2 Perceptions of Knowledge, Knowledge Society and Knowledge Management – Context and Position

2.1 The Emerging Knowledge Society

> Today, as we construct a new info-sphere [...], we are imparting to the "dead" environment around us not life but intelligence.
>
> (TOFFLER 1980: 168)

2.1.1 Basic Descriptions and Characteristics of the Knowledge Society

The description of our society as a knowledge society is only one approach among many others to characterize the society we live in (authors prefer to talk of media society, risk society, multiple option society, individualized society, multicultural society, global society etc., for example; for an overview over the authors and their different approaches see, e.g., Pongs 1999, 2000). Above all, to describe our society as a knowledge society is a self-description from an internal perspective of the society we live in, it is not a description of our society from an external point of view (see, e.g., Nassehi 2000a). Krohn (2000) identifies two different sets of variables that can be emphasized to analyze the contemporary societal change toward knowledge society: technological innovation and institutional transformation. Following Krohn (2000: 1), "the impact of technological change on the organizational and cultural institutions of society as well as on the enormous monetary and cultural investments of corporate and individual agencies in developing and using new knowledge" build the interrelated focus of these two aspects.

The term of the knowledge society is strongly influenced by the early studies in the 1960s on the (economically) dominant role of knowledge. The contribution of knowledge work to the economy was first clearly emphasized by Fritz Machlup (1962) (on the notion of knowledge work see Hayman and Elliman 2000). Peter Drucker (1969) provided guidelines for mastering the discontinuities brought about by information technology and knowledge work. Robert E. Lane (1966) is known as one of the first authors who noted the term "knowledgeable society". In the late 1960s and early 1970s, Amitai Etzioni (1968) and Daniel Bell (1975 (1973)) further investigated the emerging predominant role of (especially theoretical) knowledge as the new "axial principle" of society, particularly in the fields

of politics, work and science. A parallel line of reasoning can be found by reform Marxists in the Richta report (Richta 1971) of 1968 and the Japanese "Plan for an Information Society" of 1972 (see Masuda 1990 (1981)). Porat (1977) contributed a larger set of empirical data to the conceptual path toward a knowledge society, Lyon (1988) reflected on the validity of the concept of an information society, and Edelstein (1978) studied the different developments in the USA and Japan in a comparative analysis (as cited by Krohn 2000). During the 1980s and early 1990s, the academic and public awareness became steadily intensified "and extended the general themes of the societal centrality of knowledge to a broad variety of fields of investigation" (Krohn 2000: 1-2): the reconstruction of class structure in the knowledge society (Schiller 1984 (1981)) and its relation to postmodernism (Lyotard 1984; Poster 1990).

The growing popularity of the term knowledge society during the 1990s was fostered especially through the work of Peter Drucker and Robert Reich, both researchers in management theory. With regard to business management, features of knowledge society are strongly emphasized as the spread of expert culture (see several contributions in Stehr and Ericson 1992) and the primary importance of intellectual capital as the wealth of organizations (Stewart 1997). The OECD can be identified as an important promoter of the development toward a knowledge-based economy in its influential working paper of 1996 (OECD 1996) and various subsequent reports and activities (e.g., OECD 2001a,b). In Germany, the parliament (Deutscher Bundestag) provides a comprehensive outline of a global knowledge society (Enquête-Kommission 2002: 259-308).

A newer and widely recognized approach to the study of reconstruction of class structure in knowledge society with regard to the developments of globalization can be found in Castells' "The Rise of the Network Society" (Castells 1997) and with regard to social relationships in post-traditional knowledge societies in Knorr-Cetina (1998). As in the early concepts of the 1960s and 1970s, the dominant role of science and technical-scientific knowledge is still stressed as a basic feature of knowledge society (see, e.g., Gibbons 1994).

Lane (1966: 650) defined a knowledgeable society as one that is characterized by members who "(a) inquire into the basis of their beliefs about man, nature, and society; (b) are guided (perhaps unconsciously) by objective standards, and, at the upper levels of education, follow scientific rules of evidence and inference in inquiry; (c) devote considerable resources to this inquiry and thus have a large store of knowledge; (d) collect, organize, and interpret their knowledge in a constant effort to extract further meaning from it for the purposes at hand; (e) employ this knowledge to illuminate (and perhaps modify) their values and goals".

From a socio-economic point of view, the knowledge society is characterized primarily through three facts that have been identified in the 1960s and 1970s

debates (Machlup 1962; Bell 1975 (1973); Porat 1977) already:

- knowledge as productive force: the manufacturing of goods and services increasingly needs knowledge-based resources compared to material resources,
- employment structure dominated by knowledge workers: more than half of the employees of a society are employed at a workplace with knowledge-based work,
- general expansion of public and private research activities, like high increase of R & D expenditures.

Beyond merely focusing on mainly economic aspects, knowledge society can be distinguished on four different levels as described by (Wirth 2000) for example:

- On a sociological level, knowledge society means that knowledge and expertise based structures and processes spread throughout society and into everyday live.
- On a technological level, knowledge society is characterized through extensive dissemination of technological infrastructures in the form of knowledge-based, sensitive transport systems for information, communication, persons, goods, energy and financial transactions.
- On an organizational level, it is stated that knowledge-based management methods, globalization of business communication and knowledge as resource for production of goods and services, gain increasing importance.
- On a psychological level, education, life-long learning and the individual ability to handle excessive information overload are popular keywords.[1]

Maasen summarizes the conceptions of knowledge societies as widely-accepted at the end of the 1990s debates as follows (Maasen 1999: 59-60):

1. Besides money and power, information, knowledge and expertise play an important role as influential resources for social reproduction.
2. Increase of knowledge-based work and occupations and their permanent diffusion into other social spheres (for quantitative empirical analysis to this point see Machlup 1962, Machlup and Kronwinkler 1975). Education and career paths are not linear anymore.

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[1]Nonetheless, with regard to the individual level of the knowledge society, Wirth (2000) notes that the term of the knowledge society should be used very carefully to avoid what is known by social scientists as an "ecological misinterpretation": what is true on the level of a society, is not necessarily true for each individual person. So, the gap between supply and use of information is getting bigger and bigger. While production and conservation of information (or better: data) exponentially increase, the human capacity for information processing and the memory of the individual person remains on a constant level. The psychologist Werner Kroeber-Riehl concludes that between 95 and 99 per cent of all information that is produced every day must remain unused (as cited by Wirth 2000).

3. These developments are caused by science as the dominant paradigm, globalization of information and knowledge networks, higher awareness of risks and contingencies, increase of knowledge from the demand as well as from the supply side.
4. Transformational social effects due to the extension of knowledge as the basis for all the functional spheres in society as an evolutionary process.

All these conceptualizations of knowledge societies presented above, predominantly constructed from an economic perspective, consider the knowledge society as an attractive counterpart to the industrial society and as a societal concept to successfully approach the social and economic problems in the near future. Krohn (2000: 2) writes: "The reality of knowledge societies might have pleased Plato as putting into practice his ideal of philosophy governing society. It could also be taken as fulfilling the predictions of Condorcet (1743-1794) and Comte (1789-1857) according to which knowledge about the (laws of the) development of society would be put in control of shaping its structure". But "[n]one of these visions has even approximately come true. Neither wisdom, nor generally valid law-like insights, nor integrative and comprehensive scenarios [. . .] The permanent modernization of societies leaves all actors in successive states of uncertainty, insecurity, and ambiguity" (Krohn 2000: 2). Or as Nassehi (2000a) puts it, we are more and more forced to learn that self-stabilization of truths and certainties does rather prevent than enable the abilities needed in an accelerated and complex world: the permanent cognitive self-adaption of our knowledge to the world and the adaption of the world to our knowledge. As long as a society was able to assign a certain solution to a certain problem, i.e. to find unambiguous causalities and, moreover, to implement these clarities in the different realms of economics, science, politics, media or education, knowledge always provided the solution to solve the problem and did not cause a problem by itself. According to Nassehi (2000a), this was the very successful constellation of the industrial society, the paradigm of unambiguous scientific-technical solutions for the industrial-technical world.

Compared to the first studies and expectations of the developments toward knowledge society as presented in the 1960s and 1970s, things have changed today. Professional knowledge workers are not confronted with the task to find any solution for a given problem, they are confronted with the problem that they know too much to reach *the* solution (and to choose their actions within a given time; see also various contributions in Hennings et al. 2003). Knowledge is not only the resource for the industrial production anymore, it is its subject.[2] Not the knowledge assets (or repositories) are the critical factors today, but structures and processes

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[2]Based on this argumentation, Nassehi (2000a) suggests that we probably live in a knowledge-industrial society.

of knowledge production and transfer. And since we all know that there is not one solution, if there is any, the aim here is to provide some very small steps that may provide analytical insights and practically relevant methods among others to address these critical factors of knowledge production and transfer.

2.1.2 Knowledge Society and the Organization

In "The Rise of the Network Society", Manuel Castells (1997) describes the fundamental characteristic of modern life as being strongly influenced by the technological revolutions in the field of micro-electronics that have lead to the dissolution of the static into dynamic processes, i.e. everything flows, especially information. Social space has become a space of flows, and networks are the organizational form of these flows, i.e. of flows of resources, products, capital, information etc. And network structures have their own laws and dynamics. Not to discuss evidence of Castells' statement here, the paradigm of networks has changed our perspective of observation and analysis of social interaction without doubt. And the network paradigm can be considered as being a much more pragmatic approach than the approach of system theory for example (see also Graggober et al. 2003: 4-5).

Looking back on the preceding model of information society, Gernot Wersig (1996) explains the goal of complexity reduction as its underlying basic concept. Defining information as the reduction of complexity (Wersig 1974 (1971)), the concept of information society inheres the utopian vision to reduce complexity. Following Wersig (1996: 14-15), we can distinguish between (1) complexity of action and (2) complexity of knowledge. Complexity of action results from the interplay between increased scopes for action and a lack of corresponding models of action that guarantee safety in an insecure world. Complexity of knowledge results from a combination of various facets: technical, organizational and cultural interrelations, general complexity of the world—that has not necessarily increased in fact, but without doubt, we have become more conscious about it—, the individual situation between knowledge and the unknown, and last but not least, the loss of instruments to reduce complexity that have previously been perceived by our senses (like spirits, gods, myths and stories) and are cold, rational and not sensually perceptible anymore due to our scientific conception of the world. The conceptualization of information society was still connected with the hope to reduce and overcome complexity through extensive knowledge production and means of information and communication technologies. The same was true for the early drafts of knowledge society. If we do not want to turn the visions of a knowledge society to being useless, we should try to clearly integrate the recognition and acceptance of complexities as its integral basic characteristics. Then, knowledge society does not aim at the reduction and overcoming of complexities, but

at dealing and living with them through individual, organizational, technological, and societal strategies and processes of adaptation.

