

Towards a Reference Model for Knowledge Networking

Dr. Andreas Seufert
Prof. Dr. Andrea Back
Prof. Dr. Georg von Krogh

Bericht Nr.: BE HSG / IWI3 / 5
Version: 1.0
Datum: 16.12.99

**Research Center
KnowledgeSource
University of St. Gallen**
<http://www.KnowledgeSource.org>



Institute of Information Management
Prof. Dr. Andrea Back
Müller-Friedberg-Strasse 8
CH-9000 St. Gallen
Phone ++41 71 / 224-2545
Fax ++41 71 / 224-2716



Institute of Management
Prof. Dr. Georg von Krogh
Dufourstrasse 48
CH-9000 St. Gallen
Phone ++41 71 / 224-2356
Fax ++41 71 / 224-2355

Competence Center Knowledge Networks

Towards a Reference Model for Knowledge Networking

Table of Contents

1 INTRODUCTION	4
2 THEORETICAL FOUNDATION.....	5
3 DEMANDS MADE BY KNOWLEDGE MANAGEMENT REGARDING THE ICT SUPPORT IN THE FRAMEWORK OF KNOWLEDGE NETWORKS.....	8
3.1 EPISTEMOLOGICAL FOUNDATIONS	8
3.2 KNOWLEDGE NETWORK REFERENCE MODEL	11
4 IMPLICATIONS FOR TOOLS TO SUPPORT KNOWLEDGE NETWORKS.....	14
5 FUNDAMENTAL ICT CONCEPTS.....	15
5.1 MANAGEMENT SUPPORT SYSTEMS (MSS).....	16
5.2 COMPUTER SUPPORTED COOPERATIVE WORK (CSCW)	18
6 ICT DESIGN POTENTIALS FOR KNOWLEDGE NETWORKS	21
6.1 FIRST ORDER DESIGN POTENTIALS: KNOWLEDGE TRANSFORMATION	23
6.2 SECOND ORDER DESIGN POTENTIALS: NETWORK BUILDING.....	24
6.3 INTEGRATION MODEL DESIGN POTENTIALS KNOWLEDGE NETWORKS	26
7 SUMMARY	27
8 REFERENCES	30

1 INTRODUCTION

„Most important, in an age of rapidly proliferating knowledge, the central domain is a social network that absorbs, creates, transforms, buys, sells, and communicates knowledge. Its stronghold is the knowledge embedded in a dense web of social, economic, contractual, and administrative relationships“ (Badaracco 1991, 13-14).

Increasing competitive pressures, the constantly accelerating transformation of the economy and a stronger focus on value added have initiated the search for sustainable sources of competitive advantage. In this context, knowledge is increasingly recognized as an important source of value generation in modern organizations (Shukla 1997, 96-125). “Knowledge has become the most crucial component in the struggle for competitiveness” (Richter/ Vettel 1995, 37). Especially the ability to constantly generate new knowledge and transfer it to the development of new products and services is seen as critical: “...the ability to create knowledge and move it from one part of the organization to another is the basis for competitive advantage” (Inkpen 1996, 139). Parallel to this, a large body of theoretical and empirical research has suggested a significantly increased importance of the phenomenon network structures in recent years (Nohria/ Eccles 1992; Sydow 1992). Taking this transformation of relatively well structured and manageable systems into intertwined networks with no clear boundaries, one can assume that knowledge management will rather be pursued in the context of these networks than with traditional organizational structures. Modern Information- and Communication Technology (ICT) plays a central role as enabler, making not only the construction of networks, linking small and medium sized firms, possible (Reichwald/ Bieberbach/ Hermann/ Sirtl/ 1999, 326-334), but also promoting the transformation of hierarchical organizations into ones based on networks (Malone/ Laubacher 1998, 145-152). Although, the consequence of both aspects - the importance of the resource knowledge for future competitiveness of firms and the development of network based organizations in virtually all areas of the economy – is recognized, very little has been done to integrate the two (Roithmayr/ Fink 1997, 503-506). However, several authors have argued for the strong capabilities of network structures in processing and generating knowledge (Rehäuser/ Krcmar 1996, 27; Högberg/Edvinson 1998, 81-82; Powell 1998, 229-231).

The following paper, written from a business engineering perspective (WKWI 1994, 80-81; Mertens 1998), therefore seeks to integrate the two dimensions knowledge and networks as well for the academic community as for practical application. Considering its economic relevance, the paper will focus on the requirements and possibilities in creating innovative

Information- and Communication Technology solutions and their integration into a complete concept for knowledge networks. To illustrate the theoretical foundations, it seems helpful to first sketch out the approach and the proposed design of the research. Building on this framework, the third chapter will look at the demands knowledge management makes when developing knowledge networks. While unfolding the epistemological foundations, the term knowledge will be defined and the implications for the design of knowledge networks will be deduced. On this basis, a design of a referential model for knowledge networks is suggested. This referential model will then serve as a foundation in defining the requirements of the support of Information and Communication Technologies in the context of knowledge networks. In chapter four, the application possibilities for innovative ICT will be presented according to specific fundamental concepts of business engineering. Those will, together with the requirements deduced from the referential model, pose the starting point in developing ICT design potentials for knowledge networks, which will be discussed in chapter five. The design possibilities will first be developed from a process view and then integrated into the knowledge network referential model. The contribution concludes with a short summary of the results and some suggestions and implications for further research.

2 THEORETICAL FOUNDATION

It seems most fruitful to first outline the basic research approach as well as the underlying research design. The following contribution is the result of work in progress at the Competence Center Knowledge Networks at the University of St. Gallen, Switzerland. The focus of the Competence Center's work lies, from a theory building perspective, on advancing scientific understanding in the area of knowledge networks and, from a problem solving approach in practical usage, on developing a method for designing knowledge networks. The goal, hence, is not research focused only on testing and advancing theoretical findings, but also making a contribution to solving concrete societal problems (regarding the research methods of business engineering, especially regarding the fit of research method and desired content perspective, please see König/ Heinzl/ Rumpf/ von Poblitzki 1996, 35-66). Since the object of the research is not contained in purely technical systems but rather in socio-technical ones - which by their nature are more difficult to study with traditional research methods because of their great complexity, their multidimensionality and their social character – the researchers at the Competence Center have decided on an action research approach (Agyris/ Putnam/ Smith 1985). The basic idea of action research is that a circle of researchers and individuals in practice, with the circle's size still allowing face-to-face communication, come together to seek out a new and sensible orientation in a field of study and simultaneously are concerned with implementing their suggestions with concrete

steps to action (Frank/ Klein/ Krcmar/ Teubner/ 1999, 71). Hence, a central feature in the work of the Competence Center are workshops groups composed of a research team (4 researchers from the institute for management and 4 from the institute for business engineering) and employees of partner companies (1-2 employees of the partners DaimlerChrysler, Hewlett-Packard, Lotus/IBM and Unilever). The company internal origin of these employees reflects the trend towards system leadership of the corporate competency areas rather than of the data processing departments (Heinzl 1997, 267-278). Only one employee belongs to a strategic IT group, whereas decision power over what and how much of the Competence Center results are actually implemented lies with the competency areas in all the other firms. During the process of this cooperative research, the traditional positioning of the researchers as the observer and the object of research as the observed is consciously mutated to a dialogue between colleagues, each learning from and with the other (Agyris/ Putnam/ Smith 1985, 237). The researcher adopts the role of the mediator in this dialogue by asking probing questions, pointing out possible problems, and questioning traditional patterns of argumentation (Frank 1997, 30). The backdrop to this is given by two aspects. On the one hand, is the fact that the social world is not unconsciously given, but structured by the actor to create meaning. Therefore, it cannot be grasped independently of the interpretations and constructions of the actors. On the other hand, significant discrepancies appear between the development of a theory and its application. Agyris/ Schön differentiate for this reason between espoused theory and theory-in-use, with the later changing and developing from the espoused theory during the application process (Agyris/ Schön 1974). It becomes clear then that action research picks up on the subjective dimension of research and uses the possibilities of interpretations in social reality, to change and expand the options open to the participants. Between the workshops the participants use the time to review the results of the workshops, do further research and advance with their individual assignments as directed by the project plan. Accordingly, a typical feature of action research is a project course that is composed of spiral shaped cycles of planning, execution, observation, and reflection (Frank/ Klein/ Krcmar/ Teubner/ 1999, 77). The research design illustrated below was drawn up on the basis of action research. As mentioned above, it is especially important to note that the research advances in spiral shaped cycles, during which the uncovered insights are constantly tested and promoted during practical usage.

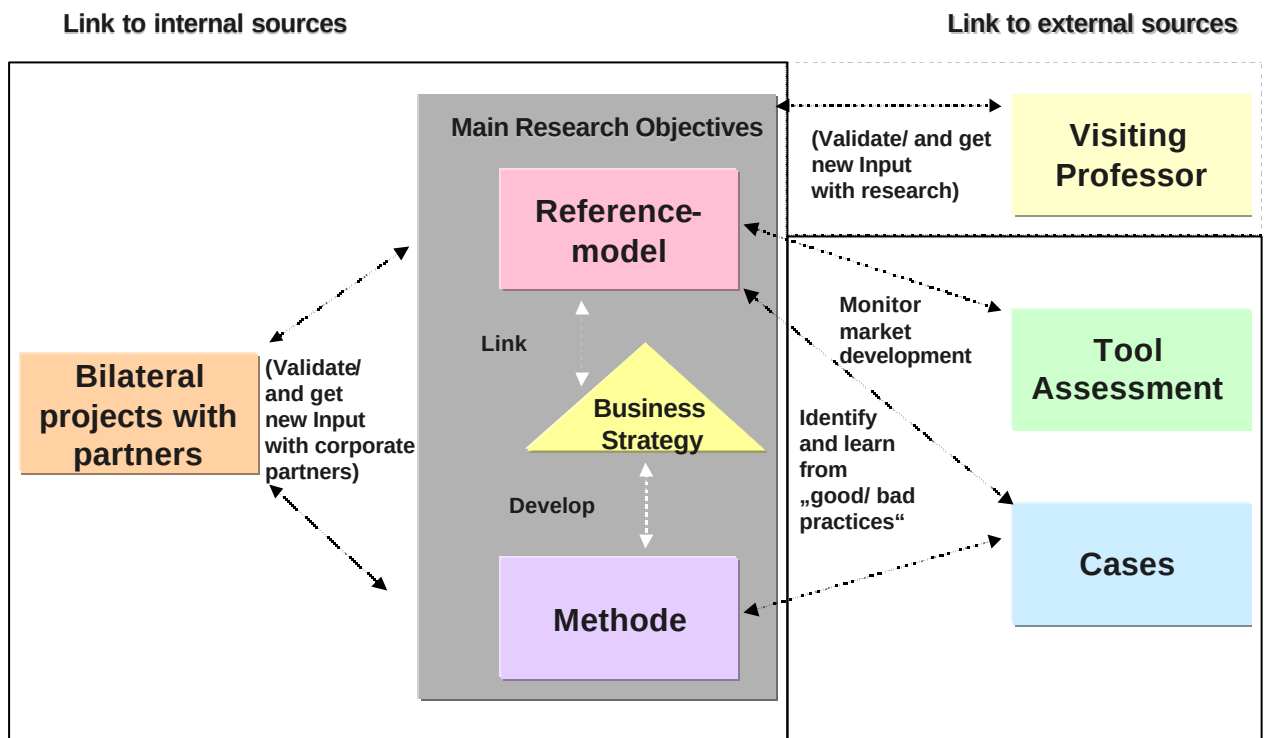


Figure 1: Research Design of the Competence Center Knowledge Networks

Starting with the joint development of the first version of a referential model for knowledge networks, this model was validated and developed further thanks to bilateral projects in practice as well as in discussions and workshops with visiting professors at the Competence Center (WS 98 Prof. Nonaka, Hitotsubashi/ Berkley; SS 99 Prof. Cusumano/ MIT). The networking of researchers and individuals in practice proves to be an additionally stimulating and success enhancing element, because of the two groups' different learning and working modes. Whereas people in practice tend to generate knowledge on the basis of experience, researchers tend to work rather more theory oriented on the level of conceptualization and validation (Realin 1997, 567; Seufert/ Seufert 2000). Simultaneously the researchers use case studies to collect, analyze and incorporate possible solution approaches into the continuous learning process at the Competence Center. Additionally, the market for tools is monitored, to ensure that new developments or trends are integrated into the project in a timely fashion. Communication with the partners is not limited to the workshops and the bilateral projects, but is continually upheld with a permanent exchange of news, intermediary results, estimates, and opinions which is made possible by specially designed an intranet platform.

3 DEMANDS MADE BY KNOWLEDGE MANAGEMENT REGARDING THE ICT SUPPORT IN THE FRAMEWORK OF KNOWLEDGE NETWORKS

The following chapter will present the demands made by knowledge management regarding the ICT support in the framework of knowledge networks. For this purpose, a model for knowledge networks will be developed after some fundamental thoughts about knowledge. This model will then serve as a basis for the analysis of the requirements and design possibilities of ICT.

3.1 Epistemological Foundations

Knowledge

In epistemology knowledge is mostly used in the context of certainty about the truth or truthfulness of occurrences (Russel 1997, 116). Knowledge in this sense it is often understood to be an opinion based on a true reason (Nonaka/ Takeuchi 1996, 58). In the framework of this contribution, however, the use of knowledge for problem solving and decision making presents the center of attention. Knowledge is hence seen as “information combined with experience, context, interpretation, and reflection. It is a high-value form of information that is ready to apply to decisions and actions” (Davenport/ De Long/ Beers 1998, 43; more elaborately in Davenport/Prusak 1998). The differentiation with signs, data, and information is achieved hierarchy of terms (Rehhäuser/ Krcmar 1996, 3-6; similarly in O'Dell/ Grayson 1998, 5). The lowest hierarchy level is composed of signs as numbers, Letters and special signs. They can be combined to data according to syntactic rules. By selecting the relevant data in the context of a given problem this data develops into information (Probst/ Raub/ Romhardt 1999, 36 and following). Finally, knowledge is created when experience and interpretation allow a meaningful combination of information (Rehäuser/ Krcmar 1996, 6 and Allee 1997, 62).

