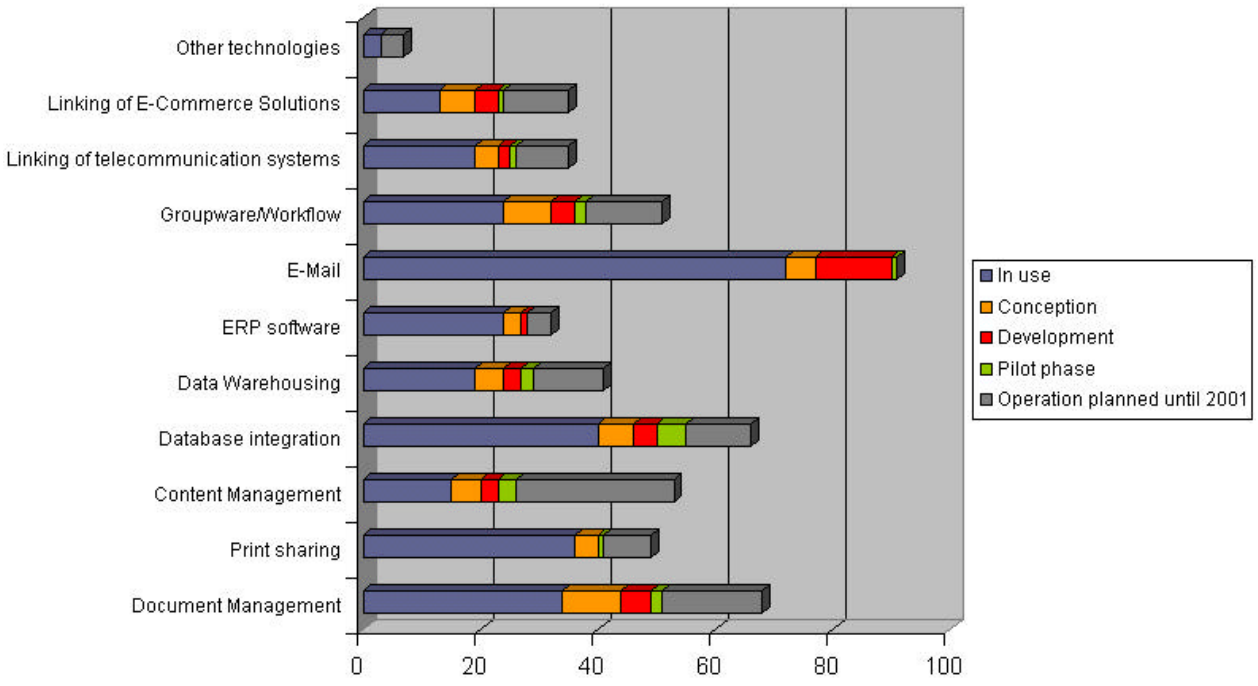

Figure 40: KM applications implemented until 2001

According to this study, E-Mail is the most widely used application. Document- and Content-Management applications possess a high potential to be implemented until 2001 [Meta Group 1999].

Research study from R.L. Chase

A research study from R.L. Chase asks for the **effectiveness of KM technologies**. According to this study, the following technologies were cited as being either 'very effective' or 'effective' [Chase 1997]:

- E-Mail (66%)
- Intranet (54%)
- Internet (53%)

Technologies cited as being either 'very ineffective' or ‚ineffective' are:

- Corporate Yellow pages (72%)
- Decision Support Tools (65%)
- Data Warehousing (65%)
- Customer Management Systems ((52%)
- Video Conferencing (52%)
- Groupware (51%)

Last not least, the study delivers some results about technologies and the percentage of organizations which did **not** use them [Chase 1997]:

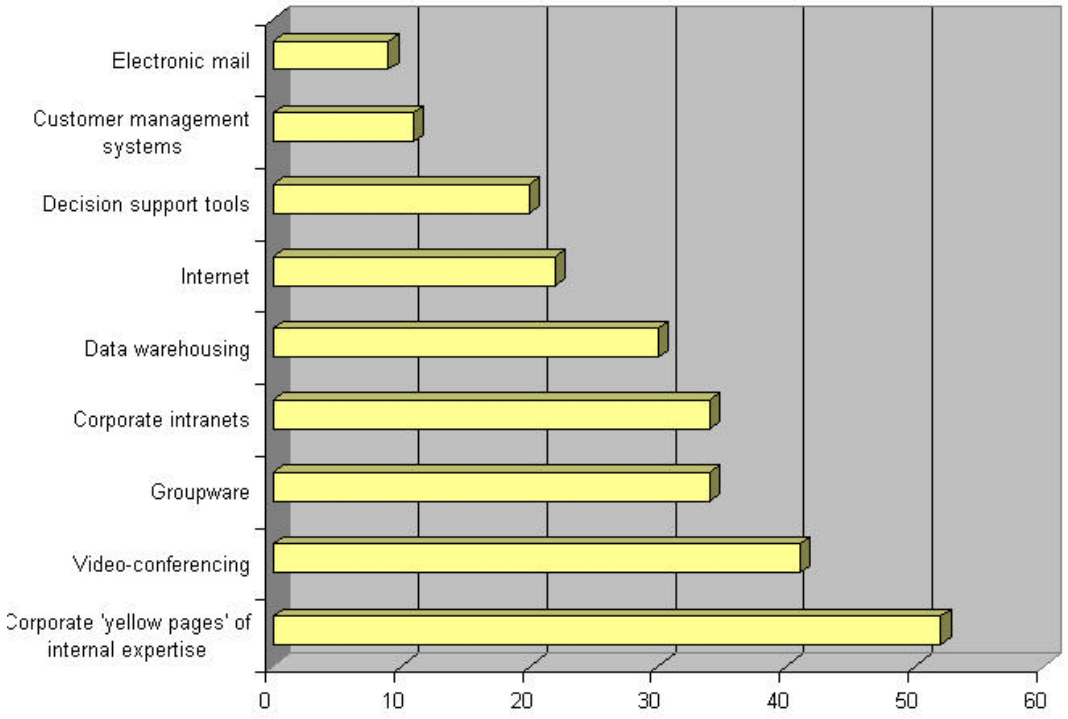

Figure 41: Technologies and the percentage of organizations which did not use them

Research study from NetworkWorld

A further research study from NetworkWorld asks for the **Intranet standard applications that probably will be used in the near future**. In this study from 1999 the following applications were mentioned as most important applications in the future [NetworkWorld 1999]:

1. Internal Communication/Web server (> 30%)
2. Groupware (> 30%)
3. Databases (> 10%)
4. Document Management (> 10%)
5. E-Mail (> 5%)
6. E-Commerce (> 5%)
7. Project Management (< 5%)

The study from NetWorkWorld also makes some statements about the benefits and costs of KM technologies.
The following KM technologies achieved good results (high benefit/rather low costs):

1. Newsgroups
2. Other forms of internal communication (including E-Mail)
3. Document Management
4. Electronic forms
5. Other forms of information providing
6. Groupware

The following KM technologies achieved rather bad results (low benefit/rather high costs):

1. Video-Conferencing
2. Internet Telephony
3. Project Management

Research study from InformationWeek

According to a study from InformationWeek [InformationWeek 1999] , **data warehousing** is a key strategy of a more customer-centric KM focus. When asked what systems they're using as part of their company's knowledge-management strategy, 93% of the InformationWeek 500 companies said they rely on **relational databases**, and nearly as many-some 86%-say they are deploying **data warehouses**. Other key knowledge technologies in place include **groupware**, **text and document search applications**, **data mining tools**, **teamware**, **expert databases** and **artificial-intelligence tools**, **group-memory** and **context-management tools**, and **expertise profiling**.