The notions of intelligent enterprise and intellectual capital as the new wealth of organizations have been prominently introduced into the debates of the last decade by Quinn (1992) and Stewart (1997). Organization development is a field of foremost studies to analyze the social and economic dimensions of what has become conceptualized as knowledge societies. Organizations are social systems that settle and control social action and processes, and that reduce complexity and communicative spaces. Thus, organizations replace insecurities through "self-made" securities (Luhmann 2000: esp. 183-221; and Luhmann 1972 (1964): 172-190, Luhmann 1993 (1981): 335-389). Since organization aims at a reduction of complexities and their handling through formal procedures, these procedures of formalization, of course, include the realm of organizational knowledge creation, transfer and conservation—and become a serious problem that all these knowledge management discussions try to address (see also Nassehi 2000a).

Following the argumentation of Nassehi (2000a), the successful paradigm of industrial modernism was complexity reduction through clear responsibilities, division of labor and functional differentiation. With regard to knowledge, this paradigm was realized through the separation of knowledge problems into small fragments, their individual solution and, finally, their combination. New perspectives on organizations from the viewpoint of a knowledge society seem to intend on making these hidden routines and their inherent restrictions visible. Nowadays, organizations are advised to make strategic use of insecurities and risks, to operationalize non-knowledge and to make mistakes. Sometimes, they must even actively try to forget what they know. Organizations must learn to limit their own expectations according to their stock of knowledge. From a social constructivist perspective of knowledge, organizations must consider that knowledge is a self-relying construction, and not an image of the world that is independent from the observer.

As Nassehi (2000a) concludes, the debates about knowledge society, as a self-description of the society we live in, then can be understood as pointing to the fact that knowledge is not the solution anymore but has become a problem itself. And that not knowledge itself is a scarce resource,[3] but the securities we have previously derived from knowledge (see also, e.g., Beck 1986; Bauman 1992, 2001). Based on these considerations, Nassehi's "game of knowledge" means exploring the differences that are made if a subject is viewed from this perspective or from another.

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[3]Like the Digital Rights Management (DRM) initiatives promote, for instance, that aim at the application of production methods from industry on knowledge.

2.2 Perspectives, Conceptions and Social Construction of Knowledge

> If we were going to be meticulous in the ensuing argument, we would put
> quotation marks around the two aforementioned terms
> every time we used them.
>
> (BERGER AND LUCKMANN 1967 (1966): 2)

2.2.1 Preliminary Remarks

Knowledge as a subject of theoretical analysis as well as an empirical phenomenon is no less than complex. To deal with knowledge, a lot could be written, a lot has been written already, and probably much more is being written about it today and will be in the future. One single discipline like the sociology of knowledge is a vast field of research that is not easily surveyed. Therefore, the aim here cannot be to fully treat knowledge from the perspective of a discipline or even from multiple disciplines. Rather, the following sections aim at gathering some of the small pieces of a jigsaw on knowledge, and fit them together to form a whole picture for the progress of this work—while the subject of this work itself, the communication of knowledge through social networks in research and development (R & D) and the method of social network analysis as a means of studying and facilitating them, is nothing more than another piece of a jigsaw of the larger picture of knowledge communication between individuals, within and between organizations and in society.

According to Maasen (1999: 7), the sociology of knowledge is currently perceived as being

- neither positivistically nor idealistically oriented, but rather constructivistically;
- situated on this side of objectivism and subjectivism;
- concerned with everything that claims the status of knowledge without any exception;
- under suspicion of relativism; and finally
- a vehicle of theoretical self-understanding of the intellectual person (especially of the social scientist).

2.2.2 Epistemology of Knowledge Sociology

The sociology of knowledge as a discipline of its own goes back to the early 20th century, especially represented by scientists like Karl Mannheim and Max

Scheler.[4] Taken not as a discipline of its own, the sociology of knowledge origi-
nates from the work of sociologists like Auguste Comte, Émile Durkheim and their
successors, especially Marcel Mauss in France, Thorstein Veblen in the USA, or
Max Weber in Germany (see Burke 2001 (2000): 11-14, also for an overview
over the European early modern social theory of knowledge 29-39 and 45-67).
The sociology of knowledge is a vast and complex field of research and cannot
be comprehensively treated here. Therefore, the following sections do not aim at
providing an outline of the sociology of knowledge or an abstract of its history and
steps of development (in more detail see, e.g., Burke 2001 (2000)). Rather, some
small parts will be provided to outline the scope of analysis for this work.

For our purpose, the sociology of knowledge can be defined as the study of
the (socio-) scientific construction of reality (of social action and knowledge). It
deals with all aspects of what is known as knowledge in a society. These include
everyday knowledge, i.e. non- or pre-scientific knowledge, as well as scientific
knowledge and the process of scientific knowledge generation itself.

2.2.3 Data—Information—Knowledge: Knowledge as Capacity for Action

In the field of information science, knowledge is often defined with regard to its
relation to data and information. Michael Buckland (1991: 3-4) distinguishes three
dimensions of information that are directly related to knowledge: (1) information-
as-process, i.e. information is communication of knowledge, (2) information-as-
knowledge, i.e. information is knowledge communicated, and (3) information-as-
thing, i.e. some things are informative. This distinction treats information as either
an intangible or tangible asset. Therefore, Buckland adds information processing
or knowledge engineering as a fourth dimension which leads to a 2x2-table as
follows:

	intangible	*tangible*
entity	**information-as-knowledge**: knowledge	**information-as-thing**: data, document, recorded knowledge
process	**information-as-process**: becoming informed	**information processing**: data processing, document process-ing, knowledge engineering

Table 2.1: Four Aspects of Information (Buckland 1991: 6)

Generally, the relationships between data, information, and knowledge are com-
monly described as follows: data must be interpreted and connected, information

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[4]For an introduction and overview of knowledge sociology, its origins and its subject see, e.g., Berger
and Luckmann (1967 (1966): 4-13) or Merton (1957 (1949)b).

must be recognized, processed, and provided with meaning to achieve knowledge. According to Wirth (2000), information could be understood as "subjectively possible knowledge" and knowledge could be perceived as "individually acquired information". The relationship between knowledge and information (and data) is excessively outlined in the knowledge management literature without providing profound new insights. The "knowledge ladder" focuses on each step from symbols, that become data by syntax, that become information by semantics, that become knowledge by integration into contexts, that becomes know-how through application, that becomes action through motivation, that becomes competency by making the right decisions, that finally becomes a competitive advantage (of an organization) (see also Sveiby 1997: 29-39). Originally introduced by North (1999: 41), the knowledge ladder is presented in figure 2.1 and has become a common conception of the illustrated relationships in the knowledge management literature. The transformation of information into knowledge has become subject of what is known as individual knowledge management (see Reinmann-Rothmeier and Mandl 2000).[5]
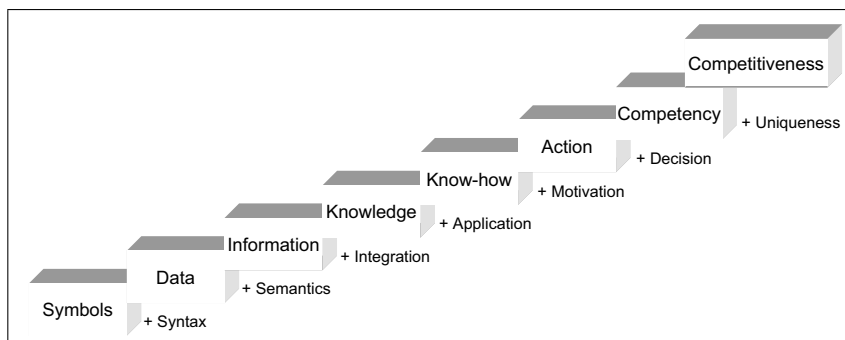

Figure 2.1: The Knowledge Ladder (following North 1999: 41)

From the starting point of a so-called "problematic situation", Wersig introduced the conceptualization of information as reduction of uncertainty through processes of communication (Wersig 1974 (1971): 74). To some extent similar to this concept of information, Stehr defines knowledge as a "capacity for action"

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[5]Another influential conception of knowledge has been introduced by Nonaka and Takeuchi (1995) with regard to the implicit and explicit dimensions of knowledge and their transformations through externalization, combination, socialization and internalization. Although these authors deserve great respect for making academics and practitioners more sensible to the importance of organizational knowledge creation, this conception is of little use due to the structurally distinct character of implicit and explicit knowledge as originally outlined by Polanyi (1958, 1976) and therefore, as discussed by Schreyögg and Geiger (2002), the impossibility of a transformation between them.

(Stehr 1999).[6] Stehr conceptualizes this perspective as derived from Francis Bacon's observation that knowledge is power.[7] This means that "knowledge derives its utility from its capacity to set something in motion" (Stehr 1999). To explain this concept, we may add that action always involves decision making. Making decision means to chose one option among (many) others and therefore, action is to decide against all other alternative options. To make the right decision then means to avoid mistakes, which involves knowledge. Therefore, it is knowledge that enables us to act.

2.2.4 Knowledge as a Symbol

Bühl's approach toward a theory of knowledge sociology (Bühl 1984) tries to gain a precise and subtle conception of knowledge through an order of knowledge on different levels. With this approach he proposes an opposition against a too broad definition of knowledge. According to Bühl, the understanding of knowledge in a very broad sense, as found for example by Mannheim, includes all kinds of human information processing and therefore loses a subtle sense for the differences of the objectivity and cultural specificity of different kinds of knowledge and their connections in psychic or social organizations of different processes of learning or knowledge communities (Bühl 1984: 11). Bühl promotes a certain willingness to expound the problems of the systemic character of the knowledge system itself and to assume the possibility of multi levels and high complexity, the incoherent and divergent nature of these levels and the related discourses (Bühl 1984: 11; with reference to Foucault 1994 (1973)). He criticizes the ambitions of the sociology of knowledge to reveal the social conditions of knowledge production, diffusion and utilization without making the analysis worthless and implausible through the influence of its own value systems or the lack of criteria and a priori character of relativism (Bühl 1984: 9). Bühl abandons the idea of a direct relation between a product of knowledge and social position. He rather considers a knowledge product embedded in multiple contexts (see Bühl 1984: 12). Based on these considerations, he outlines the order of knowledge as a multi-level system of this kind. Bühl's multi-level system of knowledge order follows the biological construction of the human brain which is not subject to further detail here.

Bühl generally defines knowledge as a representation of the world through the

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[6]Sometimes, Stehr also speaks of "capacity for *social* action" (Stehr 1992: 114). Here, we do not focus on such a narrow perception of knowledge, since knowledge is involved in all kinds of action and not in social action only. Kuhlen introduced the definition of "information as knowledge in action" (Kuhlen 1996: 34). Although this definition shows some similarities to Stehr's definition of knowledge at the first glance, it is of little help for our purposes since it does not provide a distinctive approach for the conceptualization of knowledge.

[7]As Stehr (1999) admits himself, "a somewhat misleading translation" of "scientia est potentia".

means of symbols (Bühl 1984: 84). He argues that a notation of knowledge is a prerequisite for the communication, tradition and discursive development of knowledge. On the one hand, this notation should be suitable to provide an operational and clear link to the outside world. On the other hand, this notation should be compatible with human behavior, with the human physical character and human gestures in a way that the outside world provides feedback to the human being and his inner world and, vice versa, that the psychological inner world can be represented in the outside world by the determination of relations (Bühl 1984: 77-78). Therefore, according to Bühl the crucial point of symbolism is its ability for transformation, i.e. the transformation between inside and outside, between cognition and operation, between specific and abstract, etc. (Bühl 1984: 87).