Knowledge can be classified according to different criteria (compare, for example, Roithmayr 1996, 108-110). For the purposes of this paper, it seems most sensible to classify knowledge according to the type of knowledge and the level at which this knowledge is present. Regarding the type of knowledge one can differentiate between implicit and explicit knowledge, whereas these two types can be conceptualized as two ends of a spectrum (Leonard/ Sensiper 1998, 113). Explicit knowledge can be transported, respectively coded in formal systematic language (Nonaka/ Takeuchi 1995, 59). It can be represented, distributed, and stored in books, documents, or databases (disembodied knowledge). Contrary to that, implicit knowledge (Polanyi 1996) is very hard to formalize and communicate. This implicit

knowledge, which is heavily rooted in personal experiences, subjective perceptions, values, and emotions (embodied knowledge), is very difficult to communicate and share with others. Implicit knowledge has two main components, a technical and a cognitive dimension. While the technical dimension is comprised of skills and capabilities - often called "know-how"- the cognitive dimension is made up of our mental models - defined by our beliefs, values, and convictions – with which we perceive our environment (Nonaka/ Takeuchi 1995, 60). Regarding the level at which knowledge is present, four levels can be distinguished: the individual, the group, the organizational, and the inter-organizational level. Knowledge creation and transfer are dependent upon interaction on the individual and group level, and by means of social processes these can lead to knowledge development on the organizational and the inter-organizational level. In the framework of a knowledge spiral (Nonaka 1991), knowledge then develops as a result of a dynamic interaction between explicit and implicit knowledge on several levels of knowledge. The illustration below presents the classification of knowledge according to different types and levels of knowledge and uses examples for clarification.

		Knowledge Level			
Type of Knowledge	Explicit Knowledge 	Individual-level	Group-level	Organizational-level	Inter-organizational level
		Facts about products, customer, „Know-what“	Collective knowledge in a team, Knowledge, who knows what	Organization handbooks product descriptions dokumentations yellow pages	Knowledge about market environment, knowledge whom to contact, who knows what
	Implicit Knowledge 	Communication - and problem-solving capabilities Know-how	Team skills - Know how within a team	Principles, unwritten rules“ for knowledge sharing and transferring	„Know-how“ in purchase and sales, „Know- how“ to cooperate
	Cognitive Dimension	Values, product quality perceived by the single employees	Values, product quality perceived by the team	Corporate culture Knowledge Vision, guidelines	Brand, image perceived by customer supplier and competitors

Figure 2: Dimensions of Knowledge Creation (Seufert/ Seufert 1998b)

Implications for the design of knowledge networks

From the presented characteristics of knowledge, it follows that knowledge cannot be understood as an objective measure, which can be transferred independently of person and context. Rather, a holistic approach is required which is capable of incorporating implicit knowledge in addition to explicit knowledge. The uninterrupted flow of knowledge and experience is here essential. A central prerequisite is the building of structures which are capable of providing access to and allowing exchange of employees' knowledge and experiences. The main challenge in this lies in the temptation to simply support the collection of data and information, instead of stimulating knowledge generating and exchange processes. Considering this backdrop, the following requirements seem to be particularly important:

- **Interconnection of different types, levels, and areas of knowledge:**

Knowledge evolves by making connections between new knowledge and what is already known. This requires the interconnection of individual types of knowledge (explicit and implicit) as well as of different levels of knowledge (i.e. individual, group) and of knowledge specific to competency areas (i.e. client knowledge, R&D knowledge). Additionally, significant potential is realized when interconnecting the areas work, learning, and innovation which have been separated according to respective mental models in corporations, but in reality stand in complementary relation (Brown/ Duguid 1991, 40-57; for suggestions of an integration compare Seufert/ Seufert 1999).

- **Interconnection of knowledge processes and platforms:**

The expansion of knowledge occurs at various real (i.e. office, client site), virtual (i.e. dispersed team rooms), or mental spaces (i.e. common values, ideas) (Nonaka/Konno 1998, 56-73). These can be aligned in the form of formal or informal networks. Since knowledge evolves increasingly in spaces which are separated by time or geography, the use of modern ICT is arguably a critical factor for success. Parallel to these formal networks, informal relations are also of significant importance for knowledge development (Krackhardt/ Hanson 1997, 37-49).

- **Interconnection of knowledge processes and environmental variables:**

In order to unfold their full potential, knowledge networks need to be interconnected with their environment. On the one hand, the processes need to be tuned to fit the environment and the corporate culture within which they must perform. On the other hand, companies need to

take an active part in shaping an environment which allows efficient and effective knowledge promotion.

3.2 Knowledge Network Reference Model

Building on the characteristics of knowledge and their implications for knowledge networks it will now be possible to build a referential model for knowledge networks. The conceptualization of the model is backed by Giddens' structuration theory. It seems particularly useful for the analysis of network structures, since it incorporates the togetherness of structure and object and the duality of structure, meaning that it expresses the reconstruction of subject-object relations through human action (Sydow/ Windeler/ Krebs/ Loose/ van Well 1995, 22). "Structuration theory offers a conceptual scheme that allows one to understand both how actors are at the same time creators of social systems and yet created them" (Giddens 1991, 204). Giddens' understanding of science is not dialectics (Popper 1994), which seeks to propose and falsify hypothesis. Giddens sees science as an extension of thought with method, which does not use theory to make provisionally true statements, but rather to better describe and understand what is in practice. Accordingly, it will become apparent that the discussion of structuration theory will be seen as an integral (method) part of the action research framework set earlier.

At the center of structuration theory lies the process during which action and structure are transmitted practically together. Action in this context, refers to the partly conscious and partly unconscious involvement of actors which changes and stabilizes the social world (Peterhans 1995, 360). If action is directly or indirectly focused on other actors, structuration theory describes this action as social action, respectively, social interaction. The actors of interactions use structure to refer to the structural attributes of social systems and thereby try to contain time and space in social systems. Just like practical action, structuration theory sees the actors themselves as being, for example in personality development, influenced by these structures on the one hand and shaping – through their actions – social practice, on the other hand. "According to the notion of the duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organize" (Giddens 1984, 25). The theorem of the duality of structure calls for closer analysis of two dimensions of these social practices: the structure dimension and the action/interaction dimension. Each social practice, including the management of networks, can be described using these two dimensions, which are connected by modalities. The respective modalities of structuration are interpretative schemata that allow understanding, interpretation, and rationalization of actions, facilities for the execution of power and norms used in valuation

and sanctioning of actions regarding the legitimacy structure seen to be valid. Actors use these modalities in social interactions. On the one hand, actors use them to refer to the structural attributes of social systems, on the other hand (duality of structure), those interactions include the reproduction of the structures at their basis (signification, domination, and legitimacy).

Building on these fundamentals, knowledge networks can be understood as a coming together of institutional frameworks (i.e. structures), modalities or aids, which actors employ in social interactions and with which they conceptualize interaction processes. Following an often cited definition, the following will be understood as network: “a specific set of linkages among a defined set of actors, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the actors involved” (Mitchell 1969, 2). Hence, the term network focuses on social relations between actors. Actors of a social network can include – in addition to organizations – persons and groups, but also organizational collectives, communities, or even societies. The relations which crystallize between actors can be roughly categorized according to content (i.e. products or services, information, emotions), form (i.e. duration and closeness of the relation), and intensity (i.e. number of interactions). Form and intensity of the relations give rise to the structure of the network (Alba 1982, 42-42). Networks are organized regarding structure and culture (Krebs/ Rock 1994, 329). The relationships between the actors are often contractually fixed for longer periods of time and are structured with respects to personal as well as technical organization. The relations can be studied particularly well regarding autonomy versus interdependence, the coexistence of cooperation and competition, as well as reciprocity and stability. The organizational boundaries of networks are difficult to define, which leads *Badaracco* (Badaracco 1988, 67-91) to speak of “blurred boundaries”, which are socially construed by the members of a network. *Reich* presents, from a more organizational perspective, the picture of the firm as “... facade, behind which teems an array of decentralized groups and subgroups continuously contracting with similar diffuse working units all over the world” (Reich 1991, 81). This leads to the following: “The focus shifts from products and firms as units of analysis to people, organizations, and the social processes that bind together in ongoing relationships” (Webster 1992, 10).

Based on this understanding of networks and the structuration theory it is built on, the referential model of knowledge networks encompasses the following components: Processes/relations between the actors; tools/resources that are available to the actors, as well as the underlying institutional framework (Seufert/ von Krogh, Back 1999, 185-186). The following illustration shows the referential model as a whole.

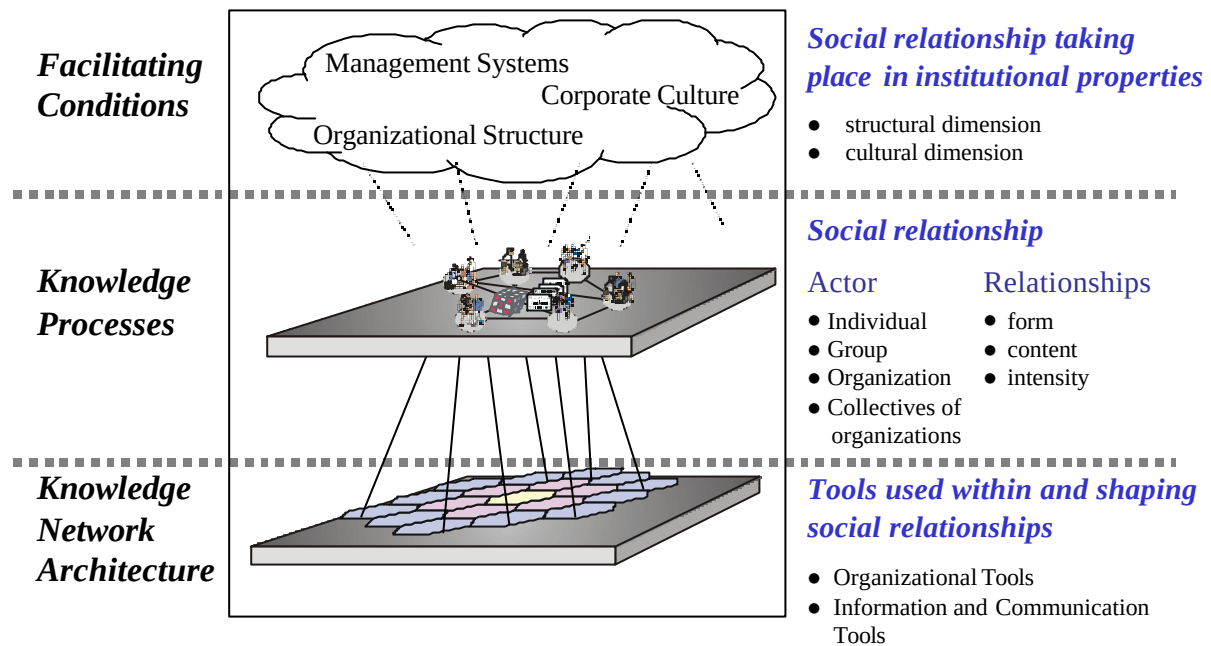


Figure 3: Reference Model Knowledge Networks

- **The underlying institutional framework** defines the environment, meaning the structural and cultural dimensions, within which the network's knowledge processes take place. Therefore, they define the either supporting or restricting environmental variables, such as organizational structure, management systems, or cultural aspects, for example norms and values or the communication culture (De Long 1997; von Krogh 1998; regarding the concept of knowledge enabler please also refer to von Krogh/ Ichijo/ Nonaka 1998, 173-204).
- **Knowledge Processes** contain the interaction and communication processes on the individual, group, organizational, and inter-organizational level, which can be categorized according to form, content, and intensity. These processes can be understood as a knowledge spiral, meaning a dynamic transformation process between explicit and implicit knowledge on the different levels.
- **Tools** are the instruments available for social interactions. It is possible to differentiate between organizational tools, such as assigned roles (von Krogh/ Ichijo/ Nonaka 1997), and ICT-tools. The support potential of these tools, can refer directly to the knowledge processes, or – on the other hand – knowledge networks can be seen, poised against the backdrop of structuration theory, as dynamic configurations, continuously expanding and changing through social interactions and learning processes. Seen in this light, the support potential of tools can be approached from a life-cycle model perspective of knowledge networks (Wenger 1998). An interesting focus of research, which would

regrettably go beyond the scope of this paper, would be the questions of how tools, particularly ICT-tools in the framework of knowledge networks, could contribute to the changing/dissolving of organizational structures (Picot/ Reichwald/ Wigand 1998; Faisst 1998; Mertens/ Griesse/ Ehrenberg 1998; Sieber 1998; Müller/ Kohl/ Schoder 1997).

4 IMPLICATIONS FOR TOOLS TO SUPPORT KNOWLEDGE NETWORKS

Before advancing to the support potential of ICT in knowledge networks, it seems sensible to first develop a concrete picture of the requirements set by it. Regarding the unfolding of the potential of ICT-Systems, one has to understand that the induced change process does not only affect technical matters, but also the meaning, content, and opinions (signification structures), the subordination, act, or place of leadership and control (denomination structures), as well as the congruence with established rules, principles, standards, and norms (legitimacy structures). To put matters differently: New forms of content transfer are introduced (i.e. an e-mail has the same content as a handwritten memo), power – indexed by resources – is shifted (i.e. everyone has access to certain parts of the database; the resource knowledge allows action), and social norms are affected (Yates/ Orlikowski 1992, 398-427; De Santis/ Poole 1994, 121-147). Using *Orlikowski's* structuration model of technology (Orlikowski 1992, 405-412), the focus in the following will be put on the potential influences ICT has on knowledge processes, on the one hand, and on the building and design of knowledge networks, on the other hand. These can be conceptualized, as the illustration below shows, as dynamic transformation processes between types and levels of knowledge present in a network. *Nonaka* uses the word *Ba* in this context, meaning “a shared mental space for emerging relationships” (Nonaka/ Reinmoeller/ Senoo 1998, 675). This space can be of physical, virtual, or mental nature (Nonaka/ Kono 1998, 40-54).