D. Trends: Market development

Taking all the different research studies together, the following market trends can be derived:

- **E-Mail**, **Intranet** and **Databases** are currently the most widely used applications for KM. The use of those technologies is cited as being quite 'effective' [Chase 1997, NetworkWorld 1999].
- Since most enterprises already have an existing E-Mail/Messaging infrastructure, an Intranet and also enough database technologies, the focus of investments has changed: companies now consider **Groupware** and **Workflow Applications**, **Document and Content Management**, **File Sharing** as well as additional **Web Servers** as most important technologies for the near future [NetworkWorld 1999, Meta Group 1999].
- Other key knowledge technologies for the future include **data warehousing**, **text and document search applications**, **data mining tools**, **teamware**, **expert databases** and **artificial-intelligence tools**, **group-memory** and **context-management tools**, and **expertise profiling** [InformationWeek 1999].
- It is interesting that the implementation of technologies like **Newsgroups** or **Discussion databases** is not considered to be important in the near future, although their usefulness is estimated as rather high [NetworkWorld 1999].
- The benefits of synchronous technologies like **Video Conferencing** and **Internet telephony** currently are extremely low and cause rather high costs [Chase 1997, NetworkWorld 1999].
- **Collaborative real-time technologies** in general do not have a big role to play at the moment. The use of such technologies is either not mentioned in the research studies or those technologies are cited to be ineffective [Chase 1997, NetworkWorld 1999] or their implementation is only long-term planned [Nextera Enterprises 1999]. One reason for this most likely is the low bandwidth of the Internet.
- The **five most important market drivers for KM** are: Improving knowledge sharing across operating units, improving competitive response, accelerating rate of innovation, reducing/controlling costs, reduce loss of intellectual assets [GartnerGroup 1999f].
- The **five most important market barriers for KM** are: Other priorities more pressing, lack of vision or leadership, cultural resistance to change, lack of clear ROI, inadequate infrastructure [GartnerGroup 1999f].

3.3.5 Service providers in the field of Knowledge Management

Today, the trend in the field of IT service providing is, that the traditional **Internet Service Providers (ISPs)** are trying to transform themselves into **Application Hosting Providers (ASPs)**.

An **ASP** is defined as a company that provides the use of an **application** -- from basic e-mail to enterprise applications – usually via a network resp. the Internet, based on ongoing usage fees. The ASP may host the applications on the customer's site, but most ASPs house the applications at data centers where the ASP is responsible for maintaining the applications and all the associated hardware, software and network services to link the applications to the customer base [GartnerGroup 1999b, GartnerGroup 1999c].

ASPs offer new hosting possibilities for enterprises which can be taken into account as an alternative to other possibilities such as **IT outsourcing** and own **internal IT hosting**. Enterprises have to consider those possibilities when making **make or buy decisions** concerning their ICT infrastructure. In order to be able to make these decisions a company has to know the risks and chances combined with ASP.

A. Risks of ASP services

The **risks** of sourcing applications through an ASP include (GartnerGroup 1999b):

- The ASP model is unproven and may have hidden issues yet to be uncovered.
- Many ASPs lack the experience or skill sets for dealing with mission-critical applications.
- Some enterprises do not account for the training and process re-engineering associated with ASP application deployment.
- Enterprises accessing applications via ASPs still have to endure some level of application implementation, deployment and training. Some ASPs provide little to no capability for customizing application code.

B. Benefits of ASP services

Potential **benefits** for outsourcing mission-critical applications include the following (GartnerGroup 1999b):

- Controlled costs: ASPs allow enterprise application, maintenance and support costs to be more predictable.
- Simplified maintenance: ASPs conduct maintenance activities that offload responsibility from enterprise personnel.

- Quick deployment: ASPs work with their corporate clients to get their applications up and running on a service provider's network in as little time as possible.