2.2.5 Social Construction of Knowledge

"From the perspective of common sense, the world of everyday life is taken for granted as *reality*. It is simply, compelling, and self-evidently *there*" (Holzner and Marx 1979: 81). From this perspective, knowledge cannot mean "the 'grasping' of reality itself", but only "the 'mapping' of experienced reality by some observer", and thus, "we are compelled to define 'knowledge' as the communicable mapping of some aspect of experienced reality by an observer in symbolic terms" (Holzner 1968: 20; as cited by Holzner and Marx 1979: 93). Frames of reference are defined as structures consisting of "taken-for-granted assumptions, preferences for symbol systems, and analytical devices within which an observer's inquiry proceeds" and can be "explicitly codified and articulated" or "remain tacit and lack specific symbolic articulation" (Holzner and Marx 1979: 99-100). Whether specialized and articulated very precisely or not, every frame of reference "contains a limited set of rules for mapping alternative frames of reference" (Holzner and Marx 1979: 102). This argumentation leads Holzner and Marx to describe social validation of knowledge as inter-subjective spaces within the context of shared frames of reference and through reality tests (Holzner and Marx 1979: 103-106).[8]

Following Berger and Luckmann, "reality" is the "quality appertaining to phenomena that we recognize as having a being independent of our own volition" and knowledge is "the certainty that phenomena are real and that they possess specific characteristics" (Berger and Luckmann 1967 (1966): 1). Typification is a universal characteristic of perceptive experiences: Looking at an animal, we may recognize

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[8]They use the latter as a mechanism to differentiate between types of so-called "epistemic communities": (1) empirical reality tests, (2) pragmatic reality tests, and (3) authoritative reality tests. Especially pragmatic reality tests prove some importance for the study presented here, since they "demonstrate knowledge through successful performance [. . .]. [. . .] [They] tend to be used in instances when the knowledge to be applied has not been or cannot be made explicit or systematically codified" (Holzner and Marx 1979: 104).

it as a four-legged friend at one occasion, at another occasion we may recognize it as a dog, or at a different occasion maybe as a dog of a certain breed. Our perception of this animal and its defining aspects and characteristics depends on our specific pattern recognition, i.e. our specific typification (Gurwitsch 1971: XIX-XX). Everyday knowledge of an individual person and its perception of the world is a system of constructions of its typical characteristics (Schütz 1971: 8).

The "stock of knowledge" (Schütz 1971) is the accumulation of all knowledge gained in our own life, like language, all kinds of formulas, rules of conduct and behavior in typical situations etc. It is the sediment of our life-story. Therefore, our stock of knowledge is never completed. On the contrary, it is continuously extended during our life-time (Gurwitsch 1971: XXII). Especially the meaning of habitualized actions is as a routine part of the stock of knowledge and thus, turns into certainty and is at our disposal for future use (see also section 2.2.9). Nevertheless, habitualized actions "retain their meaningful character for the individual although meanings involved become embedded as routines in his general stock of knowledge, taken for granted by him and at hand for his projects into the future" (Berger and Luckmann 1967 (1966): 53). But only a very small part of our own knowledge of the world has its foundation on our own personal experience. Most of our knowledge is socially derived (Schütz 1971: 15), i.e. it is socially mediated and individually accepted. This is the social origin of knowledge.[9] The stock of knowledge at hand builds the frame of reference for the orientation of our life in the world (Gurwitsch 1971: XXIII) and for the interpretation of the world (Schütz 1971: 8). Within the constructions of everyday knowledge, alter appears only as partial self, and alter is also involved in we-relationships with a part of his or her personality only (Schütz 1971: 21).[10]

Berger and Luckmann distinguish between society as objective and as subjective reality. While society as objective reality is characterized through processes of institutionalization and legitimation, society as subjective reality is characterized through processes of internalization and identity-building (Berger and Luckmann 1967 (1966)). Pre-theoretic ingredients of knowledge, i.e. "knowledge that supplies the institutionally appropriate rules of conduct" (Berger and Luckmann 1967 (1966): 65), structure all kinds of reality that is consolidated within and as a so-

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[9]Schütz describes the inter-subjective character of everyday knowledge according to three dimensions: a) reciprocity of perspectives (structural socialization of knowledge), b) social origin of knowledge (genetic socialization of knowledge), and c) social distribution of knowledge (Schütz 1971: 11-17, 360-383).

[10]Simmel discovered the same finding to overcome the dilemma between individual and collective consciousness in his concept of concentric circles (Simmel 1992 (1908): 456-511). Cooley addresses this fact as the "looking glass effect" that mirrors the origin of the self in a process of social reflections (Cooley 1922: 184). And Mead outlines these findings with the concept of the generalized other (Mead 1955 (1934): 152-164).

ciety. Conditio sine qua non of such a consolidation are the processes of institutionalization and legitimation through means of symbolic standardizing functions (Plessner 1970: XII).

Different from the construction of everyday knowledge are character and processes of the construction of intellectual objects in the social sciences (Schütz 1971: 39-76). Following Berger and Luckmann, "the sociology of knowledge must concern itself with whatever passes for 'knowledge' in a society, regardless of the ultimate validity or invalidity (by whatever criteria) of such 'knowledge'" (Berger and Luckmann 1967 (1966): 3). And insofar the subject of the sociology of knowledge is "all human 'knowledge' [that] is developed, transmitted and maintained in social situations" and the understanding of the processes involved (Berger and Luckmann 1967 (1966): 3). Exactly this conception of knowledge is contended to be a useful definition for the study of knowledge and the processes of knowledge generation, transfer and conservation within and between organizations. For the study presented here, knowledge includes all human knowledge that is generated, transmitted, maintained and—important to add—forgotten within organizational situations.

Organizational situations that involve knowledge processes are always socially constituted. Weber introduced the prominent distinction between human behavior, action and social action in sociology. Following this distinction, knowledge communication in social networks is inevitably constituted as *social* knowledge communication. Action is human behavior to which the acting individual attaches subjective meaning, whereas social action is action when, by virtue of the subjective meaning attached to it by the acting individual, it takes account of the behavior of others and is thereby guided. From this perspective, knowledge communication in social networks is communication of knowledge between social entities that are intentionally oriented toward each other. An acting individual attaches a subjective meaning to his or her communication of knowledge while he or she takes the behavior of others into account, and is thereby guided.[11] This kind of social perspective on processes of knowledge communication takes into account factors and prerequisites for mutual orientation of the acting individuals like shared language, common standards as well as social and situational norms (see also section 2.5.4).

2.2.6 A Network Model of Knowledge

Durkheim and Mauss (1963 (1903)) state that the culturally and historically specific classification of human beings is reproduced through the classification of things. Bloor (1981) suggests providing a systematic theoretical foundation to this

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[11]For an attempt to theoretically outline the relations between rational and social action in economic and sociological institutional theory with reference to Max Weber see Haase (2003a).

statement with the help of a universal classification model based on the network model by Hesse (1974). According to Bloor, (1) knowledge is not a "bricolage" of single facts, but a systematic whole that has the function to supervise and select between the individual knowledge elements, and (2) content, extent and structure of a classification system cannot be determined by its environment; there is nothing like a "natural" classification (see Maasen 1999: 38). Rather, a network starts with assigning labels to different objects and characteristics of the environment and is further established—by means of generalization—through subjectively recognized similarities between objects and environmental characteristics. This "primary classification of the environment" as an intuitive feeling of similarities is an essential part of the transfer, use and expansion of knowledge. From this perspective, knowledge is conceived as a functional relationship with the physical objects around us (Maasen 1999: 38).

2.2.7 Expertise and Specialized Knowledge

Most people are experts within a very small domain only—within a domain where they have directly gained experience and acquired first-hand knowledge.[12] They are not experts with regard to all other domains. But indeed they know that there are experts within these other domains as well, and that they could ask them for advice.[13] Especially in a society like ours that is dominated by the division of labor and specialization, the available knowledge is not in the possession of every individual person. Rather, knowledge is divided by the members of a society according to their professional fields. Again, the knowledge about this social division of knowledge is itself part of our stock of knowledge.—So far, the vivid illustration of expertise and social specialization of knowledge as outlined by Gurwitsch (1971: XXIV). Today, we cannot easily assign specialized knowledge to a professional field anymore. The professional division of knowledge, of course, basically continues to exist, but it vanishes more and more. The existence of specialized knowledge and expertise beyond clear-cut professional fields originates from a growing importance of the co-existence of specialized knowledge with general knowledge and competencies, cross-specialization of knowledge and inter-disciplinary knowledge, specialization within professional fields, changes of professional structures and, above all, the diversity and the growing non-linearity of individual work biographies.

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[12]This kind of knowledge is known by James as "knowledge about" (see James 1981: 216-218).
[13]James would call this kind of knowledge "knowledge of acquaintance" (see James 1981: 216-218).

2.2.8 The Production of Innovative Knowledge

Knorr-Cetina defines scientific knowledge production as a process of fabrication that consists of decisions and negotiations, or phrased differently, that requires selection (Knorr-Cetina 1981: 5). On the other side, this implies that "[i]f scientific facts are fabricated in the sense that they are derived from decisions, they can be defabricated by imposing alternative decisions" (Knorr-Cetina 1981: 6). Based on this assumption, a constructivist rather than descriptive perspective on the scientific construction of knowledge means studying scientific investigation by the study of the process by which the respective selections are made (Knorr-Cetina 1981: 6). But this perspective raises questions about the newness and contingency of scientific products which it cannot explain properly. Therefore, Knorr-Cetina introduces the laboratory as context of discovery, or context of validation, and the contextuality of laboratory construction itself. Contextual contingency becomes a principle of change (Knorr-Cetina 1981: 10-11)

Introducing Toulmin's model of scientific change (see Toulmin 1967, 1972), which is a close analogy of biological evolution to the process of scientific knowledge production, Knorr-Cetina provides a model of interdependency between individual and social generation of innovation. Toulmin distinguishes between the existence of a pool of scientific innovations and an ongoing process of natural selection among these innovations. According to Knorr-Cetina, "[t]he former rests with the creative individual scientist, the latter with the community of experts who judge the innovations" (Knorr-Cetina 1981: 12). Then, mutations are the variant types produced by individual innovations and the decisive factor is the production of variations. The scientific community becomes a unit of contextual organization for knowledge creation itself (Knorr-Cetina 1981: 68-70). These scientific communities again are transcended by trans-scientific fields, i.e. "networks of symbolic relationships which in principle go beyond the boundaries of a scientific community or scientific field" (Knorr-Cetina 1981: 82). With this notion, Knorr-Cetina goes beyond a network model of knowledge itself, but points to the social construction of innovative knowledge in networks.