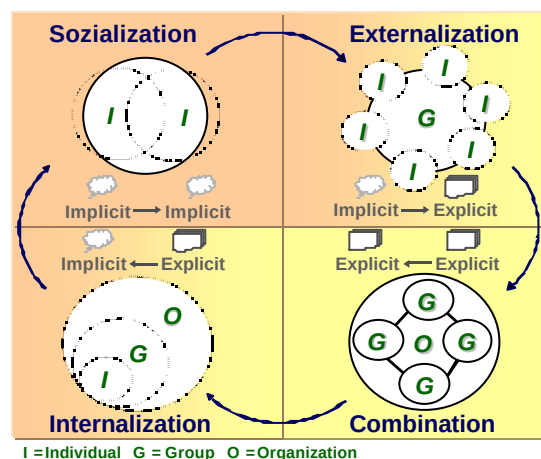


Figure 4: Knowledge Processes in Networks (referring to Nonaka/ Konno 1988, 43)

Socialization refers to the exchange of implicit knowledge between individuals, for the purpose of sharing personal knowledge and experience. Through common experience, new implicit knowledge develops; new knowledge, such as values or technical skills. In practice this implies, for example, acquiring intuitive and personal knowledge by physical closeness and direct interaction with customers and suppliers. During the *externalization* phase, change processes of a different type take place. During this phase, implicit knowledge is mutated into explicit knowledge and individuals exchange knowledge in a group. In trying to express implicit knowledge, members of the group often use certain methods, such as metaphors, analogies, an intuitively understandable language, or narratives as well as visualization helps – for example, models, diagrams, or prototypes. Additionally, a constructive discussion with deductive or inductive argumentation in the group is of particular importance, in seeking to arrive at creative conclusions. During the phase of *combination/systemization*, the goal is to change raw explicit knowledge into more complex and systematized explicit knowledge. This serves to connect different areas of explicit knowledge and to make it available throughout the entire organization. The systemization and refinement increases the value for usage of the available knowledge and its transferability to all the organization's units. This demands that the individual is able to select that organizational knowledge which is relevant to him or her. Continuous learning and the collecting of personal experiences through "learning-by-doing" support the employees with this internalization process. In this way abilities and skills ("know-how"), as well as corporate visions and guidelines can be internalized as personal values. This implicit knowledge and the experiences made on the individual level can, in turn, be shared between individuals, once again propelling the knowledge spiral.

5 FUNDAMENTAL ICT CONCEPTS

Having outlined the requirements of knowledge networks, the design potentials of ICT will be analyzed in the following. For this purpose, selected fundamental concepts of business engineering will be introduced. This framework integrates information and communication technology, on the one hand, and requirements of knowledge networks on the basis of the developed referential model, on the other hand. Considering the epistemological thoughts presented above, knowledge can be understood as a sensible connection of information for the purpose of supporting decision and action. Because of this, the following analysis of the application possibilities will focus on the fundamental concepts of Management Support Systems (MSS) and on Computer Supported Cooperative Work (CSCW). These two concepts seem particularly useful, because of their direct orientation according to business decision processes and their approach regarding the interconnection of information.

5.1 Management Support Systems (MSS)

From the onset of research in the area of computer-based management support, attempts have been made at finding all-encompassing terms and definitions (Kleinhaus/ Rüttler/ Zahn 1992, 3). However, these attempt at finding uniform definitions have not been successful. In the following, the terminological usage of *Back-Hock* will be used, which generally differentiates between the two main functions of information supply and decision support in the framework of MSS (Back-Hock 1990, 189-190). Systems that provide decision relevant information to management can be traced back to the beginnings of electronic computing machines (Kleinhaus/ Rüttler/ Zahn 1992, 2 as well as Behme/ Schimmelpfeng, 1993, 3). However, *Ackhoff* recognized already in 1967 that these Management Reporting Systems had significant weaknesses, including an surplus of information instead of the propagated lack of information, the knowledge that simply providing information does not suffice, or the necessity to recognize the social aspects of executive information (Ackhoff 1967, 144). One can see the evolution of Executive Information Systems (EIS)/Executive Support Systems (ESS) as growing from these insufficient information supply systems (Rockhardt/ De Long 1988, 14-64). Among others, the ideal-typical functions of the EIS include the integrating of internal and external data, briefing book functionalities, as well as the possibility of exception provision reporting, for example, by color coding when certain variables are outside of the set parameters (Back/ Rieger/ Seufert 1997, 157-158). The goal of the so-called Decision Support Systems (DSS) - which became possible towards the end of the 1970s, when the appearance of the first PCs allowed the provision of computing capacity and software at the individual workstation - lies in supporting and improving human decision processes (Oppelt 1995, 134). Their main area of usage is the support of semi-structured assignments, during which the decision process takes place in an interactive man-machine dialogue (for suggestions towards a usage model, please see Mertens/ Höhl 1999, 25-49). Typical functions of a DSS are, next to pure data retrieval and statistical functions, primarily the optimization and simulation of trend calculation/sensitivity analyses regarding the future (so-called what-if or how-to-achieve questions). Since the mid 1980s, DSS has been increasingly influenced by the research done in the areas artificial intelligence and office communication. On the one hand, this promotes a move towards expert systems (a growing together of DSS and XPS, please see Back-Hock 1993, 173-181), on the other hand, towards concepts of Group Decision Support Systems (Laudon/ Laudon 1995, 382 ff.) and of Distributed Group Decision Support Systems (Turban 1995, 376-399). Although, the introduction of new software products in the areas DSS and EIS have arguably brought a new quality standard into computer based management support (for an overview of application categories and

functionalities, please see Back-Hock 1996, 509-513 and Lange 1994, 43-61), important questions have to be answered (Back/ Seufert 1997). Fundamental problems are, for example, to be found regarding the information supply function with insufficient integration with the operative systems (Becker 1993, 22). This may cause data to not be up-to-date and hinder usability, spur inconsistencies in the data and prevent a firm wide semantic (Gluchowski/ Gabriel/ Chamoni 1995, 30ff.). In the area of decision making support, in turn, a lack of flexibility and visualization is remarked (regarding the requirements from the knowledge management perspective, please refer to, for example, Sparrow 1998, 51-77). The lack of visualization is indexed, for example, by the limited ability to develop one's own models of analysis and limitations of the fundamental data models, which are mostly stored in capsuled, proprietary multidimensional databases (Zwicker 1995).

The problems outlined above, have lead to new generations of MSS, since the beginning 1990s, being developed on the basis of the data warehouse approach (Inmon 1992). The goal is for back-end to continually ensure the consistency and provability of the data pool (Schreier 1996, 83), thereby promoting decision relevant data to be up-to-date, of high quality, and flexible. Of central importance in this process, next to the automatic transfer of operative data, is its preparation, illustration, and systemization in decision supporting data models (Muksch/ Holthuis/ Reiser 1996, 412-433). The use of meta-models, which contain data about data, is particularly important. Additionally, the use of new and more flexible tools allows an improvement of the analysis functions, such as access to different data types, the option to experiment with different data formats and data aggregations, the defining and presenting of new information models, or the free navigation through consolidation paths (Drill-Down and Roll-Up), the possibility to separate the data and to turn and rotate it (Slice-and-Dice) (Jahnke/ Groffman/ Kruppa 1996, 321-324). Because of their vast and flexible developing environment, these systems are capable of adjusting to the specific needs of different addressees. The advantage compared to traditional EIS-applications is that a uniform system environment can be used from the push-button EIS all the way to a free analysis system, which, combined with the use of a data warehouse, is based on consistent and identical data (Hayem 1996, 9). Resulting from the often significant size of data warehouses, which are predicted to grow as their application is expanded into cross-functional areas, like supply chain management (Drucker, 1995, 54-62) or customer relations management (Aberdeen Group 1996), procedures for dealing with the flood of available information are growing in importance. In addition to a wider application of special filtering techniques (Mertens/ Bissantz/ Hagedorn 1994, 393-399), data mining procedures (Bissantz 1996, 35-89 as well as Hagedorn 1996, 48-119) or support through intelligent agents are gaining significance. This procedures are being increasingly integrated into existing analysis

tools (for example, see Lamb 1999, 13-16). Considering this backdrop, combined OLAP/ Data Mining solutions are competing with increasing strength against expert systems (Armelingmeyer/ Strahlinger 1999, 80-92). However, the expansion into new areas of usage also set new benchmarks regarding the integration of external data into Management Support Systems (Uhr 1999, 403; Mertens 1999, 405-415; for decision support regarding the integration of external data suppliers, also refer to Uhr/ Kosilek 1999, 461-466). Figure 5 presents the system classes at the basis of innovative MSS.

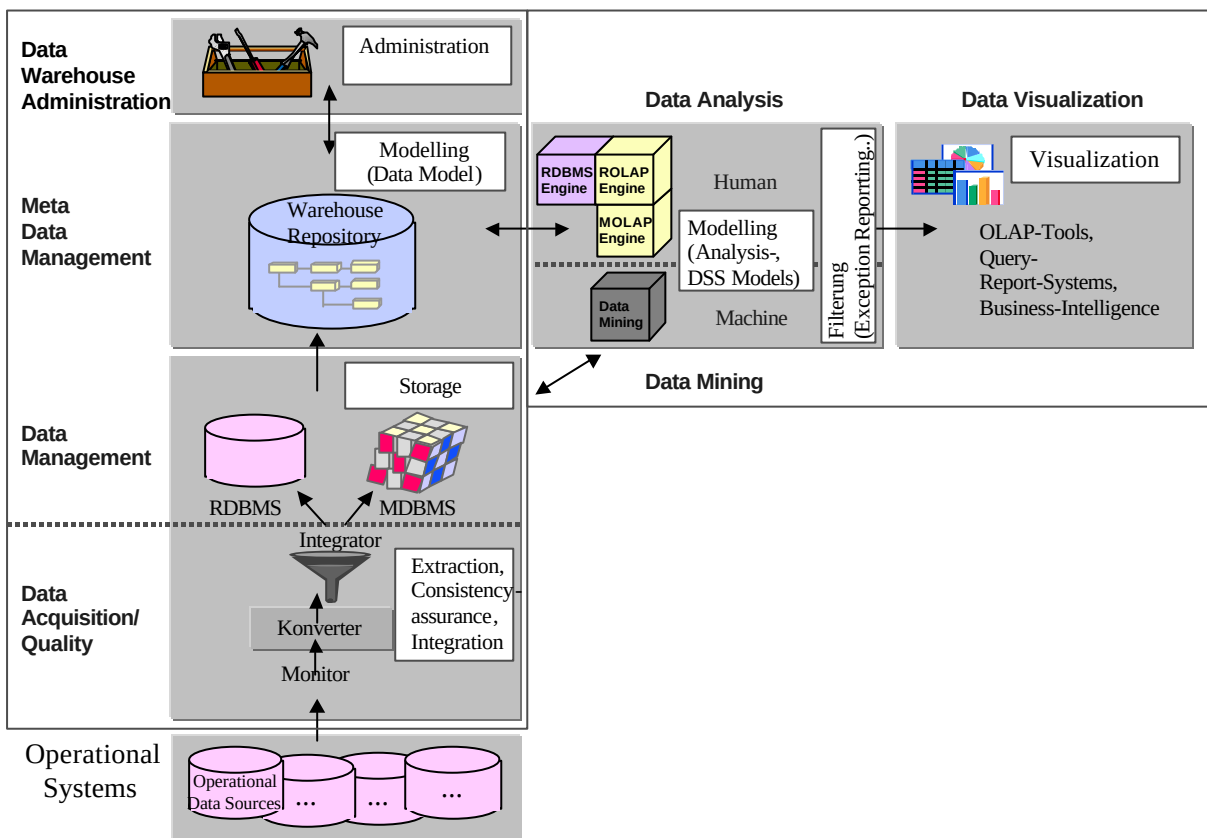


Figure 5: Management Support System Classes

5.2 Computer Supported Cooperative Work (CSCW)

The technological support of group work is one of the focuses of research since the mid 1980s (Krcmar 1992, 425). The research area CSCW seeks to advance computer support of cooperative working. It is its explicit goal to improve the people's cooperative efforts with the aid of information and communication technology, seeking to make it more efficient and flexible, but also more humane and socially viable (Hasenkampf/ Syring 1994, 15). The central focus of CSCW research lies with the assignments and the people, who execute these assignments. The research in CSCW, therefore is defined by an interaction of different disciplines, such as computer science, work science, psychology, and communication

science (Krcmar 1992, 426 as well as Malone 1988, 5-9). Three main research clusters can be defined: understanding teamwork, development of tools/concepts for the support of teamwork, and valuation of tools and concepts (Hasenkampf/ Syring 1994, 16). The central cluster, understanding teamwork, analyzes all types of group assignments, work combinations, and the factors of influence of other variables, which affect the functional and social aspects of group work. To achieve this goal, a variety of disciplines are tapped (sociology, psychology, and organization theory). Center stage of the second cluster, development of tools/concepts for the support of teamwork, is taken by the development and advancement of computer supported tools. The roots of this approach are, among others, to be found in decision supporting and communication systems. The arrival of new technologies brings new possibilities of work support which, in turn, affect the structure of teams, their working processes, and their communication behavior. The last cluster, valuation of tools and concepts, measures the support effects and results of the tools. In the framework of such empirical studies, the concepts as well as the tools' implementation needs to be analyzed (for an outline of available literature regarding the discipline, refer to Krcmar 1996, 31-44 and Uhr/ Schöne 1997, 198-202).