C. Who should use ASP services?

The following types of enterprises should consider using ASP services (GartnerGroup 1999d):

- Enterprises with limited investment capital and ones that do not have an IS department (e.g., start-ups, small companies and .coms). They can better afford to pay for projects incrementally rather than in one payment and use ASPs as a way to get to market quickly and inexpensively.
- Enterprises that do not anticipate a high rate of change in the way they do business.
- Enterprises investing in an application to reduce costs rather than enhance revenue.
- Larger enterprises that want to conduct a pilot project (e.g., as proof of concept).
- Enterprises that lack staff members for the rapid implementation of a discrete project (e.g., marketing campaign software).
- Enterprises that have a discrete application requirement that does not require complex integration with existing applications (e.g., e-mail).

D. ASP Trends

In the field of ASP the following trends have been identified by diverse research institutes [Microsoft 1999c]:

- Forester Research reports that the packaged applications rental market will grow to $21.1 billion by 2001 and will account for 15 percent of new application licenses
- Zona Research reports that the market for packaged vertical applications was 319.89 million in 1996; these packaged applications incorporate enabling technologies such as e-mail, collaboration, Knowledge Management, workflow, document management, and data warehousing.; packaged applications also offer services for business communication and connectivity, data content management and repositories, and interfaces that automate business processes
- According to Gartner Advisory, business-to-business trade will go from $43 billion in 1998 to $1.3 trillion in 2003; the US Department of Commerce predicts that by 2002, the US will conduct over 300 billion in electronic commerce
- IDC views the ASP market to be $150 million in 1999 but will grow to $2 billion in year 2003; they view North America as leading the market, with Europe being next
- According to Summit Strategies, midsize companies will be the first to adopt most types of Internet-hosted applications

E. KM External Service Provider Competency Requirements

Service providers are also building KM practices. When evaluating these external services providers (ESPs), a strong history of success in project management and business engagements is a necessary (but not by itself sufficient) predictor of success in KM. Enterprises selecting KM ESPs should look beyond the project and business experience and also require KM-specific performance, skill and expertise as represented in the figure below:

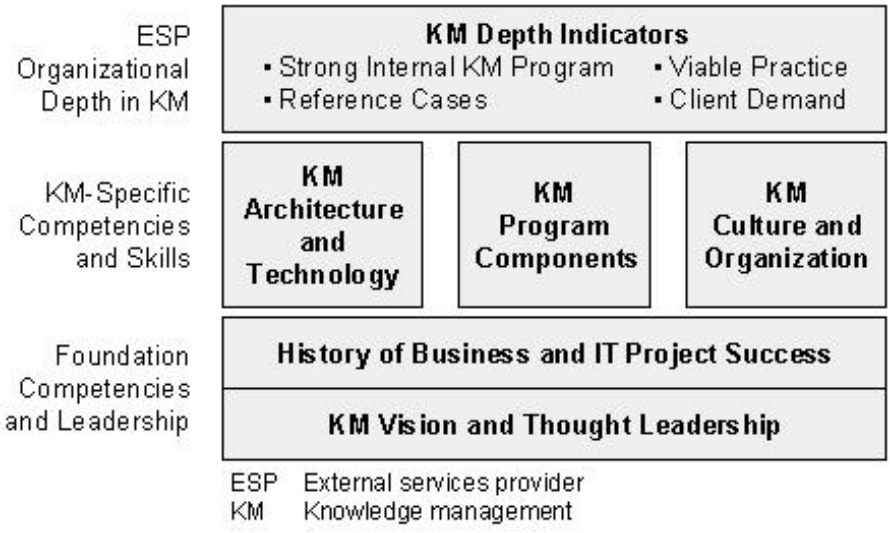

Figure 42: Competency model for KM ESPs [GartnerGroup 1999e]

F. Example: Interliant

As a pioneer in the application hosting industry, Interliant offers a broad range of flexible, customizable groupware hosting, messaging and application outsourcing solutions.

Interliant currently offers hosted solutions in the following areas:

- Distributed Learning,
- Sales Automation/Customer Relationship Management,
- Legal Automation.