2.2.9 Knowledge and Habitus *or*: Practical Knowledge

Within the framework of Bühl's multi-level model of knowledge, the post-natally developed hippocampus plays an important role for processes of habituation. According to Bühl, in the beginning of human life the hippocampus allows to stop unsuccessful behavior through modes of inhibition and, later, to change orientations or to recombine elements of behavior. But even more important, the hippocampus allows for processes of habituation that permit to reduce the entangling abundance of stimuli to a configuration of a simple stimulus (Bühl 1984: 27; with

reference to Rose 1980). As Maasen (1999: 35) explains, practices can be controlled and regulated without being subject to the obedient performance of duties or rules; they can be collectively agreed on without being based on clearly defined rules of conduct. Bourdieu searches for reasons for the existence of regularity and agreement in what he calls "habitus". According to Bourdieu, "habitus" is a system of enduring dispositions that is organized through practice (see Bourdieu 1970: 125-158).

Especially the meaning of habitualized actions is as a routine part of the stock of knowledge and thus, turns into certainty and is at our disposal for future use. Nevertheless, habitualized actions "retain their meaningful character for the individual although meanings involved become embedded as routines in his general stock of knowledge, taken for granted by him and at hand for his projects into the future" (Berger and Luckmann 1967 (1966): 53). Processes of habitualization precede any institutionalization: "Institutionalization occurs whenever there is a reciprocal typification of habitualized actions by types of actors. Put differently, any such typification is an institution" (Berger and Luckmann 1967 (1966): 54).[14] And "the institutions are now experienced as possessing a reality of their own, a reality that confronts the individual as an external and coercive fact" (Berger and Luckmann 1967 (1966): 58). In a world that contains within it "the roots of an expanding institutional order" (Berger and Luckmann 1967 (1966): 57), society and its knowledge is constructed as "objective reality".[15]

With reference to Durkheim's logical conformism, i.e. the mutual adjustment of categories for the perception of the natural world under the appearance of objective necessity, Bourdieu speaks of "practical knowledge". This practical knowledge means the practical ability of categorization and classification according to a certain order that can be transferred to any social situation and met with suitable behavior. According to Bourdieu, the patterns of "polyethie"[16] and "polysemie"[17] are the generative principle of this "practical logic", which acts as a mediator between objective structure and habitus-specific disposition (see Maasen 1999: 37). This practical knowledge, which the actors are not aware of, which is even neglected by them, calls Bourdieu "doxa". The doxa consist of the whole of the aspects of the symbolic order that are generally shared by all groups of classes. The symbolic order regulates the perception and action as a kind of a "collective unconscious" in an indirect way only, namely through a so-called "practical sense"

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[14]On the processes of institutionalization from a sociological perspective see also section 2.3.

[15]On legitimation and control in processes of institutionalization see Berger and Luckmann (1967 (1966): 61-67, 92-128).

[16]i.e. the application of the same patterns on different subjects.

[17]i.e. the application of different patterns on the same subjects.

that serves as orientation for the individuals according to the naturally accepted social order (Maasen 1999: 37-38).

2.2.10 Knowledge as an Empirical Problem

Kant (1968 (1787): 531-538) distinguishes three types of "thinking that something is true": "Meinen" (having the opinion that something is true), "Glauben" (believing that something is true) and "Wissen" (knowing that something is true). In this sense, an opinion is subjectively as well as objectively insufficient, accidental and random in character, a believe is objectively insufficient, but subjectively adequate, and knowledge is subjectively and objectively adequate. Following Kant's distinction, Nassehi finds that dealing with knowledge in practice is not at all related to these conditions of adequacy that are derived from subjective and objective adequacy of knowledge. Therefore, he asks the question whether we really live in a knowledge society or rather in a "society of opinions" or, even worse, in a "society of beliefs": obviously, we think / believe / know different things (Nassehi 2000c: 3).

Varela speaks of consciousness as a "constant veiling" of the images of the inner and the outside world and the corresponding individual processes of the evolutionary development of a perspective of the world, that veils its own perspective and thus, allows for an adequate perspective of the world (Varela 2000: 152; as cited by Nassehi 2000c: 4-5). Due to these processes, consciousness is nothing else than the condensation of experiences and expectations into a structure, that proves usefulness in the world. And the same is true for knowledge: knowledge is nothing else than a kind of condensation and self-stabilization of observation (Nassehi 2000c: 5). Or as Buckland noted, "knowledge is based on belief" (Buckland 1991: 42). From this perspective, the majority of our knowledge is not the result of intended cognitive processes or reflexive procedures, but the result of assertions and experiences: it is open for revisions and stable at the same time, and is always build on prior knowledge and experience (Nassehi 2000c: 5). Following Nassehi, this epistemic perspective leads to a "problem of knowledge" that is not a problem of "true" or "adequate" knowledge, but an empirical problem of what is cognitively treated as knowledge or not: then, knowledge is what can be supposed to be those things that are known without dependence on any observer. All kinds of operations appear as knowledge that have the ability to veil their observed existence as being based on the fact of observation. This includes an assumption and a routine, which are exclusively endogenously proven, and not the evolution of an adequate adaptation to an environment that remains unknown. To prove means that knowl-

edge is embedded within the communicative space of a society, or: condensed in processes of communication (Nassehi 2000c: 5-6).[18]

Max Weber described knowledge as demystification and therefore, as a central category of scientific-technical modern times to provide solutions for the existing problems. And indeed, during the second half of the 20th century, knowledge has become a critical force of production and an important factor of economic growth—or at least the knowledge about or the believe to (see also section 2.1). But nowadays, we experience that knowledge is not the solution anymore (or the hope to find a solution to our problems, or maybe something like the "hope of redemption"). It would contribute to a more appropriate scenario of the "knowledge society" to include aspects of uncertainty and non-knowledge as well (Nassehi 2000c: 10). Maasen states that the inclusion of non-knowledge in the discipline of the sociology of knowledge can be found recently as well, if only rarely. For example, Merton (1987) speaks of "specified ignorance" to analyze non-knowledge as a necessity to gaining knowledge about knowledge under circumstances of uncertainty (conditions of risk). The significance to deal with "ignorance" in organizations has been studied by March (1994) and Zack (1999b), for example. And Lachenmann (1994) identifies whole "systems of non-knowledge" in a comparative study of cultures. In his recent study, Stehr (2000) explicitly focuses on the fragility of modern knowledge societies: he analyzes technological and scientific developments as the sources of new uncertainties. Krohn identified these uncertainties already as being the result of continuously transcending the principles of scientific activity: the creation of knowledge always inheres the creation of non-knowledge, and science transforms ignorance (non-knowledge of knowledge) into uncertainty and insecurity (knowledge of non-knowledge) (Krohn 1997: 69, 84). Traditionally, these dynamics of knowledge and non-knowledge were restricted to the realm of science and technology. But these limited frames of reference have vanished through increasing permeability between the different sub-systems of society (see also section 2.1, on postmodern knowledge communication in society see also Wersig 1998a, Wersig 1998b: esp. 215-216).

2.2.11 The Framework of a Pragmatic Conception of Knowledge

To summarize the various aspects of knowledge briefly, we can follow Wenger et al. (2002: 8-11) who note that knowledge

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[18]Nassehi searches for a direct connection to Luhmann in that he perceives knowledge as a cognitive stylization of communication and the latent function of knowledge to establish inter-subjectivity through truth and validity of what is communicated.

- lives in the human act of knowing,
- is tacit as well as explicit,
- is social as well as individual,
- is dynamic.

Taking the outline and discussion of knowledge presented in the previous sections, knowledge as understood here is a human act and it is socially constructed. The social construction of knowledge from the perspective of the sociology of knowledge is used in this study as its basic assumptions, since this conception of knowledge is the common link between the various approaches presented above and it serves the goal of this study best from analytical and conceptual perspectives with regard to its subject of research. In the study presented here, communities and networks are the units of analysis, not knowledge. Due to this focus, the critical remarks about "'knowledge' as a unit of analysis" by Hull (1998) can be rejected: "Time and again, when various experts invoke or study knowledge, they place their work in opposition to logical positivism; either simply by invoking Polanyi's distinction between explicit and implicit knowledge, or through more complex formulations such as the social construction of knowledge" (Hull 1998: 26).[19]

2.2.12 Knowledge and its Management?

Generally speaking, economic relationships are being developed for the solution of problems of the economic subjects. Beginning in the 1960s, information economics (Stigler 1961) focused on information processes based on costs and benefits calculations derived from treating information as an economic good (see Darby and Karni 1973; Nelson 1970). The new institutional economics laid the ground for studies on institutional and organizational structures by which economic actors engage with each other (Coase 1960; Alchian and Woodward 1988). In the context of business economics, institutional economics needs to be further elaborated: Suppliers and customers are considered to be in need of co-operation in order to achieve a solution to their problems (Berekoven 1974; Rosada 1990; Maleri 1994). Within the production process the customer even has to provide production factors, of which information is the most important one (Kleinaltenkamp and Haase 1999). In consequence, the knowledge of and information flows between all participants

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[19]With regard to different analytical foci, Hull of course would be right, especially when he continues: "In these present conditions, it is surely necessary to be sceptical of the taken-for-granted assumption that knowledge is an important entity of some sort, a unit and a subject of analysis that can be reliably treated by a variety of experts. It is necessary to ask how it has happened that 'knowledge' has been problematised in this way, and not in others" (Hull 1998: 26). He suggests as an answer the widespread utilization of knowledge as a rhetorical justification for particular forms of economic coordination (see Hull 1998: 26-27).

in the production process as well as the extent and type of their communication decisively influence the solubility of problems and the efficiency and effectiveness of the solutions (Haase 2003b).

Under a perspective of business economics, knowledge is usually distinguished with regard to (1) knowledge as object and (2) knowledge as process (see, e.g., Heckert 2002: 13):

- *Knowledge as object:* Similar to the character of a production force, knowledge is considered as a static quantity that is the result of a process or activity. From this perspective, we can own or possess knowledge as an asset. This kind of perception of knowledge is rather focused on knowledge using terms and perspectives of data or information and therefore, knowledge management is often like data or information management.
- *Knowledge as process:* Knowledge is considered as a process or activity. From this perspective, we put our focus on the dynamic character of knowledge. In the course of knowing, the individual human being becomes conscious of real facts and uses this knowledge as a frame of orientation for his or her activities (see, e.g., Kleinhans 1989: 5; Wille 2000: 357).

Both interpretations show the pragmatic and action-oriented character of knowledge that is relevant from the perspective of business economics and management (see Heckert 2002: 14). The object-based approach is widely prominent as a theoretic foundation of information technology based solutions from a management perspective, while the process-oriented approach refers to philosophical, psychological and sociological approaches even from an economic perspective (see Sveiby 1997: 24-50). If we assume that we can indeed manage knowledge, the aim of an organization must be to manage knowledge as an object as well as to manage the processes of knowledge (see also Zack 1999a: 46).

A different perspective emerges from the focus of social construction of knowledge. From this perspective, knowledge is primarily in the heads of individuals (Wersig 2000), or as McDermott puts it "knowing is a human act" (McDermott 2002). Armbrecht talks of "purists" who "consider 'knowledge' to be that which is *within and between the minds* of individuals and is tacitly possessed" (Armbrecht et al. 2001: 29). From this perspective, we cannot manage knowledge: "data and information may be managed, and information resources may be managed, but knowledge (i.e., what we know) can never be managed, except by the individual knower and, even then, only imperfectly" (Wilson 2002). Rather, we can try to manage influence factors like organizational environments or communication processes that facilitate and improve processes of knowledge creation and sharing. Especially from the perspective of knowledge processes within R & D environments, managing knowledge is not literally possible. Rather, as Armbrecht et al.