Building on this terminological foundations, CSCW-application or Groupware should be considered systems that allow computer supported cooperative work (Nastansky 1992, 6; Back-Hock 1995, 45; Coleman 1995, 3-41). Since research in this area is rather new, no uniform definitions and categorizations have been developed and instead a wide array of differing explanation and systemization approaches still exist (for an overview of currently existing approaches, please refer to Behrens 1994, 31-35). The arguably most prevalent classification of CSCW-applications (Groupware) uses a time-space matrix (Johansen 1988, 44). This classification differentiates according to the geographical (same place/geographically separated) and temporal (synchrony/ asynchrony) distribution of the participants (Johansen 1988, 44). For the purposes of this contribution, however, a classification according to the support functions communication, coordination, and cooperation seems more fruitful (Wendel 1996, 22-25 and Teufel/ Sauter/ Mülherr/ Bauknecht 1995, 12-26). Communication in this context, refers to the processes of information transfer or exchange between members of an organization and between those members and external communication partners, as well as the activities surrounding those exchange processes. If communication takes place in the context of teamwork and if this communication is used to align work related activities, it is called coordination. Hence, coordination is the use of appropriate communication processes for the necessary alignment of decentralized activities and decisions of interdependent organizational units, with the purpose of optimally achieving set goals. Starting from these support functions, the four main

categories communication systems, communal information spaces, Workflow Management Systems, and Workgroup Computing Systems can be introduced (Teufel/ Sauter/ Mülherr/ Bauknecht 1995, 27). Communication systems are systems that allow explicit information between different communication partners. Hereby, the predominant goal is to bridge differences in time and space. Typical examples of this systems class are e-mail, video-conference systems, and – as far as closed groups are addressed – Bulletin Board-Systems. Communal information spaces are systems that provide virtual interaction space for groups, in which information can be stored in appropriate form and with the help of appropriate access mechanisms (Van House/ Butler/ Schiff/ 1998, 335-344; Dennis/ Aronson/ Heninger/ 1999, 95-108). Examples are distributed hypertext systems as well as special databases. Bulletin Board-Systems can also be included in this class. Workflow Management Systems support all work that needs be done during the modeling, simulating as well as implementing and governing of processes. A workflow is a limited chain of activities, with the chain reaction of activities is started and finished. More generally, workflows are organization wide processes which involve a large number of actors and resources. The support function of Workflow Management Systems lies in the software based coordination of activities. The continuous support of a workflow continuum, reaching from pure ad-hoc communication to purely standardized processes, seems particularly promising (Nastansky/ Hilpert 1994). Workgroup Computing Systems, support the cooperation of people who work in groups or teams and who are solving problems with medium to low structuration as well as repetitive elements. Here, the coordination function refers to the coordination relations within the group that are necessary to solve a given problem. This class includes planning systems, agenda setting systems, screen-sharing systems, group editors, as well as decision and meeting support systems. The following illustration summarily shows the classification of Groupware/CSCW-applications using the main categories and their system classes (for an overview of CSCW-tools, also refer to Schwabe/ Krcmar 1996, 209-224).

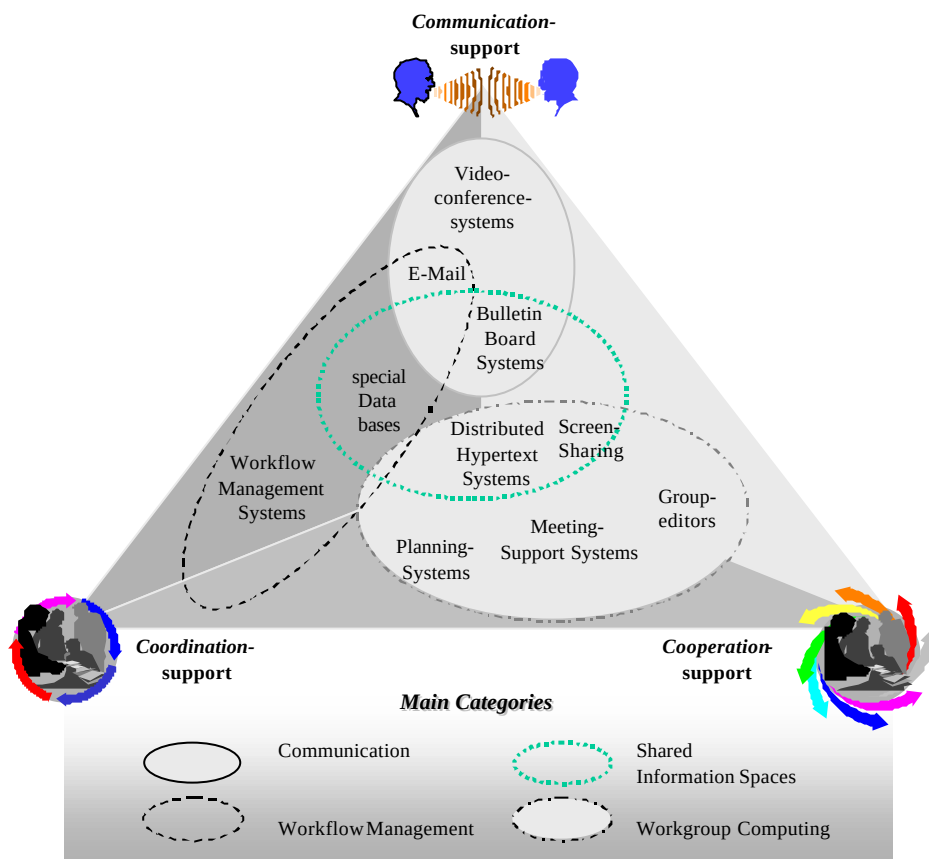


Figure 6: Groupware System Classes

6 ICT DESIGN POTENTIALS FOR KNOWLEDGE NETWORKS

Having discussed these fundamental concepts, the following illustration will use the identified processes in knowledge networks to present an overview of the design potentials of ICT. While the support through CSCW-applications makes sense whenever communication, coordination, and collaboration processes take place, MSS-based applications provide possibilities when knowledge needs to be integrated into electronic knowledge bases as well as when the goal is systemization and retrieval of knowledge (Wolf/ Decker/ Abecker 1999, 745-765; Warschat/ Ribas/ Ohlhausen 1999, 53-59). A particular challenge is present in the approaches which attempt to integrate the potential of both areas (Seufert 1997, 46-49; Nonaka/ Reinmoeller/ Senoo 1998, 673-684 and Baets 1998, 177-214).

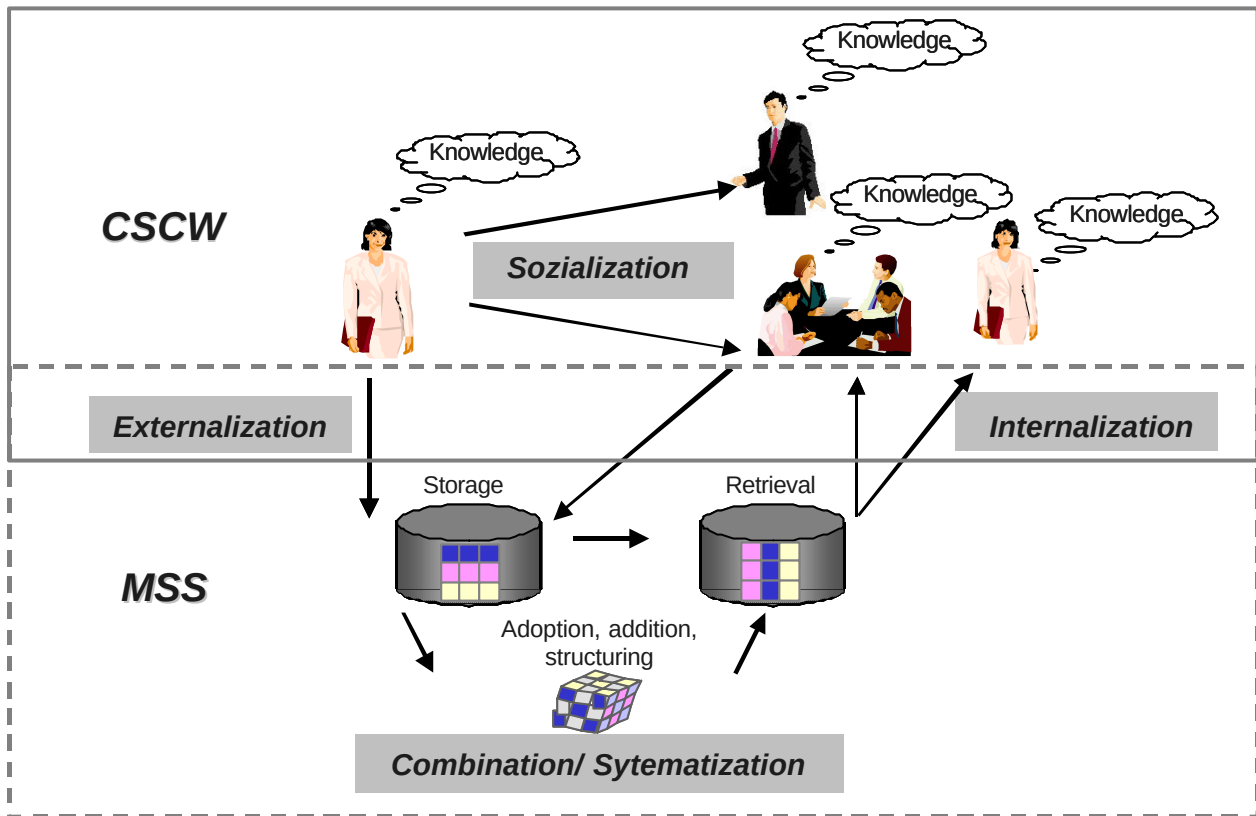


Figure 7: Knowledge Processes and ICT (referring to Wolf/ Decker/ Abecker 1999, 751)

In the following, a framework will be developed which integrates the defined requirements and application potentials of ICT. With this framework it will be possible to provide a detailed judgement regarding ICT design potential. For this purpose, the initial model of the knowledge spiral for networks will have to be looked at in more detail. Building on the already introduced model of structuration theory, a differentiation can be made between the generic knowledge process, 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). Proceeding in this way, design potentials of a first order (the immediate influence of ICT on the generic knowledge processes) and design potentials of a second order (the influence on the institutional framework conditions) can be identified.

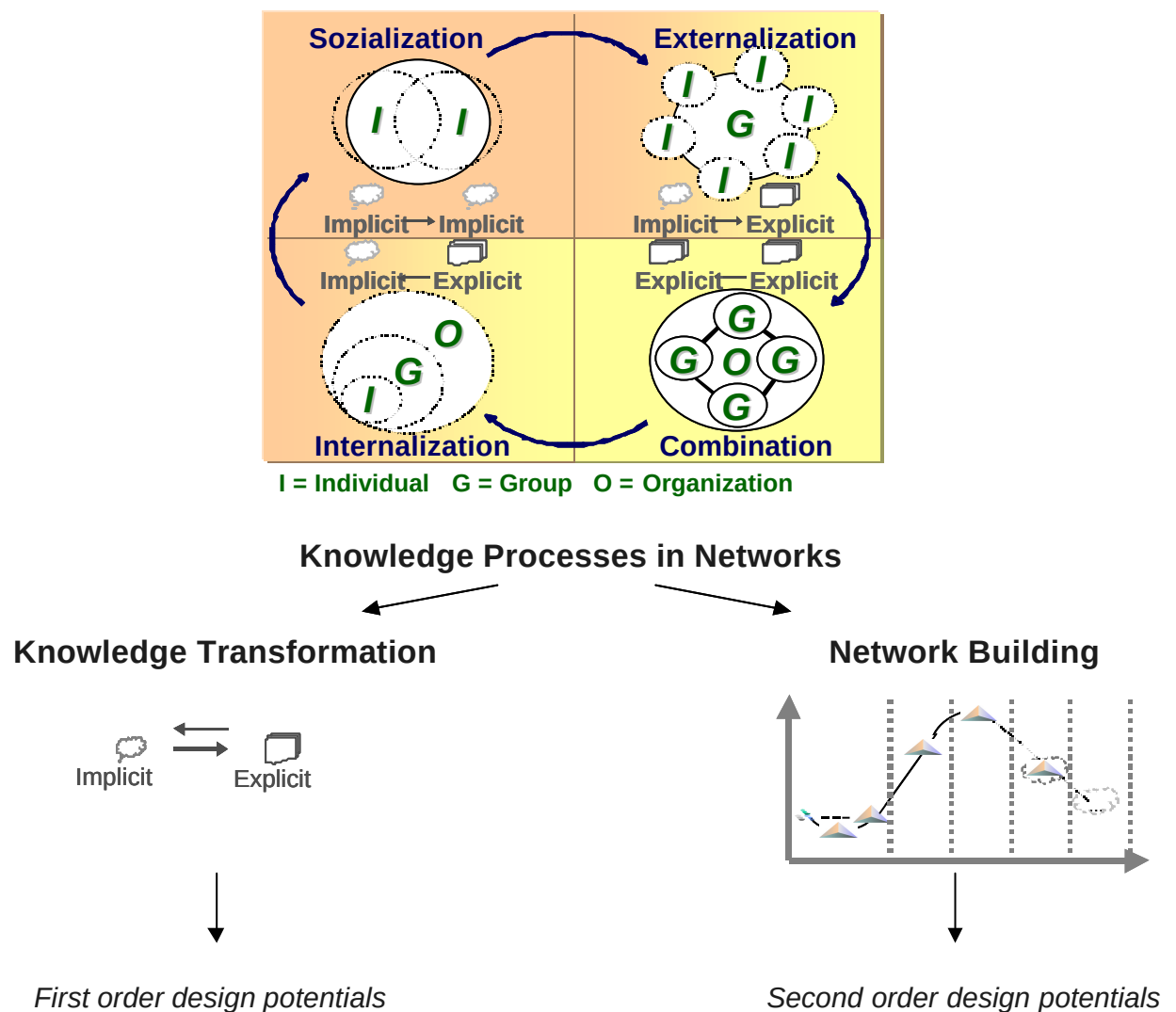


Figure 8: Design Potentials in Knowledge Networks

6.1 First order design potentials: Knowledge transformation

Regarding knowledge transformation, the following generic knowledge processes can be distinguished: locate, capture, share, apply (Zack 1999, 45-58; similarly Harris/ Fleming/ Hunter/ Rosser/ Cushman 1999, 11-12 and Heilmann 1999, 11-12). These processes can be set against the knowledge transformation processes developed in the framework of the referential model. In order for implicit knowledge to be exchanged during socialization, it first needs to be identified, so as to be internalized through adaptation and model-learning. Externalization, in turn, can be understood as a 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. Combination can be described as the identification of already explicitly available knowledge that is interconnected and prepared for decision making, hence, (re-) organized and then distributed. Finally, internalization can

thought of as the identification of explicit knowledge and the internalizing thereof, in order to apply it in concrete circumstances. The following graph illustrates the connections.