For Knowledge Management the hosting of **groupware applications**, **intranet hosting**, **messaging solutions** and hosting of distributed **learning applications** are especially of interest [www.interliant.com].

G. Example: Microsoft

Microsoft supports ISPs or enhanced service providers like ASPs. With their products for application hosting services they focus on the following four broad categories:

- Communication and collaboration services
- Media streaming services
- Electronic commerce services
- Managed application services

The first two services and also the third one in particular concern the field of Knowledge Management [Microsoft 1999b].

H. Example: Lotus

Lotus also supports service providers like ASPs with their products for application hosting services. Independent software vendors (ISVs) need tools to help them easily create "hosting-friendly" applications, and application service providers (ASPs) need comprehensive platforms on which to deploy, market and manage those applications.
With its ASP Solution Pack, Lotus Development will attempt to address the hosting needs of both these constituencies, especially as they relate to the small and midsize business (SMB) marketplace. The ASP Solution Pack will combine products and technologies from both Lotus and parent IBM, including three foundation servers (Domino, WebSphere and Sametime), the DB2 database, several horizontal "starter" applications and comprehensive Lotus Hosting Management System middleware. This pre-tested, integrated offer and platform could significantly speed the time to market for ISVs and ASPs as well as lower the barriers the face as they attempt to capitalize on the fast-emerging applications-hosting trend [Summit Strategies 1999].

4 IMPLICATIONS FOR THE WORK OF DAIMLERCHRYSLER AND THE CC KNN

4.1 Implications for DaimlerChrysler

4.1.1 Business processes

For DaimlerChrysler it is important to understand their business processes and identify the Knowledge Management potentials they include. Knowledge Networks are one organizational form to exploit this potentials. In order to choose the network option as the right option to solve a task or to support a business process it is important to know the organizational alternatives. On this account we show several possibilities – Knowledge Networks and other forms – instancing Knowledge Management in automotive to exploit Knowledge Management potentials. The following statements should help to choose the network option.

Knowledge is a key resource in order to achieve competitive advantage. Therefore our model includes business processes, which are derived in order to execute the business strategy. Strategy serves in this perspective as a starting point for defining the requirements that have to be fulfilled by a Knowledge Network. Additionally, especially in practice a concrete task or process might serve as a starting point, too. Within our research we identified the business goals risk reduction, efficiency improvement and increasing innovation. Knowledge Networks are part of the organizational environment in which Knowledge Management activities take place. Research has shown that there are different types of Knowledge Networks that can be identified and described by different characteristics. These Knowledge Network Types may serve as blueprints for building a Knowledge Network.
The Knowledge Network Scorecard as part of the procedural model finally measures the impact of the implemented Knowledge Network. The Knowledge Network's performance is measured by the output of the business process, which in turn is determined by the degree of goal achievement. Hereby we suggest a system that measures the output of the Knowledge Network in respect to the initial business goal, integrating quantitative and qualitative factors.

Here are some short recommendations for Knowledge Management in business processes and the deployment of Knowledge Networks:

- Knowledge Management has to be aligned to business goals, since KM is most successful, when it comes to middle- and long-term goals like efficiency improvement, increased innovation and risk optimization.

- Knowledge Networks can be seen as a part of the organizational environment in which knowledge processes take place. They can support linear as well as non-linear business processes. An advantage of them is, that the capturing and sharing of knowledge in many cases is faster and better and the creation of new knowledge is easier in netlike structures rather than in hierarchical structures.
- According to the business goals and the derived tasks that have to be executed by the knowledge network, a different cluster of Knowledge Networks becomes relevant. This cluster can be seen as a portfolio of network possibilities, which have different characteristics (e.g. size, roles etc.).

4.1.2 Information and Communication Technology

The technological part of the project was defined very broadly. Accordingly, the project results give more a general view. Nevertheless the project results are of practical relevance for companies and in particular for DaimlerChrysler.