(2001: 30) put it, "we are really interested in facilitating knowledge flows". And as they continue, "[t]he expansion process creates new knowledge beyond that contained in the individuals' heads. This is the 'between mind's knowledge' related to interactions that take place between individuals and within teams" (Armbrecht et al. 2001: 31). And we should add: that takes place in and between organizations, institutions, disciplines and societal spheres as well. From this perspective, the conception of knowledge management presented here deals with conditions and influence factors of knowledge generation, sharing, use, conservation, and forgetting on individual, organizational, and societal levels.

2.3 Constitutional Conditions of Knowledge Management and its Institutionalization

> See, it's the first function of any organization to control its own sphincters. We're not even doing that. So we're working on refining our management techniques so that we can control that information no matter where it is—on our hard disks or even inside the programmers' heads.
>
> (STEPHENSON 1992: 108)

2.3.1 Sociological Institutional Analysis and Knowledge Management

A review of the literature and research activities in the field of knowledge management shows that an institutional approach was never applied on knowledge management until today.[20] This section outlines the usefulness of sociological institutional analysis in the field of knowledge management in that it offers completely new perspectives.

Sociological institutional analysis puts its focus on the continuous processes of institutionalization and de-institutionalization (see Lepsius 2000: 19-20). It provides an analytical framework that helps us to gain insights into the processes of the institutionalization of knowledge management on the different levels and between them: on the level of the individual person, on the organizational level, and on the level of society, as well as on knowledge transfer between individual, organizational, and societal levels. This framework lays the foundation to analyze and facilitate knowledge flows, to internalize modes of knowledge transfers, and to institutionalize flourishing knowledge environments on and in-between all levels.

Sociological institutional analysis as understood here, is primarily based on the work of the German sociologist M. Rainer Lepsius. He always emphasized not to use the term "institution" for a social construct if another one could be used more appropriately (see, e.g., Lepsius 1995: 394; use and avoidance of the term "institution" in sociology is discussed by Rehberg 1997: 95-98). Willke (1998: 9) defines knowledge management as the whole set of organizational strategies for the creation of an "intelligent" organization. Without discussing Willke's attempt to define knowledge management in more detail here, it is important to mention that his outline describes knowledge management as an integrative approach to "deal" with all knowledge resources of an organization. This points to (1) the organization itself and its environment, (2) technological infrastructures, and (3) —even when

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[20]The only exception known by the author is the dissertation from a neo-institutional perspective by Glückstein (2002).

sometimes forgotten—especially to human beings: "Knowledge always involves a person who knows" (McDermott 2002: 5; see also Polanyi 1958).

Following Dahrendorf (1991: 148), institutions are normative structures or decision making and sanctioning "authorities" (as cited by Rehberg 1997: 95). Rehberg (1994: 56-57) describes institutions as symbolic rules. He proposes not to speak of institutions or social structures of institutions but to speak of institutional mechanisms and their impact on stabilization of social relations (Rehberg 1997: 102; see also Rehberg 1994). Following Rehberg, Lepsius (1997: 9) conceives of institutions as processes that structure social behavior and are related to ideas of norms. As Lepsius puts it, the term "institution" shows its very analytical importance when applied to a defined subject of research. Thus, Lepsius is laying the foundations for a sociological analysis of institutions. Drawing back on Weber's "legitime Ordnung" (Weber 1980 (1921): 16-17), Lepsius focuses on the analysis of the conditions of legitimate power and rules as integral parts of the analysis of institutions (see Lepsius 1995: 395). Following this approach, the focus of institutional analysis is put on the effects of "principle" or "basic" ideas ("Leitideen") and their influence on structuring behavior, i.e. sociological analysis of institutions means to focus primarily on constitutional conditions of institutions. This draws the attention to the analysis of the constitutional conditions of the institutionalization process of knowledge management and their impact on knowledge management theory and practical application as outlined in the following sections.

Following Lepsius (1995: 395-397), the constitutional problem of institutions can be characterized by three different processes: (1) to put the underlying principle idea in concrete form and thus to structure behavior through the process of establishing specialized rational criteria according to the principle idea, (2) to differentiate an action frame of reference according to the rational criteria, and (3) to develop means for sanctioning deviant behavior not in line with the rational criteria according to the principle idea. Then, the institutionalization process of a principle idea causes (1) consequences and contingencies as well as (2) interconnections between other institutions, i.e. the rise of conflicts between different institutionalized principle ideas. These five dimensions provide the framework for the analysis of the constitutional conditions of the institutionalization processes of knowledge management:

1. the principle idea of knowledge management: knowledge as a competitive force;
2. knowledge management and its frame of reference: environments of flourishing knowledge creation;
3. knowledge management and sanctioning mechanisms: in search of measuring knowledge assets;
4. consequences: technology orientation and capitalization of knowledge;

5. competition between principles and other interdependencies: the rise of multiple conflicts.

2.3.2 The Principle Idea of Knowledge Management: Knowledge as a Competitive Force

Knowledge management is based on the perception of knowledge as a productive force and on its important role for economic competition. As outlined in section 2.1, the growing importance of knowledge, especially in economic terms, is influenced by (1) a structural change from labor and capital intensive to information and knowledge intensive production of goods and services, (2) globalization and acceleration processes of information and communication flows, and (3) extensive distribution and dissemination of information and communication infrastructures and technologies (see, e.g., North 1999: 14-23; Prusak 2001). Economics, science, and society are spreading the ideas and concepts of knowledge workers (Bell 1975 (1973); Drucker 1999), of intelligent products and organizations (Quinn 1992) and of the knowledge society (Stehr 1994; compare also section 2.1). The rapid development of information and communication technologies, the promotion of information and expert systems with its early beginnings in the 1970s and 1980s already, leading to ubiquitous computing and extensive dissemination during the 1990s, results in a shift of focus away from technical solutions to cognitive skills and undigitized knowledge (Prusak 2001). The first wave of knowledge management is derived from the conceptualization of so-called "organizational knowledge creation" (Nonaka and Takeuchi 1995) or "working knowledge" (Davenport and Prusak 1998). Basically, these issues were subject to the precedent discussions about information management already (see, e.g., Wersig 1989: esp. 69-75).

The analysis of this development in the framework of sociological institutional analysis, leads to the conclusion that knowledge management is based on the principle idea of knowledge as a productive force: knowledge determines the value of an organization and gains influence over the organization as well as over the national economy and their competitiveness (see DIW 1997; Krogh and Venzin 1995; Nonaka and Takeuchi 1995; North 1999; Probst et al. 1997; Stewart 1997; Sveiby 1997). According to the underlying principle idea of knowledge management, it seems rational to systematically initiate and intensify activities with regard to creation, transfer, conservation, and use of knowledge. These rational criteria of knowledge management are assumed to increase organizational wealth as well as stimulate innovative processes and to strengthen competitiveness of an organization (and the society).

2.3.3 Knowledge Management and its Frame of Reference: Flourishing Knowledge Creation Environments

Corresponding to the principle ideas of knowledge management, a frame of reference is differentiated where the rational criteria are valid, i.e. where creation, transfer, conservation, and use of knowledge can be practiced. To support growth of knowledge as a competitive force, environments are created within organizations to foster free flows of knowledge. These developments can be observed, for instance, through simple facts like the approval and semi-official recognition of the coffee corner as a place for informal "gossip", discussions and knowledge sharing on the lower organizational levels or the establishment of the position of a chief knowledge officer (CKO) on the level of the top management.

The promotion of knowledge management activities within organizations can be interpreted in terms of sociological institutional analysis as the differentiation of a reference frame that enables productive use of knowledge (i.e. that follows the rational criteria according to the principle idea of knowledge management). This reference frame consists of a mixture of concepts, methods, and instruments to stimulate creation, transfer, conservation, and use of knowledge.[21] While the first wave of knowledge management was extremely driven by technology (yellow maps, ontologies, knowledge data bases, etc.), putting the focus on technology-based creation of intra-organizational knowledge environments, the next wave in knowledge management focuses on human factors and on knowledge transfer on and between vertical (individual, organizational, and societal) and horizontal levels (inter-individual, inter-organizational levels and between societal spheres; see also section 2.5.3). Thus, research and practice increasingly concentrate on knowledge communities and networks. As McDermott (2002: 8) puts it: "Knowledge is the residue of thinking. [...] To share knowledge we need to think together. [...] Sharing knowledge is itself an act of knowing. [...] Knowledge belongs to communities". And he continues: "Only by participating in the knowledge community can we distinguish cutting edge ideas from common ones, revolutionary ideas from conventional wisdom".

2.3.4 Knowledge Management and Sanctioning Mechanisms: In Search of Measuring Knowledge Assets

Processes of institutionalization do not only mean developing their own frame of reference according to their underlying basic idea, but also developing a space which is free of influences and sanctioning mechanisms of other institutions, of

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[21]The four paths for introducing knowledge management in business practice as identified by North and Papp (2000) can be viewed as idealizations only.

other principle ideas and of other reference frames (see Lepsius 1990: 55). This is a prerequisite for the development of their own values, norms and rules, and is accompanied by the development of means for sanctioning deviant behavior not in line with their own rational criteria.

Based on the assumption that it is rational in the context of knowledge management to increase organizational wealth by stimulating environments for creation, knowledge generation, sharing and conservation become a set of values sui generis. All activities that support these values are set free from the influence of other organizational goals (even if the return on investment is to be considered as the "final" goal of all economic action). Following this assumption, the perspective focuses on a set of related values: (1) the measurement of the individual employee's knowledge orientation (creation, use and exchange of knowledge), (2) the measurement of knowledge assets itself, and (3) the performance of the organization that results from these activities (winning strategies for product innovation, competitiveness, market position, market strategies etc.).

From a human centered knowledge management perspective, the focus is put on reward systems and on the organizational "knowledge management culture". Here, reward systems are to be understood in a very broad sense as the whole set of organizational strategies and actions to influence internal human relations and employee's activities. With regard to reward systems in knowledge management, it has become a popular approach to differentiate different types of incentives: intrinsic vs. extrinsic and material vs. immaterial incentives. In the late 1990s, debates arise about methods to increase knowledge exchange through the introduction of market mechanisms in the field of knowledge management practice, i.e. to organize knowledge markets as self-regulating systems for the coordination of knowledge exchange (Davenport and Prusak 1998; North 1999).

2.3.5 Consequences: Technology Orientation and Capitalization of Knowledge

The institutionalization process of knowledge management leads to (1) technology orientation of knowledge management in a first wave and (2) approaches to capitalize knowledge in a second wave.