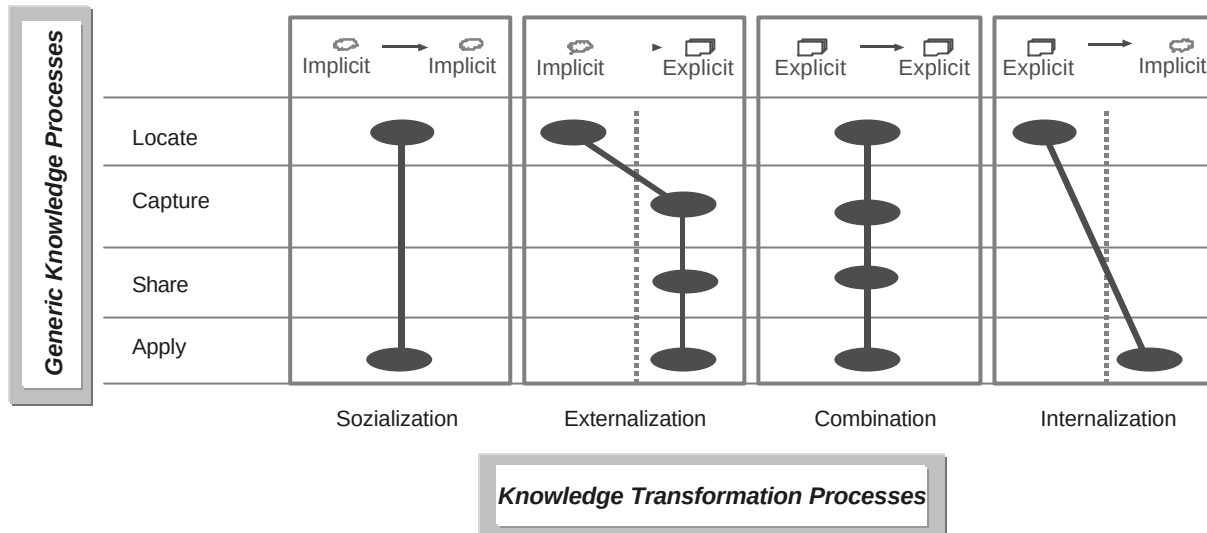


Figure 9: Classification Knowledge transformation

6.2 Second order design potentials: network building

Network building and design can be conceptualized using a life-cycle model and be set against the knowledge transformation processes of the referential model. Phase 1 hereby serves preparation, mutual introduction, and finding similarities. During this phase, the heavy coordination needs in connection with the large content of implicit knowledge often leads to a decrease in productivity (regarding suggestions for efficient team management, please see Cusumano/ Selby 1995, 73-126). Therefore, socialization – meaning a physical, mutual introduction of the participants – is of central importance Seufert/ Seufert 1998a, 14-20). The performance begins to improve, only after the participants have acquired a certain basis, for example, of trust or evaluation of abilities (Katzenbach 1993, 91-92). In the framework of establishing the network, actors begin to recognize and test the potential of the cooperation (Wenger 1999). In this phase they begin to generate first artifacts together and they (inter-) act with their eyes on the mutual achievement of a goal. Hence, the aspect of externalization of knowledge becomes dominant in this phase. Phase 3, is defined by the active design of the network. Additionally, the actors begin to influence the institutional framework conditions (Yates/ Orlikowski/ Okamura 1999), due to the continuous production of artifacts, the (re-) organization and (re-)structuring of existing knowledge, and the establishment of specific routines (regarding the significance of routines for knowledge storage, refer to Aargote 1999, 82-87). During this phase, combination and internalization lead to the use of all instruments for knowledge generation and exchange (face-to-face, artifacts, routines) and to the

establishment institutional framework conditions of the knowledge network are to serve the mutually agreed upon goals. Therefore, the highest performance of the knowledge network can be achieved during this developmental stage. Phase 4 can be described as the dissolving of the network, since knowledge networks are, on the one hand, established permanently and, on the other hand, often set up as temporally limited structures. The participants no longer engage actively. They are still in contact, though, meeting informally or asking each other for advice. Hence, the knowledge network remains active in the sense of a knowledge source. This knowledge source can be comprised of the actors themselves, the artifacts generated by them, or the network's structures and routines. Phase 5, finally, signifies the absolute end of the knowledge network. It only lives in the memories of the network's members and in their stored artifacts. The illustration below helps to visualize the model.

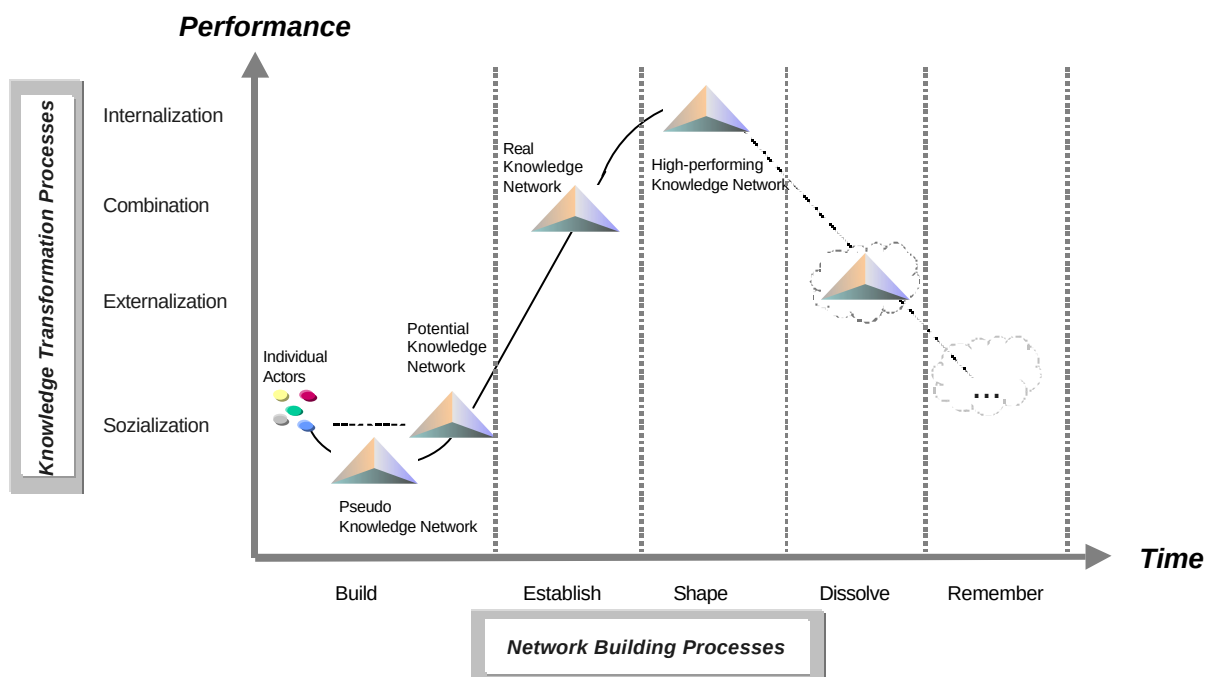


Figure 10: Classification Network Building (referring to Katzenbach 1993, 87-108 and Wenger 1999, 3-4)

Because of the duality of structuration, actions and processes do not only influence the institutional frameworks but, in turn, the already established institutional frameworks influence the processes which at its basis. From a knowledge management perspective, the two fundamental archetypes of codification strategy and personalization strategy can be distinguished (Hansen/ Nohire/ Tierney 1999, 106-116). The codification strategy follows the primary goal of providing codified knowledge in a qualitatively high, reliable, and fast manner

through information system implementation. This approach is based on the economic model of efficiency, respectively, reusability. The norm strategy, therefore, is the following: focusing on revenue maximization, invest once in a knowledge asset and use it multiple times. Taking this background into account, heavy investments are being made in IT; the goal hereby is to provide people with reusable, codified knowledge. The focus, therefore lies with systems which support and provide for the codification, storage, distribution, and reusability, on the one hand, and on rewards and incentives for the use of IT, on the other hand. Representatives of this approach are, for example, Arthur Andersen, Andersen Consulting, and Ernst & Young (Davenport/ Hansen 1999, 1-14; Chard/ Sarvary 1997, 1-24; March/ Garvin 1997, 1-20; Burke 1996, 63-69). The personalization strategy, on the contrary, aims at providing creative and high-quality analytical expert knowledge through individual expertise. Hence, this strategy aims – compared to the codification strategy – more at innovation, meaning knowledge generation and development. Due to this, the approach focuses on the interconnection of experts and the provision of systems that allow the exchange of implicit and explicit knowledge as well as creating rewards and incentives for direct knowledge exchange. The classical example for this approach is McKinsey (Bartlett 1999, 1-20).

6.3 Integration model design potentials Knowledge networks

In the following, the ICT design potentials will be summarized in a model. Since this model is deduced from the referential model developed above, it is necessary to place the ICT design potentials into the framework referential model. This integration model of ICT design potentials for knowledge networks, therefore contains the levels institutional framework conditions, tools, and knowledge processes. It describes, based on structuration theory, the design potentials of information and communication technology on the actors in the framework of knowledge processes, as well as the duality between institutional framework conditions and ICT. The later is indexed, on the one hand, by the reciprocal relation of the influence the chosen knowledge management strategy has on the technological approach and, on the other hand, the chosen tools take a shaping role regarding the institutional framework conditions. The model is built by integration of the classification schemata of first and second order ICT design potentials developed in chapter five and the ICT application potentials discussed in chapter four. Taking the identification of knowledge in a network as an example, it seems that with a personalization strategy a videoconference system is better, while with a codification strategy intelligent search agents might be recommended (Hattori/ Oghuro/ Yokoo/ Matsubara/ Yoshida 1999, 55-61) (first order ICT design potential).

Efficiency considerations, on the other hand, might dictate that during the network building process and during the preparation and trust building phase, tools are used that promote communication between the actors and that a step-by-step approach should be taken towards codifying and externalizing the network's knowledge. The interaction of the actors in the context of the knowledge network thereby allows for a transition in the direction of codification strategy, which is all the stronger, the more generic knowledge processes it includes. In this way, the institutional framework conditions are affected by the use of information and communication technology (second order ICT design potential). The illustration below shows summarily the integration model knowledge networks and ICT.

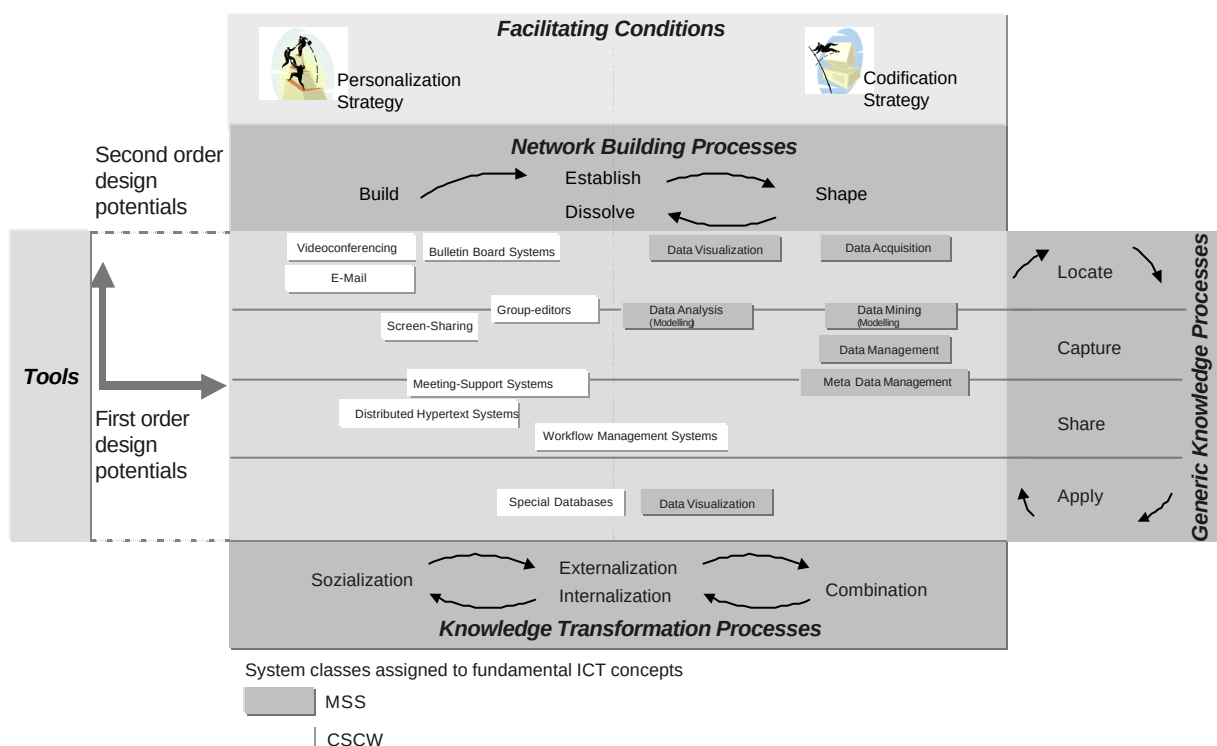


Figure 11: Integration model Knowledge Networks and ICT

7 SUMMARY

It was the goal of this paper to provide a contribution, from a business engineering perspective, to the scientific body of research as well as to the solving of problems encountered in practice. The focus was set on developing the requirements and potentials of information and communication technology in the context of knowledge networks. On the basis of the theoretical framework, the knowledge management's demands regarding information and communication technological support had to be unfolded. For this purpose and building on the introduced epistemological foundations, a referential model for

knowledge networks was developed and its implications for ICT support were presented. Then an analysis of the application potentials of innovative information and communication technology followed. As a part of this analysis – once again referring to the epistemological foundations – a selection was made on the basis of selected management oriented business engineering concepts. Together with the requirements deduced from the referential model, these application potentials provided the starting point for the integration into the model ICT design potentials for knowledge networks.