The topics ‚KM Architecture' and the corresponding **network-oriented KM architectural framework** were elaborated within the project. The architectural model clarifies **which elements** (e.g. services, tiers, knowledge base) **a KM architecture that wants to belong to the ‚state of the art' must have**. Another practical benefit of the architectural model therefore can be, to serve as a **reference model** to align the existing ICT infrastructure. Further, the architectural framework can serve as a pattern for the **strategic alignment of the ICT infrastructure towards the direction of Knowledge Management** as well as for the purpose of **selecting ICT tools**.

Further, **ways how to realize the described network-oriented architecture model** were also shown using a semi-technical model. Of course, for concrete use the architecture model still needs further elaboration – e.g. towards the direction of ‚specific support for business goals'.

Essentially for KM in practice is, that **the existing ICT infrastructure is going to be enlarged towards an integrated KM architecture**. Different approaches can be used for this. In this report, a **process-oriented** as well as a **network-oriented KM architecture approach** were presented and compared with each other. The common characteristics and the differences between both architectures with regard to its qualities and its different applicability were identified.

The **process-oriented model** is principally suitable for **delimited, well-structured business processes with predictable knowledge demand.** This approach focuses on **knowledge transfer and explicit knowledge**. On the other hand, the **network-oriented model** is

rather suitable for **weakly structured processes, in which knowledge creation, implicit knowledge, social processes and relationships come into play**.

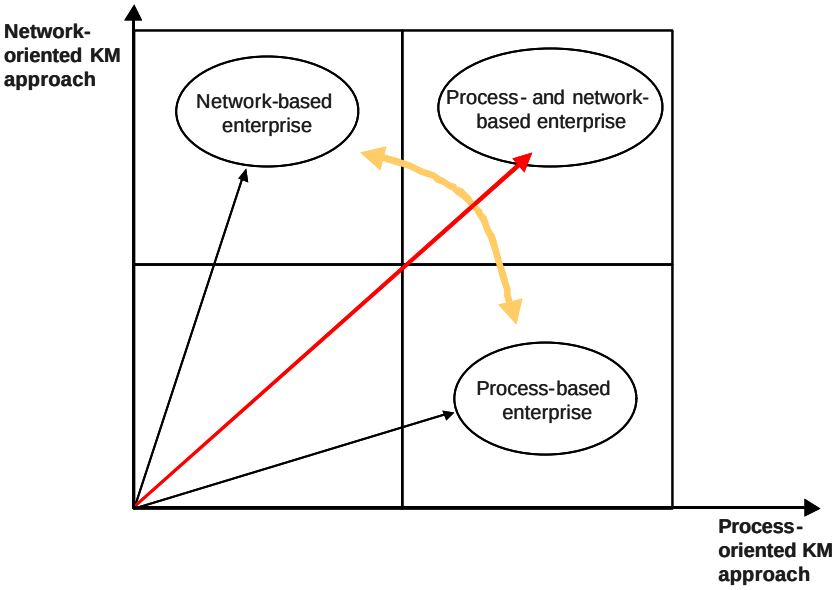

Figure 43: Network- and process-based enterprise

The portfolio above includes some strategic implications how KM should be implemented. A practical implication could be, to **align the KM activities to the appropriate architectural model and/or to combine the two approaches in a suitable manner with each other**. Further can be said, that those companies in the future will be most successful, which are able to manage both: **Processes and Networks**. Processes as well as networks have to be supported with an appropriate KM approach in the best possible way. This should be done through **optimized and systematic applying of the chosen KM strategy**.
Further, the portfolio implicates that leading companies in KM ‚best practice' should have the ability to **combine and interlink process-oriented and the herewith presented network-oriented KM approach in a flexible way**.