1. Regarding knowledge management from a historical point of view, it can be conceived as the idea to overcome the limits of information management, which was mainly centered on resources and mere technological solutions. Therefore, a popular approach of knowledge management is to analyze its constitutional components (see section 2.5.2) and then, in business practice, to realize them separately—in most cases by means of technical solutions,

again. But, as McDermott (2002: 9) puts it: "Ironically, while the knowledge revolution is inspired by new information systems, it takes human systems to realize it". Recently, the approach of the so-called "business process oriented knowledge management" (Heisig 2002, 2003; Remus 2002), for instance, shows similar characteristics. Although it suggests a strong orientation toward established organizational processes, its technical perspective loses human needs out of sight. Nevertheless, a variety of efforts toward a holistic view of knowledge management can be found.

2. Discussions about approaches to capitalize knowledge have become popular in the knowledge management debate a few years ago. These approaches aim at measuring knowledge assets on the one hand. From a process orientated perspective on the other hand, they aim at establishing self-regulating coordination systems for knowledge flows. A precondition to introduce market mechanisms for the activities of intra-organizational knowledge transfers is to determine its price. While "[p]rice does not have to be in terms of hard currency", "[i]t is important that it has a well-defined utility value to employees" (Altintepe 2001: footnote 19). Today, strong efforts are being made on the measurement of knowledge, knowledge flows and knowledge management activities. Although a need for measuring knowledge management activities for business evaluation undeniably exists, one big question persists: How is it possible to assign the contribution of individual knowledge management activities (or even of "knowledge artifacts") to the overall organizational performance? Similar questions were addressed already in the early approaches of library, information and documentation science (see, e.g., Wersig 1974 (1971)) and, probably, there will never be an answer to this.

2.3.6 Competition between Principles and other Interdependencies: The Rise of Multiple Conflicts

The introduction of knowledge management activities within organizations has faced a lot of problems and obstacles. To analyze these problems and barriers from the perspective of sociological institutionalization processes, means to investigate the conflicts and interdependencies that are related to competing principle ideas and their dimensions of institutionalization. From a human centered focus on organizational knowledge management, conflicts and interdependencies arise along three dimensions: (1) between the individual human beings within the organization, (2) between the organization and its members, and (3) between social needs and technical solutions.

1. Knowing is a human act. But exchange of individual knowledge as a vital concretion of the principle ideas of knowledge management competes and conflicts with different goals and principle ideas of the individual person (see also Choo 2002: 503-504). Knowledge exchange always involves the sharing of knowledge and thus, giving away personal advantages based on exactly this (originally unshared) knowledge. This leads to the fact that the principle idea of knowledge transfer may conflict with other goals, like monopolizing knowledge, gaining power and influence, or advancing in one's career. But even if people are willing to share knowledge, individual soft skills are necessarily needed: the ability to communicate and to build relationships of trust with others. Moreover, the person who receives someone else's knowledge must be able to integrate the new knowledge into his or her own. This circumstance points, among others, to the debates about knowledge cultures, lifelong learning and beyond.

2. Knowledge management as an institution causes conflicts not only on an inter-individual level, but also between the organization and its members. There is a cycling interplay between individual and organizational knowledge. The individual members of an organization contribute to the knowledge of the organization. This constitutes the organizational knowledge base. At the same time, the total organizational knowledge exceeds the sum of the individual member's knowledge, whereby the individual member participates in the knowledge of the organization. This individual-organizational knowledge cycle gives rise to multiple potential conflicts based on different conflicts of goals, i.e. diverging goals between individual members and their organization. Moreover, beyond a human-centered perspective, conflicts of goals arise on inter-organizational levels (for a discussion on competition vs. co-operation see, e.g., North 1999: 75-78) as well as on societal levels. Additional perspectives may arise with a focus on "virtual" business organization.

3. Two different sets of knowledge management technologies can be identified according to their kind of use. On the one hand, knowledge management technologies can be used to gather, store, and retrieve pieces of knowledge (e.g., knowledge data bases, document or content management systems). This always involves a de-personalization of knowledge (see also Wersig 1996: 209-210). While this process seems to be rational according to the principle ideas of knowledge management, i.e. to systematically make the individual knowledge available to the organization, it produces a deep human-technology gap. On the other hand, technology can support situationally specific communication of knowledge. Use of knowledge management technologies on behalf of inter-personal communication gives a

chance to meet against de-personalization of knowledge and to minimize the human-technology gap. This way, technologies provide tools for better communication, connection of individuals, and at its best, support growth of knowledge communities.

2.3.7 Current State and Future Developments of the Institutionalization of Knowledge Management: Summary and Outlook

Knowledge management has become a buzz phrase during the 1990s. After the hype about knowledge management, the discussions have slowed down. The outline of the development of knowledge management in terms of sociological institutional analysis shows that knowledge management is not a brand new concept although it has reached a very early state of institutionalization until now. Knowledge management seems to be a holistic approach to deal with all organizational knowledge issues, and its institutionalization is starting right now. Recently, its account on organizational performance and its limits started to be revealed and will be revealed even more during the next years. It is more and more agreed on that the perception of knowledge management transcends the organizational perspective and provides a framework to integrate inter-organizational knowledge transfer as well as knowledge transfer in society. The sociological approach to analyze processes of institutionalization provides a theoretical and conceptual framework to systematically analyze the processes, potentials and limits of knowledge management on the different levels and between them: on the individual level, on the organizational level and on the level of society, as well as knowledge transfer between individual, organizational and societal resources.

2.4 Today's Knowledge Management Practices and Future Perspectives – Expert Views

> From a very early age, we are taught to break apart problems, to fragment the world. This apparently makes complex tasks and subjects more manageable, but we pay a hidden, enormous price. We can no longer see the consequences of our actions; we lose our intrinsic sense of connection to the larger whole.
>
> (SENGE 1990: 3)

2.4.1 About the Expert Survey

Goal and Method

The author undertook an expert survey to identify the current state and challenges of knowledge management. This expert survey empirically explores the research topics that have already been theoretically outlined before, focusing on central issues of today's knowledge management and its future perspectives. The exploration tries to grasp the views, conceptions and genuine perspectives of experts on the research topic and with regard to the theoretic foundations of the method development presented in later sections. This is done through a structured expert survey as a focused interview with open questions (see, e.g., Lamnek 1989: 78-80; see also Bogner 2002; Plath 1995). To embed the survey into the theoretically outlined framework as well as into the expert's own realm of specific knowledge (and his or her organizational environment), the survey is arranged according to the different subjects and problems that have been previously identified as central to the study (see also Mayring 1990: 46-50; Merton et al. 1956; Spöhring 1989: 177-181; Witzel 1982; Hoffmann-Riem 1980: 357-359). Topics that go beyond these central issues can be mentioned by the survey participants if they consider them relevant (see also Kohli 1978: 8). The open questions provide keywords to the survey participants that allow for answers within a broad range of possibilities of structurations and subjective interpretations (see Hopf 1978: 99; Kohli 1978: 7; Scheuch 1973 (1967): 121-127; Kromrey 1994 (1980): 426).[22]

Fields of Study

The expert survey was held in two rounds at different points in time. The first round of the survey focused on three central fields of knowledge management: (1)

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[22]For a discussion of the arising difficulties with structured interviews see Hopf (1978: 101-106).

success, challenges and methods of knowledge management, (2) knowledge management in the field of research and development (R & D), and (3) knowledge communities. The second round of the export survey focused on an explorative study of the views and interpretations that expert knowledge management academics and practitioners have of the three distinct concepts of knowledge communities, communities of practice, and knowledge networks. This section outlines results within the first field of the first round, while results of the second field are subject to section 4.2 and findings of the third field are presented in section 3.2. Results of the second round are the focus of section 3.4. An explorative expert survey does not claim to be representative, but tries to identify all aspects that are relevant in the field of analysis. A wide range of diverse participants serves this goal best. It was reached by including knowledge management experts from different fields of expertise, from small, medium and large enterprises and universities, from academia and practice, and it includes all sorts of job positions of the participants. While including a wide range of participants, quality had to be ensured by selecting only participants with a proven expertise and experience in the domain of research. Although this knowledge management expert survey does not present a representative picture, (quantitative) statistical evaluation of this material renders interesting indicative results. Findings presented here indicate the quote (per cent) of given answers to show relevance and popularity of certain fields. Since the survey was based on open questions, the sum of the indicated quotes per question does not equal 100 per cent (each participant could mention different aspects related to one question). Participants indicated from none (= no answer) to 7 different aspects to the open questions. The majority of participants mentioned two different aspects to open questions where multiple answers were allowed.

Period and Type of Data Collection

The first round of the knowledge management expert survey was held from August until September 2003 (for results of the second round see section 3.4). Most of the data was collected on-line, two interviews were conducted by telephone and three others were submitted by fax. The duration of each interview (or filling-out of the questionnaire) was between 7 minutes and 1 hour 35 minutes, depending on the extent and intensity of the answers. 80 per cent of the questionnaires were filled-out in a time between 11 minutes and 58 minutes. On an average all questions were answered in 28 minutes. Taken together, the data of the survey is based on a total of 24 hours and 38 minutes of the participants' time.

Participants

Proven experts in knowledge management were invited to participate in the survey. 42 experts were invited personally by email. In addition, the members of the Berlin KM Group (Wissensmanagement-Stammtisch Berlin, Germany), with about 12 active members, and of the Frankfurt KM Group (Wissensmanagement-Stammtisch Frankfurt am Main, Germany), with about 20 active members, were invited as well as the members of SIG Knowledge Angels (42 registered alumni of the Berlin meeting), SIG CoP (about 55 members) from Knowledgeboard.com and 8 selected participants of the Knowledge Management Summer School 2003 in San Sebastian. A total of 52 knowledge management experts finally participated in the expert survey which is equal to a participation quote of 29.1 per cent.

The participants of the survey work in

- private companies (40.4 per cent),[23]
- universities, including business schools etc. (26.9 per cent),
- other research and service organizations (25 per cent), and
- other organizations (7.7 per cent).

The participants are from organizations of all sizes according to employees

- <10: 17.3 per cent,
- 10 to <50: 9.6 per cent,
- 50 to <250: 28.8 per cent,
- 1000 to <10,000: 9.6 per cent,
- more than 10,000: 17.3 per cent
- not applicable / no answer: 3.8 per cent

and according to sales / business volume

- $\leq$ 2 mill. EUR or US$: 21.2 per cent,
- 2 mill. $\leq$ 10 mill. EUR or US$: 15.4 per cent,
- 10 mill. $\leq$ 50 mill. EUR or US$: 11.5 per cent,
- 50 mill. $\leq$ 100 mill. EUR or US$: 1.9 per cent,
- 100 mill. $\leq$ 1 billion EUR or US$: 7.7 per cent,
- more than 1 billion EUR or US$: 11.5 per cent;
- no answer / not applicable: 3.8 per cent.

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[23]The participants from private companies are mostly from consultancy (47.6 per cent) and IT (19 per cent), moreover from telecommunications (9.5 per cent), chemistry / pharmacy / health / life science (9.5 per cent), transport (9.5 per cent) and finance (4.8 per cent).

50 per cent of the participants have their workplace located in Germany. The other 50 per cent of the participants have their workplace located in other (mainly European) countries: Netherlands (13.5 per cent), UK (7.7 per cent), Finland, Spain, USA (3.8 per cent each) and Austria, Croatia, Greece, Israel, Luxembourg, Poland, Switzerland (1.9 per cent each).