The developed integration model, allowed showing that the application and design potentials of information and communication technology for knowledge networks arguably go beyond traditional approaches. From a technological perspectives, significant potentials are to be found by more strongly integrating group/team centered approaches and solutions from the area of management support. On the one hand, these can be seen in the reciprocal usage of already existing procedures and mechanisms (see, i.e., Min 1996) and, on the other hand, in scalable models that support the mutual transition from rather person oriented and rather computer oriented knowledge processing (Kellogg/ Erickson 1999). Considering the backdrop of a more strongly demanded flexibility of ICT, due to the network structures, new additional requirements are presented regarding the development of application architectures (Ferstl/ Sinz/ Hammel/ Schlitt/ Wolf 1997, 24-46; Ferstl/ Sinz 1997, 393-411; Cusumano/ Yoffie 1998, 156-221; Cusumano/ Yoffie 1999, 72-78; Sinz 1999, 3). Additionally, the approach of Application Service Providers (N. N. 1999) seems noteworthy. From a rather management oriented perspective and with the structuration approach as basis, it was possible to show that the potentials of information and communication technology lie not only in the efficient implementation of managerial concepts. Rather, that it has significant influence in the shaping of framework conditions within which economic processes take place (Kelly 1998, 118-139; Shapiro/ Varian 1999, 1-19; Kollock 1999, 220-239; Wellman/ Gulia 1999, 167-194; Yoffie/ Cusumano 1999, 70-81). This holds true regarding the relations between actors in the framework of knowledge processes as well as network building as such (Orlikowski 1995a; Orlikowski 1995b; Orlikowski/ Hofman 1997, 11-22; Karsten/ Jones 1998 29-38). It is the opinion of this author that business engineering should act as a “boundary spanning” discipline, actively promoting the dialogue between a purely technology centered approach (Harris/ Phifer/ Hayward 1999, 1-5) and a purely business/sociological approach.

Following from the action research approach taken in this contribution, the goal was also to concretely contribute in solving problems of societal relevancy. Seen against this backdrop, the integration model ICT and knowledge networks in the context of Competence Center Knowledge Networks, is centrally important in two ways. On the one side, with respect to the

capturing and identification of connections between the use of technology and organization development (structure capture). On the other side, regarding the development of a method for building and designing knowledge networks (structure design). For this purpose, a connection with the business strategy is promoted, centering around the question of how knowledge networks can be used for the advancement of certain business goals. This extension to a macro-level is hereby conceptualized as an additional, higher level of institutional framework conditions. Additionally, the reciprocal relations of the institutional framework conditions (micro-level of the network), tools, and knowledge processes are concretized on the basis of the developed model. Building on this, a classification and description – according to the business goals - of ideal-typical networks is presented. To support the generalization claim of the Competence Centers' work, a complementary, empirical study dealing with range of themes is currently being prepared. Building on these findings, the development of a method follows which contains the identification of the current situation as well as giving concrete suggestions for building and designing knowledge networks.

8 REFERENCES

- (Aargote 1999), Aargote, L.: Organizational Learning: Creating, Retaining and Transferring Knowledge. Boston, Dordrecht, London: Kluwer Academic Publishers, 1999.
- (Aberdeen Group 1996), Aberdeen Group (Hrsg.): Web Warehouses: DSS for the Masses. Technology Viewpoint, 9 (1996) 6.
- (Ackhoff 1967), Ackhoff, R. L.: Management Misinformation Systems. Management Science, 14 (1967) 4, pp. 147-156.
- (Alba 1982), Alba, R. D.: Taking stock of network analysis: A decade's results. In: Bacharach, S. B. (Ed.): Research in the sociology of organizations. Connecticut: Greenwich, 1982, pp. 39-74.
- (Allee 1997), Allee, V.: The Knowledge Evolution: Expanding Organizational Intelligence. Boston et al.: Butterworth-Heinemann, 1997.
- (Argyris/ Putnam/ Smith 1985), Argyris, C.; Putnam, R.; Smith, D.: Action Science: Concepts, Methods and Skills for Research and Intervention. San Francisco: Jossey-Bass, 1985.
- (Argyris/ Schön 1974), Argyris, C.; Schön, D. A.: Theory in Practice: Increasing Professional Effectiveness, San Francisco: Jossey-Bass, 1974.
- (Armelingmeyer/ Strahlinger 1999), Armelingmeyer, J.; Strahlinger, S.: Expertensysteme als Werkzeug für das Wissensmanagement. In: HMD - Theorie und Praxis der Wirtschaftsinformatik, 36 (1999) 208, S. 80-92.
- (Back/ Rieger/ Seufert 1997), Back, A.; Rieger, B.; Seufert, A.: Executive Information Systems. In: Mertens, P. (Haupthrsg.): Lexikon der Wirtschaftsinformatik. 3. Auflage, Berlin u. a.: Springer 1997, S. 157-158.
- (Back/ Seufert 1997), Back, A.; Seufert, A.: State of the Art des Management Supports Teil 1: Klassische Management Support Ansätze, Arbeitsbericht, Institut für Wirtschaftsinformatik, Universität St. Gallen, 1997.
- (Back-Hock 1990), Back-Hock, A.: Executive-Information-Systems-Software für die Gestaltung von Controlling-Informationssystemen. In: Scheer, A.-W. (Hrsg.): Rechnungswesen und EDV - 11. Saarbrücker Arbeitstagung 1990. Heidelberg: Physica 1990, S. 186-210.
- (Back-Hock 1993), Back-Hock, A.: Beiträge der Daten-, Informations- und Wissensverarbeitung zur Weiterentwicklung des Internen Rechnungswesens und Controllings. Habilitation an der Universität Erlangen-Nürnberg, Nürnberg 1993.
- (Back-Hock 1995), Back-Hock, A.: Entwicklungen im Markt und in Anwendungsfeldern von Groupware. Informatik/Informatique, o. Jg. (1995) 6, S. 4-7.
- (Back-Hock 1996), Back-Hock, A.: Management-Informationssysteme. In: Schulte, C. (Hrsg.): Lexikon des Controlling. München, Wien: Oldenbourg 1996, S. 509-513.
- (Badaracco 1988), Badaracco, J. L.: Changing forms of the corporation. In: Meyer, J. R./ Gustafson, J. M. (Eds.) The U. S. business corporation – An institution in transition. Cambridge: Ballinger, 1988, pp. 67-91.
- (Badaracco 1991), Badaracco, J. L.: The Knowledge Link – How Firms Compete Through Strategic Alliances. Boston: Harvard Business School Press, 1991.
- (Baets 1998), Baets, W.: Organizational Learning and Knowledge Technologies in a Dynamic Environment. Boston, Dordrecht, London: Kluwer Academic Publishers, 1998.
- (Bartlett 1999), Bartlett, C.: McKinsey & Company: Managing Knowledge and Learning, Harvard Business School Case Study No. 9-396-357, 1999, pp. 1-20).
- (Becker 1993), Becker, J.: Modellierung und Speicherung aggregierter Daten als Basis für das Controlling. In: Scheer, A.-W. (Hrsg.): Rechnungswesen und EDV - 14. Saarbrücker Arbeitstagung 1993. Heidelberg: Physica 1993, S. 19-37.

- (Behme 1993), Behme, W.; Schimmelpfeng, K.: Führungsinformationssysteme: Geschichtliche Entwicklung, Aufgaben und Leistungsmerkmale. In: Behme, W.; Schimmelpfeng, K. (Hrsg.): Führungsinformationssysteme. Neue Entwicklungstendenzen im EDV-gestützten Berichtswesen. Wiesbaden: Gabler 1993, S. 3-16.
- (Behrens 1994), Behrens, O. M.: Konzepte, Anforderungen und Lösungsmöglichkeiten für die Integration von Hypermediakonzepten in Groupwareapplikationen. Dissertation an der Universität St. Gallen, St. Gallen 1994.
- (Bissantz 1996), Bissantz, N.: Clusmin - Ein Beitrag zur Analyse von Daten des Ergebniscontrollings mit Datenmustererkennung (Data Mining). Dissertation an der Universität Erlangen-Nürnberg, Nürnberg, 1996.
- (Brown/ Duguid 1991), Brown, J. S.; Duguid, P.: Organizational Learning and Communities-of-Practice: Toward a unified View of Working, Learning and Innovation. *Organizational Science*, 2 (1991) 1, pp. 40-57.
- (Burke 1996), Burke, C. A.: Arthur Andersen & Co: Virtual Visioning. In: Lloyd, P.; Whitehead, R.: Transforming Organizations through Groupware, London: Springer, 1996, pp. 63-69.
- (Chard/ Sarvary 1997), Chard, A. M.; Sarvary, M.: Knowledge Management at Ernst & Young, Case Study Graduate School of Business, Stanford University, 1997, pp. 1-24.
- (Coleman 1995), Coleman, D.: Groupware Technology and Applications: An Overview of Groupware. In: Coleman, D.; Khanna, R. (Hrsg.): Groupware: Technologies and Applications. New Jersey: Prentice Hall 1995, S. 3-41.
- (Cusumano/ Selby 1995), Cusumano, M. A.; Selby, R. W.: Microsoft Secrets: How the World's Most Powerful Software Company Creates Technology, Shapes Markets, and Manages People. New York: Free Press, 1995.
- (Cusumano/ Yoffie 1998), Cusumano, M. A.; Yoffie D. B.: Competing on Internet Time: Lessons from Netscape and its Battle with Microsoft. New York: Free Press, 1998.
- (Cusumano/ Yoffie 1999), Cusumano, M. A.; Yoffie D. B.: What Netscape learned from Cross-Platform Software Development In: *Communications of the ACM*, 42 (1999) 10, pp. 72-78.
- (Darling 1996), Darling, C. B.: Think Outside the OLAP Box. *Datamation*, 42 (1996) 8, S. 88-92.
- (Davenport/ De Long/ Beers 1998), Davenport, T. H.; De Long, D. W.; Beers, M. C.: Successful Knowledge Management Projects. Eight Key Factors Can Help a Company Create, Share, and Use Knowledge Effectively. In: *Sloan Management Review*, 39 (1998) 2, pp. 43-57.
- (Davenport/ Hansen 1999), Davenport, T. H.; Hansen, M. T.: Knowledge Management at Andersen Consulting, Harvard Business School Case Study No. 9-499-032, 1999, pp. 1-14.
- (Davenport/ Prusak 1998), Davenport, T. H.; Prusak, L.: Working Knowledge: How Organizations Manage What They Know. Boston: Harvard Business School Press, 1998.
- (De Long 1999), De Long, D.: Building the Knowledge-Based Organization: How Culture Drives Knowledge Behaviors, Working Paper, Ernst & Young Center for Business Innovation. <http://www.businessinnovation.ey.com/mko/newpdfs/cultdorg.pdf>, Stand: 19.10.99.
- (Dennis/ Aronson/ Heninger/ 1999), Dennis, A. R.; Aronson, J. E.; Heninger, W. G.; Walker, E. D.: Structuring Time and Task in Electronic Brainstorming. In: *MIS Quarterly*, 23 (1999) 1, pp. 95-108.
- (DeSantis/ Poole 1994), DeSantis, G.; Poole, M.S.: Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory, *Organisation Science*, 5 (1994) 2, pp. 121-147.
- (Drucker 1995), Drucker, P. F.: The Information Executives Truly Need. *Harvard Business Review*, 73 (1995) 1, pp. 54-62.