What became clear by means of the **technology and market monitoring** is, that it is very difficult to separate KM technologies from so called traditional ICT. **Almost every ICT tool is in some way usable as a KM tool**. Furthermore, quite often specific KM tools require other, more traditional technologies as a pre-requisite.
In general, it is more the surrounding context, the way how ICT is used and the underlying point of view **that changes the deployment of ICT towards the direction of KM**. The **integration** with the organizational facilitating conditions, the enterprise culture, the enterprise

strategy as well as with organizational tools **can be regarded as crucial for KM** and the adequate use of ICT.

Nevertheless, the **essential core components of KM** from the ICT-side have been identified in this project report and also have been considered for the development of the network-oriented architectural KM framework.

Through the technology and market monitoring **a broad palette of software, hardware and standards for KM with its strategic potentials have been pointed out**. For practice, the classification of the technologies by means of the technology lifecycle concept gives a first **support for choosing a technology**. In addition to it, when one is looking at the mentioned **key- and pace technologies**, it is getting clearer in which direction the ICT landscape will change in the future.

The technology lifecycle model was applied most consequently to KM-relevant software. From the derived technology forecast resulted several technology portfolios, that in practice can be used for the **selection of technologies**, for **finding the own technological position** and may be also for other purposes.

The practical benefit of representing the **vendor strategies** exists in its comparative description, that is useful in practice as **information and decision aid**. The description of the vendor strategies makes clear into which direction the KM approaches of the vendors aim, if these approaches are more broad or narrow, which products and core functionalities are available, and so forth.

The section about the market development provides insights about **market barriers** and **market drivers**. Further, several different research sources about market development have been opposed and as far this has been possible **market trends** have been derived.

For practice, clues which technologies are currently picked up by the ‚mainstream' result from this. The **information about the effectiveness of technologies** which also is presented in this chapter can serve as a support for (strategic) decision making.

The chapter about **Application Service Providing** (ASP) delivers information about **risks** and **chances** of this outsourcing variant. In addition, the statements of the GartnerGroup give guidance for which enterprises Application Service Providing makes sense and which competency requirements an External Service Provider for KM should fulfill. The examples of Interliant, Microsoft and Lotus show exemplarily **that KM and Knowledge Networks principally can also profit from ASP offers.**

4.2 Implications for the Competence Center Knowledge Networks

The bilateral project generates a number of findings concerning the **correlation between business processes and Knowledge Networks**. As one implication for the Competence Center Knowledge Networks we need to define this correlation more in detail. This might be a next important step in our research work.
Another very important implication is, that networks are not the only and not the at every time right option to exhaust Knowledge Management potentials. We have to discuss what characteristics make networks the ideal organizational form to act and under which conditions it is better to use other forms. Moreover, we clearly need to define the **situations where one should choose the network option** for acting in business processes.

The insights concerning the tool layer of the CC framework were deepened through the bilateral project. Therefore, not only **software** but also the **role of hardware and ICT standards for Knowledge Management** has been examined. Together with the working paper about tools [Raimann et al.1999] there exists now a broad basis for the tool and architecture layer of the CC framework. Taken altogether it became clearer, which role ICT plays for Knowledge Management and in particular for knowledge networks.
The **network-oriented KM architectural framework** has been developed within the project. The technology and market monitoring and the research on vendor strategies brought insights for the development of the network-oriented KM architectural framework.
Since the **KM potentials in business processes** were an important part of the project, these business processes moved more into the focus of the network-oriented perspective of the Competence Center. Not only therefore the attempt was made, to delimit the network-oriented KM approach from a process-oriented KM approach. This delimitation can also be seen as an important project result for the CC.
As already said, due to the insights of this bilateral project, it will be necessary to shapen the **relationship between business processes and (knowledge) networks** further in the future work of the CC. This is also valid for the architecture and tool layer, since different architecture models are possible. The layer of business processes may become also quite important for the topic of **KM measurement**, which also still has to be elaborated in the work of the CC.
Moreover, the project results about the network architecture model can be even better and tighter integrated with the over-all CC framework and the different elements of its layers.

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