The participants are working as

- project managers (26.9 per cent),
- executive managers (19.2 per cent),
- heads of department (11.5 per cent),
- academic researchers (13.5 per cent),
- consultants and other project workers (9.6 per cent each), or
- freelancers (7.7 per cent)

in

- R & D departments (28.8 per cent),
- university research and teaching (19.2 per cent),
- consultancy and market research (15.4 per cent),
- executive or strategic management and general administration (13.5 per cent),
- IT departments (7.7 per cent),
- HR departments (3,8 per cent);
- no answer / not applicable: 11.5 per cent.

Knowledge management in the focus of different disciplines is reflected by the educational background of the participants who are from

- economics, including business administration (40.4 per cent),
- social sciences (19.2 per cent),
- computer science, including business informatics (11.5 per cent),
- natural sciences (9.6 per cent),
- engineering (7.7 per cent), and
- arts and humanities (3.8 per cent);
- no answer / not applicable: 7.7 per cent.

2.4.2 Central Findings

Central findings of the survey were:

- The most important successes of knowledge management until today were identified in the five central issues of (1) creating awareness of the importance of knowledge and knowledge management, (2) creating awareness

of the primary importance of social aspects in knowledge management, (3) supporting networking and communication processes, (4) advances in knowledge management theory, and (5) design and integration of information technology (IT) solutions in knowledge management.

- Two topics of overall importance were identified as the critical challenges that knowledge management faces today and will face in the near future: (1) knowledge sharing and (2) the development of adequate methods and indicators to measure the benefits of knowledge management activities. Other challenges were identified in the fields of knowledge management theory, organizational culture and the role of higher management, social factors, networking and communication processes, and the use and role of information and communication technologies.

- Although IT solutions for knowledge management played a minor role according to the majority of answers to the questions about successes and challenges of knowledge management, they are still of primary importance for more than a third of the participants as instruments to deal with the challenges mentioned above. According to 34.6 per cent of the participants, integrated, automated and user-friendly IT solutions will play an important role to handle knowledge management in practice. Nevertheless, these findings indicate a clear shift away from technical solutions to social aspects of knowledge management and their purposeful integration into knowledge management practices.

- Most of the participants mentioned methods, measures and instruments to deal with the challenges knowledge management faces today that do not focus on IT solutions but on organizational and managerial instruments as well as on human resource development, facilitation and support of all kinds of inter-personal communication processes and knowledge management culture.

- According to the opinion of almost all participants, knowledge management plays an important or very important role in the field of R & D, especially in the fields of knowledge transfer, efficiency and process optimization, or knowledge and information supply.

- According to the participants' views, the most important role in R & D play networks and communities (84.6 per cent). These particularly include intra- and inter-organizational networks as well as inter-disciplinary networks and knowledge transfer.

- Knowledge communities are estimated by the participants as highly important with regard to the facilitation of knowledge sharing, to exchange experiences and to foster knowledge diffusion as well as to connect people (67.3 per cent). 21.2 per cent of the participants see a superior role of knowledge

communities for innovation, especially through enabling creative spaces, creative chaos and productive environments for innovative knowledge generation as well as a form of social organization to actively influence innovative processes.

2.4.3 Recent Advances of Knowledge Management

The first question of the expert survey was:

As a proven expert you have been working in the field of knowledge management (KM) for some time now. According to your opinion, which are the most important successes of KM until today?

The answers given by the experts focus on five central issues: (1) awareness of the importance of knowledge and knowledge management, (2) awareness of the important role of social aspects in knowledge management, (3) networking and communication processes, (4) aspects of knowledge management theory, and (5) IT solutions in knowledge management.
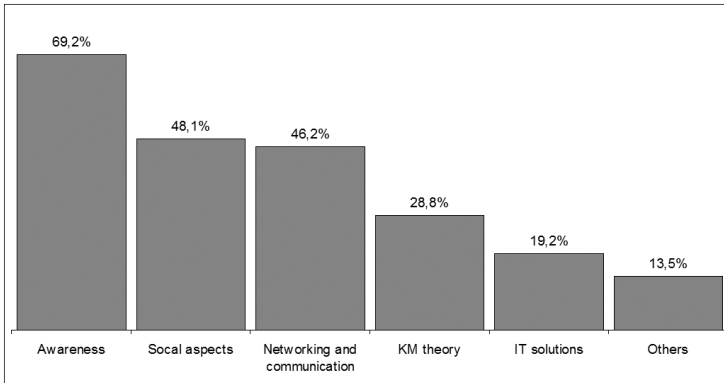

Figure 2.2: Expert Survey: Recent Advances of Knowledge Management

"Awareness" of the value of knowledge and the importance of knowledge management was mentioned by 69.2 per cent of the participants as the most important success of the knowledge management debate until today. This includes awareness of the value of knowledge as a critical factor and resource for the competitive success of an organization which has become "common sense" and the change in attitude toward invisible assets of the company that have been neglected for

a long time in both theory and practice of management (55.8 per cent), growing awareness of the importance of knowledge sharing (13.5 per cent) and awareness of the importance of implicit knowledge and the role of knowledge management to develop methods and tools for the transfer of implicit knowledge (7.7 per cent).

Almost half of the participants (48.1 per cent) mentioned the growing awareness of "social aspects of knowledge management", the growing "human focus" in management theory and practice. 23.1 per cent of the participants literally spoke of the term "human focus": the individual worker as a resource of knowledge ("people are more important than technology", knowledge management "has reinforced the importance of human resource perspectives in organizations"). Other social aspects include increasing the key competencies of the employees and the core competencies of the organization (7.7 per cent), efforts to localize experts (7.7 per cent), development of knowledge management tools and new products based on user (customer) needs (9.6 per cent), growing awareness of the importance of human-computer (or technology in general) interfaces (3.8 per cent), and human-centered methods and instruments to increase innovation orientation and creativity (3.8 per cent). 7.7 per cent mentioned other aspects with a focus on the individual human being, on the individual worker and employee.

46.2 per cent of the participants mentioned "networking", processes of communication and knowledge transfer, and processes of organizational change as fields of success of the knowledge management debate. Besides the already mentioned awareness of the importance of knowledge sharing (13.5 per cent) this especially includes networking activities of experts, co-operations and the creation of communities (15.4 per cent) as well as a general improvement of communication structures and knowledge flows (15.4 per cent), integration of disciplines (3.8 per cent), integration of suppliers and customers (3.8 per cent), and all kinds of other processes of communication, transfer and organizational change (19.2 per cent).

Theoretical aspects and approaches to knowledge and knowledge management were named by more than a quarter of the participants (28.8 per cent). This includes various aspects of theoretical knowledge management approaches (13.5 per cent), theoretical aspects of knowledge (7.7 per cent), the emerging realization that knowledge management is not equal to IT systems and software tools (7.7 per cent), and aspects of knowledge storage (5.8 per cent).

Only 19.2 per cent of the knowledge management experts mentioned aspects of IT solutions as a success of the knowledge management debate. Most of those who mentioned successes in the field of information and communication technologies (ICTs) focused on professionalization, realization of benefits, and awareness of the limits of IT solutions in knowledge management (13.5 per cent).

13.5 per cent of the aspects given as answers cannot be categorized according to the above mentioned central topics. These also include those who cannot see

any successes of the knowledge management debate until today or who even talk of counterproductive results (3.8 per cent).

Results of the expert survey presented above clearly show that creation of awareness of the importance of knowledge and knowledge management for individuals, organizations, and societies and the growing focus on social aspects of knowledge management in practice are considered as the major advances of the knowledge management debate. According to the survey participants, networking issues and aspects of knowledge communication that go far beyond mere IT solutions have become the primary concern of today's knowledge management.

2.4.4 Today's and Tomorrow's Challenges of Knowledge Management

The second question of the expert survey was:

> What are the challenges KM is facing today and will be in the near future?

Asked about the challenges, the answers of the participants focused on five central fields again: (1) knowledge management theory, (2) organizational culture and the role of higher management, (3) social factors, (4) networking and communication processes, and (5) the use and role of information and communication technologies (ICTs). Above all, two single topics were mentioned:

1. 38.5 per cent of the participants focused on knowledge sharing as a great challenge of knowledge management. This includes the creation of an organizational culture ("to create an environment in which knowledge is shared for the benefit of individuals and the organization") (25 per cent), followed by the creation of incentive systems for knowledge sharing (13.5 per cent), knowledge exchange in general (9.6 per cent) and means to promote inter-organizational knowledge exchange (including the whole process chain from suppliers to customers) (3.8 per cent).
2. 32.7 per cent of the participants focused on the development of methods and indicators to measure benefits of knowledge management activities. These include managerial, monetary and non-monetary, quantitative and qualitative methods and indicators to measure the use of knowledge management (return on investment), to monitor and legitimate knowledge management activities and to prove their impact on organizational change and performance.

63.5 per cent of the participants focused on academic challenges in knowledge management theory. As already mentioned above, the development of methods and indicators to measure benefits of knowledge management activities was
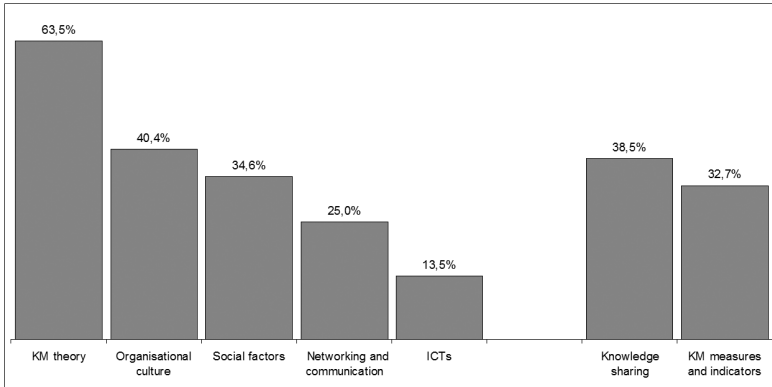
Figure 2.3: Expert Survey: Challenges of Knowledge Management

viewed as a primary challenge by 32.7 per cent of the participants. The second priority challenge according to relative frequency of mentioning was to keep knowledge management on the agenda ("staying focused and avoiding hype") (17.3 per cent). Other challenges mentioned were the development of concrete and experienced methods for practical knowledge management implementation on all levels (individual worker, team, organization, inter-organizational) (11.5 per cent), establishing a holistic approach to knowledge management and recognizing knowledge as a process (11.5 per cent), developing a knowledge management framework with a common terminology and the acceptance of the relevance of knowledge and knowledge sharing for action (5.8 per cent), integrating knowledge management into existing management theories and practices (5.8 per cent), and finally establishing knowledge management as a discipline by its own (3.8 per cent). Various other aspects on theoretical approaches to knowledge management and its further development were mentioned by 7.7 per cent of the participants.

The second central field focused on aspects of organizational culture and the role of higher managerial levels for knowledge management (40.4 per cent). This includes the creation of a knowledge management culture for knowledge sharing as already mentioned above (25 per cent).