- (Faisst 1998), Faisst, W.: Die Unterstützung virtueller Unternehmen durch Informations- und Kommunikationssysteme: eine lebenszyklusorientierte Analyse, Dissertation Universität Erlangen-Nürnberg, 1998.
- (Ferstl/ Sinz 1997), Ferstl, O. K.; Sinz, E. J.: Flexible Organizations Through Object-oriented and Transactionoriented Information Systems. In: Krallmann, H. (Hrsg.): Wirtschaftsinformatik '97. Heidelberg: Physica, 1997, S. 393-411.
- (Ferstl/ Sinz/ Hammel/ Schlitt/ Wolf 1997), Ferstl, O. K.; Sinz, E. J.; Hammel Ch.; Schlitt M.; Wolf S.: Bausteine für komponenten-basierte Anwendungssysteme. In: HMD - Theorie und Praxis der Wirtschaftsinformatik, 34 (1997) 197, S. 24-46.
- (Frank 1997), Frank, U.: Erfahrungen, Erkenntnis und Wirklichkeitsgestaltung – Anmerkungen zur Rolle der Empirie in der Wirtschaftsinformatik. In: Grün, O.; Heinrich, L. J. (Hrsg.): Wirtschaftsinformatik – Ergebnisse empirischer Forschung, Wien, New York: Springer, 1997, S. 21-35.
- (Frank/ Klein/ Krcmar/ Teubner 1999), Frank, U.; Klein, S.; Krcmar, H.; Teubner, A.: Aktionsforschung in der WI - Einsatzpotentiale und Einsatzprobleme. In: Zelewski, S.; Schütte, R.; Siedentopf, J. (Hrsg.): Wirtschaftsinformatik und Wissenschaftstheorie - Grundpositionen und Theoriekerne. Arbeitsbericht des Instituts für Produktion und Industrielles Informationsmanagement. Nr. 4. Universität GH Essen. Essen 1999, S. 71-90. <http://caladan.wiwi.uni-frankfurt.de/IWI/wiwiss99/uebersicht.html>, Stand: 19.10.99.
- (Giddens 1984), Giddens, A.: The constitution of Society : Outline of the Theory of Structuration, Berkeley : University of California Press, 1984.
- (Giddens 1991), Giddens, A.: Structuration theory: past, present and future. In: Bryantm C.G.A.; Jary, D. (Eds.): Giddens` theory of structuration. A critical appreciation. London, New York: Routledge, 1991, pp. 201-222.
- (Gluchowski/ Gabriel/ Chamoni 1995), Gluchowski, P.; Gabriel, R.; Chamoni, P.: Strukturbestimmende Merkmale von Managementunterstützungssystemen - Management Support Systeme II. Diskussionsbeitrag an der Universität Duisburg, Duisburg 1995.
- (Hagedorn 1996), Hagedorn, J.: Die Automatische Filterung von Controlling-Daten unter besonderer Berücksichtigung der Top-Down-Navigation (BETREX II). Dissertation an der Universität Erlangen-Nürnberg, Nürnberg, 1996.
- (Hansen/ Nohira/ Tierney 1999), Hansen, M. T.; Nohira, N.; Tierney, T.: What`s your Strategy for Managing Knowledge ?. In: Harvard Business Review, 77 (1999) 2, pp. 106-116.
- (Harris/ Fleming/ Hunter/ Rosser/ Cushman 1999), Harris, K.; Fleming, M.; Hunter, R.; Rosser, B.; Cushman A.: The Knowledge Management Scenario: Trends and Directions for 1998-2003, Gartner Group Strategic Analysis Report, 18.03.1999.
- (Harris/ Phifer/ Hayward 1999), Harris, K.; Phifer, G.; Hayward, S.: Important Distinctions between Enterprise Portals and Knowledge Management, InSide Gartner Group, 25.08.1999.
- (Hartroth/ Kottmann 1996), Hartroth, J.; Kottmann, D.: Mobile Softwareagenten: Entwicklungsstand und Einsatzperspektiven. Handbuch der modernen Datenverarbeitung - Theorie und Praxis der Wirtschaftsinformatik, 33 (1996) 196, S. 91-107.
- (Hasenkamp/ Syring 1994), Hasenkamp, U.; Syring, M.: CSCW (Computer Supported Cooperative Work) in Organisationen - Grundlagen und Probleme. In: Hasenkamp, U.; Kirn, S.; Syring, M. (Hrsg.): CSCW - Computer Supported Cooperative Work. Informationssysteme für dezentralisierte Unternehmensstrukturen. Bonn: Addison Wesley 1994, S. 15-37.
- (Hattori/ Ohguro/ Yokoo/ Matsubara/ Yoshida 1999), Hattori, F.; Ohguro, T.; Yokoo, M.; Matsubara, S.; Yoshida, S.: Socialware: Multiagent Systems for Supporting Network Communities, In: Communication of the ACM, 42 (1999) 3, pp. 55-61.

- (Hayem 1996), Hayem, M.: (R) OLAP Next Generation. Tagungsunterlagen vom 01.03.1996. 4. MSS-Workshop des Arbeitskreises 5.5.2 Management Support Systems der Gesellschaft für Informatik e. V. und des Instituts für Wirtschaftsinformatik der Universität St. Gallen: „Teamorientierung im Management - Management Support goes Groupware“, St. Gallen 1996.
- (Heilmann 1999), Heilmann, H.: Wissensmanagement – ein neues Paradigma ?. In: HMD - Theorie und Praxis der Wirtschaftsinformatik, 36 (1999) 208, S. 7-23.
- (Heinzl 1997), Heinzl, A.: Zur Entwicklung der betrieblichen Informationsverarbeitung: IV-Sicht und Anwendersicht. In: Grün, O.; Heinrich, L. J. (Hrsg.): Wirtschaftsinformatik: Ergebnisse empirischer Forschung, Wien und New York: Springer 1997, S. 267-278.
- (Högberg/ Edvinson 1998), Högberg, C.; Edvinson, L.: A Design for futurizing knowledge networking. In: Journal of Knowledge Management, 2 (1998) 2, pp. 81-92
- (Inkpen 1996), Inkpen, A.C.: Creating Knowledge through Collaboration. In: California Management Review, 39 (1996) 1, pp. 123-140.
- (Inmon 1992), Inmon, W. H.: Building the Data Warehouse. Boston u. a.: QED 1992.
- (Jahnke/ Groffmann/ Kruppa 1996), Jahnke, B.; Groffmann, H.-D.; Kruppa, S.: On-Line Analytical Processing (OLAP). Wirtschaftsinformatik, 38 (1996) 3, S. 321-324.
- (Johansen 1988), Johansen, R.: Groupware: Computer Support for Business Teams. New York, London: Free Press, 1988.
- (Karsten/ Jones 1998), Karsten, H.; Jones, M.: The Long and Winding Road: Collaborative IT and Organisational Change. In: Proceedings of the ACM 1998 Conference on Computer Supported Cooperative Work, November 14 - 18, 1998, Seattle, WA USA. pp. 29-38, <http://www.acm.org/pubs/articles/proceedings/cscw/289444/p29-karsten/p29-karsten.pdf>, Stand: 19.10.1999.
- (Katzenbach 1993), Katzenbach, J. R.: The Wisdom of Teams : Creating the High-Performance Organization. Boston: Harvard Business School Press, 1993.
- (Kellogg/ Erickson 1999), Kellogg, W. A.; Erickson, T.: Towards an Infrastructure for Knowledge Communities. A position paper for the ECSCW'99 Workshop: „Beyond Knowledge Management: Managing Expertise“. <http://www.informatik.uni-bonn.de/~prosec/ECSCW-XMWS/PositionPapers/EricksonKellogg.pdf>, Stand: 19.10.1999.
- (Kelly 1998), Kelly, K.: New Rules for the New Economy: 10 Radical Strategies for a Connected World. New York: Viking, 1998.
- (Kirn 1995), Kirn, S.: Kooperierende intelligente Agenten in virtuellen Organisationen. Handbuch der modernen Datenverarbeitung - Theorie und Praxis der Wirtschaftsinformatik, 32 (1995) 185, S. 24-36.
- (Kleinhans/ Rüttler/ Zahn 1992), Kleinhans, A.; Rüttler, M.; Zahn, E.: Management-Unterstützungssysteme - Eine vielfältige Begriffswelt. In: Hichert, R.; Moritz, M. (Hrsg.): Management-Informationssysteme. Praktische Anwendungen. Berlin u. a.: Springer 1992, S. 1-14.
- (Kollock 1999), Kollock, P.: The Economies of Online Cooperation: Gifts and Public Goods in Cyberspace. In: Kollock, P.; Smith, M. A. (Eds.): Communities in Cyberspace. London, New York: Routledge 220-239.
- (König/ Heinzl/ Rumpf/ von Poblotzki 1996), König, W.; Heinzl, A.; Rumpf, M.-J.; von Poblotzki, A.: Zur Entwicklung der Forschungsmethoden und Theoriekerne der Wirtschaftsinformatik. Eine kombinierte Delphi- und AHP-Untersuchung. In: Heilmann, H.; Heinrich, L.-J.; Roithmayr, F. (Hrsg.): Information Engineering. Wirtschaftsinformatik im Schnittpunkt von Wirtschafts-, Sozial- und Ingenieurwissenschaften, München, Wien: Oldenbourg, 1996, S. 35-66.
- (Krackhardt/ Hanson 1997), Krackhardt, D.; Hanson, J. R.: Informal Networks: The Company. In: Prusak, L. (ed.): Knowledge in Organizations. Boston: Butterworth-Heinemann 1997, pp. 37-49.

- (Krcmar 1992), Krcmar, H.: Computerunterstützung für die Gruppenarbeit - Zum Stand der Computer Supported Cooperative Work Forschung. *Wirtschaftsinformatik*, 34 (1992) 4, S. 425-437.
- (Krcmar 1996), Krcmar, H.: Teamarbeit produktiver machen - Einige Bemerkungen zur Forschung auf dem Gebiet des Computer Supported Cooperative Work. In: Schiestl, J.; Schelle, H. (Hrsg.): *Groupware - Software für die Teamarbeit der Zukunft: Grundlegende Konzepte und Fallstudien*. Marburg: Tectum Verlag 1996, S. 31-44.
- (Krebs/ Rock 1994), Krebs, M./ Rock, R.: Unternehmensnetzwerke - eine intermediäre oder eigenständige Organisationsform. In: Sydow, J./ Windeler, A. (Hrsg.): *Management interorganisationaler Beziehungen. Vertrauen, Kontrolle und Informationstechnik*. Opladen: Westdeutscher Verlag. 1994.
- (Lamb 1999), Lamb, C.: Introducing BusinessMiner: Business Mining for Decision Support Insights. Business Objects Technical White Paper, <http://www.businessobjects.com/decision/library/index.htm>, Stand 19.10.99.
- (Lange 1994), Lange, A.: Einsatzmöglichkeiten von Management-Informationssystemen im Controllingbereich. *Handbuch der modernen Datenverarbeitung - Theorie und Praxis der Wirtschaftsinformatik*, 31 (1994) 178, S. 43-61.
- (Laudon/ Laudon 1995), Laudon, K. C.; Laudon, J. P.: *Essentials of Management Information Systems*. Englewood Cliffs: Prentice-Hall 1995.
- (Leonard/ Sensiper 1998), Leonard, D.; Sensiper, S.: The Role of Tacit Knowledge in Group Innovation. In: *California Management Review*, 40 (1998) 3, pp. 112-132.
- (Malone 1988), Malone, T.: What is Coordination Theory ? Working Paper, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts 1988.
- (Malone/ Laubacher 1998), Malone, T. W.; Laubacher R. J.: The Dawn of the E-Lance Economy. In: *Harvard Business Review*, 76 (1998) 5, pp. 145-152.
- (March/ Garvin 1997), March, A.; Garvin, D. A.: A Note on Knowledge Management, Harvard Business School Case Study No. 9-398-031, 1997, 1-20.
- (Mertens 1998), Mertens, P.: Operiert die Wirtschaftsinformatik mit den falschen Unternehmenszielen? - 15 Thesen. In: Becker, J.; König, W.; Schütte, R.; Wendt, O.; Zelewski, S. (Hrsg.): *Die Bedeutung der Wissenschaftstheorie und Wirtschaftswissenschaften - diskutiert am Beispiel der Wirtschaftsinformatik*. Wiesbaden 1998. <http://www.wi1.wiso.uni-erlangen.de/veroeffentlichungen/1998.shtml>, Stand: 19.10.1999.
- (Mertens 1999), Mertens, P.: Integration interner, externer, qualitativer und quantitativer Daten auf dem Weg zum Aktiven MIS. In: *Wirtschaftsinformatik*, 41 (1999) 5, S. 405-415.
- (Mertens/ Bissantz/ Hagedorn 1994), Mertens, P.; Bissantz, N.; Hagedorn, J.: Neuere Entwicklungen bei der Filterung von Massendaten für das Ergebniscontrolling. *Kostenrechnungspraxis*, o. Jg. (1994) 6, S. 393-399.
- (Mertens/ Griesel/ Ehrenberg 1998), Mertens, P.; Griesel, J.; Ehrenberg, D.: *Virtuelle Unternehmen und Informationsverarbeitung*. Berlin: Springer, 1998.
- (Mertens/ Höhl 1999), Mertens, P., Höhl, M.: Wie lernt der Computer den Menschen kennen? Bestandsaufnahme und eigene Experimente zur Benutzermodellierung in der Wirtschaftsinformatik. In: Scheer, A.-W.; Nüttgens, M. (Hrsg.): *Electronic Business Engineering*, 4. Internationale Tagung Wirtschaftsinformatik 1999, Heidelberg: Physica, 1999, S. 25-49.
- (Min 1996), Min, Y.: Team-Informationsmanagement. Konzept und Implementierung eines agentenbasierten Team-Informationsmanagement-Systems (aTIMS). Dissertation an der Universität St. Gallen, St. Gallen, 1996.
- (Mitchell 1969), Mitchell, J. C.: The concept and use of social networks: In: Mitchell, J. C. (Ed.): *Social networks in urban situations*. Manchester: Manchester University Press, 1969, S. 1-12.

- (Mucksch/ Holthuis/ Reiser/ 1996), Mucksch, H.; Holthuis, J.; Reiser, M.: Das Data-Warehouse-Konzept - ein Überblick. *Wirtschaftsinformatik*, 38 (1996) 4, S. 421-433.
- (Müller/ Kohl/ Schoder 1997), Müller, G.; Kohl, U.; Schoder, D.: Unternehmenskommunikation: Telematiksysteme für vernetzte Unternehmen. München: Addison-Wesley, 1997.
- (N. N. 1999), N. N.: Produkte und Dienstleistungen für Provider. Sun-Netscape-Allianz stellt Pläne für ISP-Geschäft vor. *Computerwoche* Nr. 19 vom 14.05.1999, S. 4. <http://www.computerwoche.de/info-point/heftarchiv/drucken.cfm?id=132574&cfid=53332&cftoken=82700425>, Stand 19.10.1999.
- (Nastansky 1992), Nastansky, L.: Nach 20 Jahren CSCW-Forschung: Durchbruch in der Praxis bei Groupware-Anwendungen in Client-Server Architekturen. In: Nastansky, L. (Hrsg.): *Workgroup Computing - Computergestützte Teamarbeit (CSCW) in der Praxis. Neue Entwicklungen und Trends*, Hamburg: Steuer- und Wirtschaftsverlag 1992, S. 1-20.
- (Nastansky/ Hilpert 1994), Nastansky, L.; Hilpert, W.: The GroupFlow System: A Scalable Approach to Workflow Management between Cooperation and Automation. Working Paper at the University of Paderborn, Paderborn, 1994.
- (Nohria/ Eccles 1992), Nohria, N.; Eccles R. G.: *Networks and Organizations: Structure, Form, And Action*. Boston: Harvard Business School Press, 1992.
- (Nonaka 1991), Nonaka, I.: The Knowledge-Creating Company. *Harvard Business Review*, 69 (1991) 6, pp. 96-104.
- (Nonaka/ Konno 1998), Nonaka, I.; Konno, N.: The Concept of „Ba“: Building a Foundation for Knowledge Creation. In: *California Management Review*, 40 (1998) 3, pp. 40-54.
- (Nonaka/ Reinmoeller/ Senoo 1998), Nonaka, I.; Reinmoeller, P.; Senoo, D.: The Art of Knowledge: Systems to Capitalize on Market Knowledge, In: *European Management Journal*, 16 (1998) 6, pp. 673-684.
- (Nonaka/ Takeuchi 1995), Nonaka I.; Takeuchi, H.: *The Knowledge-Creating Company. How Japanese Companies Create the Dynamics of Innovation*, Oxford, New York: Oxford University Press, 1995.
- (O'Dell/ Grayson 1998), O'Dell, C.; Grayson, C. J.: *If Only we Knew what we Know. The Transfer of Internal Knowledge and Best Practice*, New York: Free Press, 1998.
- (Oppelt 1995), Oppelt, R. U.: *Computerunterstützung für das Management. Neue Möglichkeiten der computerbasierten Informationsunterstützung oberster Führungskräfte auf dem Weg von MIS zu EIS ?* München, Wien: Oldenbourg 1995.
- (Orlikowski 1992), Orlikowski, W.: The Duality of Technology: Rethinking the Concept of Technology in Organizations. In: *Organization Science*, 3 (1992) 3, pp. 398-427.
- (Orlikowski 1995a), Orlikowski, W.; Hofman, J. D.: Realizing the Potential of Groupware Technologies: An Improvisational Strategy for Change Management, Working Paper Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts 1995.
- (Orlikowski 1995b), Orlikowski, W.: Evolving with Notes: Organizational Change around Groupware Technology. Working Paper Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts 1995.
- (Orlikowski/ Hofman 1997), Orlikowski, W.; Hofman, D.: An improvisational Model for Change Management: The Case of Groupware Technologies. In: *Sloan Management Review*, 38 (1997) 2, pp. 11-22.
- (Peterhans 1995), Peterhans, M.: Informationsmanagement. In: Lehner, F.; Hildebrand, K.; Maier, R. (Hrsg.): *Wirtschaftsinformatik - Theoretische Grundlagen*, München, Wien: Hanser 1995, S. 327-368.
- (Picot/ Reichwald/ Wigand 1998), Picot, A.; Reichwald, R.; Wigand, R. T.: *Die grenzenlose Unternehmung*. 3. Aufl., Wiesbaden: Gabler, 1998.

- (Polanyi 1996), Polanyi, M.: The Tacit Dimension, New York: Doubleday, 1996.
- (Popper 1994), Popper, K.: Logik der Forschung. 10 Aufl., Tübingen: Mohr, 1994.
- (Powell 1998), Powell W. W.: Learning from Collaboration: Knowledge and Networks in the Biotechnology and Pharmaceutical Industries. In: California Management Review, 40 (1998) 3, pp. 229-231.
- (Probst/ Raub/ Romhardt 1999), Probst, G.; Raub, S.; Romhardt, K.: Wissen managen. Wie Unternehmen ihre erfolgreichste Ressource optimal nutzen, 3. Aufl., Frankfurt/Main: Frankfurter Allgemeine Zeitung, Wiesbaden: Gabler, 1999.
- (Realin 1997), Realin, J. A.: A Model of Work-Based Learning. In: Organization Science, 8 (1997) 6, pp. 563-578.
- (Rehäuser/ Krcmar 1996), Rehäuser, J.; Krcmar, H.: Wissensmanagement im Unternehmen. In: Schreyögg, G./Conrad, P. (Hrsg.): Managementforschung 6 – Wissensmanagement, Berlin; New York: de Gruyter 1996, S. 1-40.
- (Reich 1991), Reich, R. B.: The work of Nations: Preparing ourselves for the 21st-Century Capitalism. New York: Knopf, 1991.
- (Reichwald/ Bieberbach/ Hermann/ Sirtl 1999), Reichwald, R.; Bieberbach, F.; Hermann, M.; Sirtl, H.: Vernetzungsstrategien und Techniknutzung von Small Offices und Home Offices (SOHOs). In: Wirtschaftsinformatik, 41 (1999) 4, S. 326-334.
- (Richter/ Vettel 1995), Richter, F.J.; Vettel, K.: Successful Joint Ventures in Japan: Transferring Knowledge Trough Organizational Learning. In: Long Range Planning, 28 (1995) 3, pp. 37-45.
- (Rockart/ De Long 1988), Rockart, J. F.; De Long, D. W.: Executive Support Systems. The Emergence of Top Management Computer Use. Homewood: Dow Jones-Irwin 1988.
- (Roithmayr 1996), Roithmayr, F.: Ansätze zu einer Methodik des Know-how-Engineering. Eine inhaltliche Auseinandersetzung – aber auch ein Beitrag zu einer wissenschaftstheoretischen Diskussion für die Positionierung der Wirtschaftsinformatik. In: Heilmann, H.; Heinrich, L.-J.; Roithmayr, F. (Hrsg.): Information Engineering. Wirtschaftsinformatik im Schnittpunkt von Wirtschafts-, Sozial- und Ingenieurwissenschaften, München, Wien: Oldenbourg, 1996, S. 101-122.
- (Roithmayr/ Fink 1997), Roithmayr, F.; Fink, K.: Know-how-Unternehmen. In: Wirtschaftsinformatik, 39 (1997) 5, S. 503-506.
- (Russel 1997), Russel, B.: Probleme der Philosophie, 18 Aufl., Frankfurt/Main: Suhrkamp Verlag, 1997.
- (Schreier 1996), Schreier, U.: Verarbeitungsprinzipien in Data-Warehousing-Systemen. Handbuch der modernen Datenverarbeitung - Theorie und Praxis der Wirtschaftsinformatik, 33 (1996) 187, S. 78-93.
- (Schwabe/ Krcmar 1996), Schwabe, G.; Krcmar, H.: CSCW-Werkzeuge. In: Wirtschaftsinformatik, 38 (1996) 2, S. 209-224.
- (Seufert 1997), Seufert, A.: Groupware-enabled Data Warehouse. Management Support für die Professionelle Know-how Organisation Prüfungs- und Beratungsgesellschaft, Dissertation an der Universität St. Gallen, St. Gallen, 1997.
- (Seufert/ Back/ von Krogh 1999), Seufert, A.; Back, A.; von Krogh, G.: Wissensnetzwerke: Vision - Referenzmodell – Archetypen und Fallbeispiele. In: Götz, K. (Hrsg.): Wissensmanagement: Zwischen Wissen und Nichtwissen. München: Hampp, 1999, S. 133-156.
- (Seufert/ Seufert 1998a), Seufert S.; Seufert A.: Collaborative Learning in an Inter-University Learning Network. In: Informatik/ Informatique, 5 (1998) 6, S. 14-20.
- (Seufert/ Seufert 1998b), Seufert, A.; Seufert, S.: Wissensgenerierung und -transfer in Knowledge Networks. Knowledge Networks als Basis für die Steigerung der Lernfähigkeit von Unternehmen. In: IO Management, 67 (1998) 10, S. 76-84.

- (Seufert/ Seufert 1999), Seufert, A.; Seufert, S.: The Genius Approach: Building Learning Networks for Advanced Management Education. In: Proceedings 32nd Hawaii International Conference on System Sciences, 05.-08.01.1999, Maui, Hawaii.
- (Seufert/ Seufert 2000), Seufert, S.; Seufert, A.: Towards the Continuously Learning Organization through Knowledge Networking – Case Swiss Re Group -. To appear in: Proceedings 33rd Hawaii International Conference on System Sciences, 04.-07.01.2000, Maui, Hawaii (accepted).
- (Seufert/ von Krogh/ Back 1999), Seufert, A.; von Krogh, G.; Back, A.: Towards Knowledge Networking. In: Journal of Knowledge Management, 3 (1999) 3, pp. 180 – 190.
- (Shapiro/ Varian 1999), Shapiro, C.; Varian, H. R.: Information Rules: A Strategic Guide to the Network Economy. Boston: Harvard Business School Press, 1999.
- (Shukla 1997), Shukla, M.: Competing through Knowledge: Building a Learning Organisation. Thousand Oaks: Response Books, 1997.
- (Sieber 1998), Sieber, P.: Virtuelle Unternehmen in der IT-Branche. Die Wechselwirkungen zwischen Internet-Nutzung, Strategie und Organisation, Bern: Haupt, 1998.
- (Sinz 1999), Sinz, E. J.: Editorial zum Schwerpunktthema Anwendungssysteme aus fachlichen Komponenten. In: Wirtschaftsinformatik, 41 (1999) 1, S. 3.
- (Sparrow 1998), Sparrow, J.: Knowledge in Organizations: Access to Thinking at Work. Thousand Oaks: Sage Publications, 1998.
- (Sydow 1992), Sydow, J.: Strategische Netzwerke- Evolution und Organisation. Wiesbaden: Gabler, 1992.
- (Sydow/ Windeler/ Krebs/ Loose 1995), Sydow, J.; Windeler, A.; Krebs, M.; Loose, A.; van Well, B.: Organisation von Netzwerken. Strukturationstheoretische Analysen der Vermittlungspraxis in Versicherungsnetzwerken, Opladen: Westdeutscher Verlag, 1995.
- (Teufel/ Sauter/ Mülherr/ Bauknecht 1995), Teufel, S.; Sauter, C.; Mülherr, T.; Bauknecht, K.: Computerunterstützung für die Gruppenarbeit. Bonn: Addison Wesley 1995.
- (Turban 1995) Turban, E.: Decision Support and Expert Systems. Management Support Systems. 4th Edition, Englewood Cliffs: Prentice-Hall 1995.
- (Uhr 1999), Uhr, W.: Editorial zum Schwerpunktthema Externe Daten in Management-Support-Systemen. In: Wirtschaftsinformatik, 41 (1999) 5, S. 403.
- (Uhr/ Kosilek 1999), Uhr, W.; Kosilek, E.: Internet-Quellen zur Integration wirtschaftsrelevanter unternehmensexterner Daten in Management Support Systems. In: Wirtschaftsinformatik, 41 (1999) 5, S. 461-466.
- (Uhr/ Schöne 1997), Uhr, W.; Schöne, K.: Groupware. Vergleichende Buchbesprechung. In: Wirtschaftsinformatik, 39 (1997) 2, S. 198-202.
- (Van House/ Butler/ Schiff 1998), Van House, N. A.; Butler, M H.; Schiff, L. R.: Cooperative Knowledge Work and Practices of Trust: Sharing Environmental Planning Data Sets. In: Proceedings of the ACM 1998 Conference on Computer Supported Cooperative Work, November 14 - 18, 1998, Seattle, WA USA. pp. 335-344. http://www.acm.org/pubs/articles/proceedings/cscw/289444/p335-van_house/p335-van_house.pdf, Stand: 19.10.99.
- (Von Krogh 1998), von Krogh, G.: Care in Knowledge Creation. In: California Management Review, 40 (1998) 3, pp. 133-153.
- (Von Krogh/ Ichijo/ Nonaka 1998), von Krogh, G.; Ichijo, K.; Nonaka I.: Knowledge Enablers. In: von Krogh, G.; Roos, J.; Kleine, D. (Eds.): Knowing in Firms, London: Sage, 1998, pp. 173-204.
- (Von Krogh/ Nonaka/ Ichijo 1997), von Krogh, G.; Nonaka, I.; Ichijo, K: Develop Knowledge Activists !. In: European Management Journal, 15 (1997) 5, pp. 475-483.

- (Warschat/ Ribas/ Ohlhausen 1999), Warschat, J.; Ribas, M.; Ohlhausen, P.: Wissensbasierte Informationssysteme zur Unterstützung wissensintensiver Prozesse im Unternehmen. In: HMD - Theorie und Praxis der Wirtschaftsinformatik, 36 (1999) 208, S. 53-59.
- (Webster 1992), Webster, F. E. : The Changing Role of Marketing in the Corporation. In: Journal of Marketing, 56 (1992) 2, pp. 1-17.
- (Wellman/ Gulia 1999), Wellman, B.; Gulia, M.: Virtual Communities as Communities: Net Surfers don't ride Alone. In: Kollok, P.; Smith, M. A. (Eds.): Communities in Cyberspace. London, New York: Routledge, 164-194.
- (Wendel 1996), Wendel, T.: Computerunterstützte Zusammenarbeit. Konzeption und Realisierung eines Teamarbeitssystems. Wiesbaden: Gabler 1996.
- (Wenger 1999), Wenger, E.: Communities of Practice, Learning as a Social System. <http://www.co-i-l.com/coil/knowledge-garden/cop/lss.shtml>, Stand 19.10.99.
- (WKWI 1994), WKWI – Wissenschaftliche Kommission Wirtschaftsinformatik: Profil der Wirtschaftsinformatik. In: Wirtschaftsinformatik, 36 (1994) 1, S. 80-81.
- (Wolf/ Decker/ Abecker 1999), Wolf, T.; Decker, S.; Abecker, A.: Unterstützung des Wissensmanagements durch Informations- und Kommunikationstechnologie. In: Scheer, A. W.; Nüttgens, M. (Hrsg.): Electronic Business Engineering. 4. Internationale Tagung Wirtschaftsinformatik 1999, Heidelberg: Physica, 1999, S. 745-765.
- (Yates/ Orlikowski 1992), Yates, J.; Orlikowski, W.: Genres of Organizational Communication: A Structural Approach to Studying Communication and Media. In: The Academy of Management Review, 17 (1992) 2, pp. 299-326.
- (Yates/ Orlikowski/ Okamura 1999), Yates, J.; Orlikowski, W.; Okamura, K.: Explicit and Implicit Structuring of Genres in Electronic Communication: Reinforcement and Change of Social Interaction. In: Organization Science, 10 (1999) 1, 83-103.
- (Yoffie/ Cusumano 1999), Yoffie, D. B.; Cusumano, M. A.: Judo Strategy: The Competitive Dynamics of Internet Time. In: Harvard Business Review, 77 (1999) 1, pp. 70-81.
- (Zack 1999), Zack, M. H.: Managing Codified Knowledge. In: Sloan Management Review, 40 (1999) 4, pp. 45-58.
- (Zwicker 1995), Zwicker, E.: Möglichkeiten und Grenzen der Anwendung von Executive-Informationssystemen. Arbeitsbericht an der Technischen Universität Berlin, Berlin 1995.