"Social factors" of knowledge management were the third central complex of answers given by 34.6 per cent of the participants. This includes the development of incentive systems for knowledge sharing (13.5 per cent) as well as a stronger general focus on social aspects in knowledge management and on human resource management and development which should prevent a predominant focus on tech-

nical knowledge management solutions and ICT systems (11.5 per cent). Also mentioned was the challenge to meet information overload and stress of the individual knowledge worker (5.8 per cent).

"Networking" and processes of communication were the fourth central complex of issues mentioned by 25 per cent of the participants as challenges in knowledge management. These include stronger facilitation of knowledge exchange (9.6 per cent), especially across organizational boundaries (3,8 per cent), identification and facilitation of knowledge sharing, knowledge communication and knowledge generation through social networks (7.7 per cent) as well as the general improvement of information and communication processes (5.8 per cent) and the improvement of knowledge exchange disciplines and between theory and practice (5.8 per cent).

Challenges in the field of ICT systems and technical knowledge management solutions were mentioned by 13.5 per cent of the participants. This includes system automation, automated management of documents and other knowledge assets (5.8 per cent), systematic separation of IT solutions from knowledge management ("the single greatest challenge knowledge management is facing today may be to avoid being identified with operational IT solutions") (5.8 per cent).

2.4.5 Methods, Measures, and Instruments of Knowledge Management

The third question of the expert survey was:

> Which methods, measures, and instruments will be most important for these KM challenges? Please specify your reasons shortly.

Answers to this question are illustrated in figure 2.4 according to frequencies of mentioned methods, measures, and instruments that will be important to meet the current and future challenges of knowledge management.

Although IT solutions for knowledge management played a minor role according to the answers to the first two questions, they still played an important role for more than a third of the participants as instruments to deal with the above mentioned challenges. According to 34.6 per cent of the participants, "integrated", "automated" and "user-friendly" IT solutions will play an important role in the fields of project management, skill management, data management, document management and information management.

Nonetheless, most of the participants mentioned methods, measures and instruments to deal with the challenges knowledge management is facing today that do not focus on IT solutions but on organizational and managerial instruments as well as on measures in the field of human resource development (75 per cent). Methods in the field of human resource management and development were mentioned by 25 per cent. 23.1 per cent of the participants focused on processes of
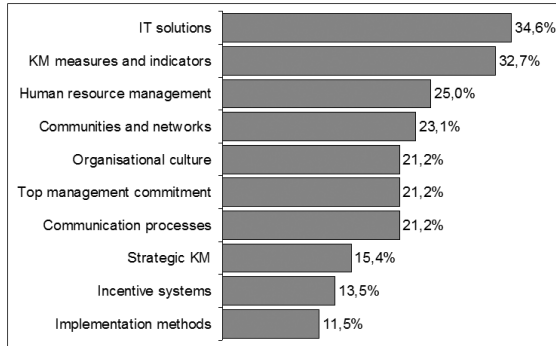
Figure 2.4: Expert Survey: Methods, Measures, and Instruments in Knowledge Management

self-organization through communities and social networks. 21.2 per cent of the participants focused on

- facilitation and support of all kinds of inter-personal communication processes;
- the primary role of the higher management as a role model and enabler of knowledge management, the influence of the higher management on the organizational policy and the strategic orientation toward knowledge management. This also includes demands of the participants to widely establish the staff position of a knowledge manager (like a CKO);
- the creation of a "knowledge management culture", especially to create free spaces for knowledge sharing based on trust, motivation, transparency and rules of conduct.

15.4 per cent of the participants mentioned the strategic orientation toward knowledge management and change management in general, 13.5 per cent mentioned the development of incentive systems to intensify knowledge sharing as primary instruments to cope with the challenges knowledge management is facing today and in the near future.

32.7 per cent of the participants mentioned the development of methods and indicators to measure benefits of knowledge management activities, to measure knowledge assets, and to legitimate knowledge management activities. Methods, instruments, and indicators mentioned include general managerial methods to measure, analyze and manage knowledge assets as well as very concrete in-

struments and methods like balanced scorecards, metrics, social network analysis, audits, collaborative climate index, knowledge maps.

11.5 per cent of the participants focused on the development of implementation methods for knowledge management in organizational practice.

Exploration of methods, measures, and instruments that play a prominent role shows a variety of different approaches that purposefully aim at the various aspects of existing challenges in knowledge management. We cannot find one major focus, but certain main aspects on an aggregated level that aim mainly at the development of measures and indicators for organizational knowledge management, management and facilitation of social processes of knowledge communication and organizational culture, and various kinds of IT solutions.

2.5 Communication and Management of Knowledge

> [...] they had to stop building the tower because of an informational
> disaster—they couldn't talk to each other.
>
> (STEPHENSON 1992: 101)

2.5.1 About Conceptual Approaches to Knowledge Management

In the literature, in academic research, and in organizational practice as well, a variety of conceptualizations, perceptions and interpretations exist of what is known under the label "knowledge management". A clear-cut conceptualization or even implementation can rarely be found. This could be explained by the relative young age of so-called knowledge management as "invented" in the 1990s and the various approaches to its use in theory and practice on the one hand. On the other hand, knowledge management is not only a relatively new field of research and a relatively new method of management practice, moreover, it is not a discipline of research by its own (as wrongly suggested by, e.g., Heckert 2002: 23), but an inter- or better: a trans-disciplinary approach, resulting from the heterogeneity of knowledge, its complexity and diverse conceptions within and between different disciplines.[24] Thus, the introduction of conceptualizations of knowledge management in the following sections does not aim at providing one knowledge management concept, but approach an answer of the question asked by Hull (1998: 25): "How has it become possible for anyone to even *consider* the idea of knowledge management?", as already started with the outline presented in section 2.3.

2.5.2 Components and Practices of Knowledge Management

A common theoretical approach of knowledge management was to analyze its constitutional components and its individual characteristics. The same applies for business practice: facing selected problems with regard to knowledge management, i.e. focusing on individual knowledge management components of knowledge management and implementing solutions, mostly based on information and communication technologies.

Basically, the following components of knowledge management are commonly identified:

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[24] On inter-conceptual approaches as postmodern challenges in science see also Wersig (1993: 164-167) and Wersig (1996: 204-206).

1. generation of (new) knowledge;
2. transfer of knowledge;
3. use of knowledge;
4. conservation and loss of knowledge.

A second layer of components from the individual perspective may be added:

1. knowledge creation;
2. knowledge integration;
3. knowledge sharing.

The conceptualization of knowledge management as individually separate components could be interpreted as a double-layered "knowledge life cycle", presented in figure 2.5. Of course, knowledge-related processes involve changes over time and therefore, models always have a snapshot character, unless they purposefully integrate the dimension of time (from that perspective, the knowledge life cycle becomes more of a spiral over time).
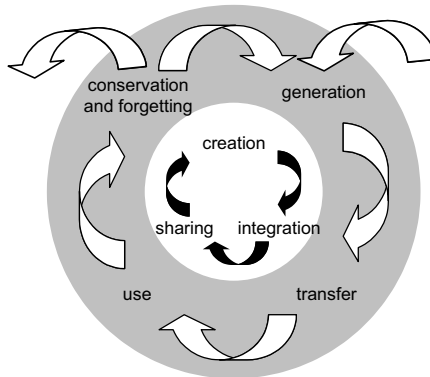

Figure 2.5: Knowledge Life Cycle

The generation of knowledge aims at the creation of new knowledge. Challenges with regard to the generation of new knowledge affect the two different dimensions of (1) availability of knowledge and (2) implementation of new knowledge (see Heckert 2002: 105-106). Transfer of knowledge includes the dissemination of knowledge on different levels (intra- and inter-individual knowledge transfer, intra- and inter-organizational knowledge transfer), between different levels (individual, organization, society) as well as between different disciplines, or between academic research and business practice. Above all, challenges of knowledge transfer include problems of the identification of knowledge (resources) and

of knowledge communication (for a discussion in more detail see section 2.5.4. Use of knowledge is the use of existing knowledge for the development of new products or just for everyday individual or organizational practice, for example. Conservation of knowledge aims at proper storing of knowledge and securing its access in the future. Keywords like explication and codification of knowledge point to only some of the challenges with regard to knowledge conservation. Often neglected, but nonetheless essential for the conceptualization of knowledge processes, is the loss and forgetting of knowledge (on the social construction of forgetting see Shotter 1990; on organizational forgetting see Engeström et al. 1990). Other issues of knowledge conservation, especially those of the conservation of personal knowledge in organizations, are discussed throughout this thesis.

Some authors identify more components than the four outlined above, for example Probst et al. (1997) conceptualize knowledge management as existing of the basic components of (1) goals, (2) identification, (3) acquisition, (4) development, (5) transfer, (6) use, (7) conservation, and (8) evaluation of knowledge. But these conceptualizations of knowledge management components are just an elaboration of knowledge management components in more detail, which can be easily identified as sub-components of the four components above.[25]

The identification of several knowledge management components is helpful for exploring different dimensions of a knowledge life cycle. Unfortunately, it seems to be less helpful to deal with organizational knowledge issues as the slow-down of the first knowledge management hype may indicate. A new approach to deal with organizational knowledge resources (as well as with individual and social knowledge resources) could be "less about applying what you think you know than becoming conscious about what the limits of your knowledge are and how to connect through others to extend one's capabilities" (Smith 2000: 310). This approach is contiguously consistent with the perception of "knowledge as an empirical problem" (as outlined in section 2.2.10). To systematically approach knowledge management from this perspective, Jack Smith (2000: 310, Figure 8) proposes in his outline of transitions and challenges from R & D to strategic knowledge management a "knowledge management matrix" presented in table 2.2.

To approach knowledge management this way might help to take into account what we do not know and the limits of knowledge and thus, to get a better image of our "organizational knowledge map" than blindly focusing on tools and

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[25]In the literature, different conceptualizations of knowledge management components can be found. They identify components in different detail. Another simple conceptualization identifies the components of (1) communication, (2) use, (3) creation, and (4) representation of knowledge, for example. From a social constructivist perspective of knowledge, the conceptualization of the components presented here (generation, transfer, use, conservation) proves to be most useful for analytical purposes as well as for practical needs.

dimension	example
what we know we know	transparent expertise and knowledge
what we know we don't know	lack of expertise for known problems or the development of new solutions
what we don't know we know	hidden expertise
what we don't know we don't know	lack of expertise for unknown problems
what we pretend to know	fake expertise and solutions that do not adequately address problems, for instance, of clients

Table 2.2: Knowledge Management Matrix (Smith 2000: 310, Figure 8, examples added)

instruments of knowledge management without being conscious about its limits, contradictions and dilemmas.

When we look at knowledge management practices (KMPs), we derive a picture that is different from a theoretical analysis of knowledge management components. In 1997, a study by the Ernst & Young Center for Business Innovation, with participants from 431 US-American and European organizations, identified eight categories of knowledge-focused activities (as outlined by Ruggles 1998):

- generating new knowledge,
- accessing valuable knowledge from outside sources,
- using accessible knowledge in decision making,
- embedding knowledge in processes, products, and / or services,
- representing knowledge in documents, databases and software,
- facilitating knowledge growth through culture and incentives,
- transferring existing knowledge into other parts of the organization,
- measuring the value of knowledge assets and / or impact of knowledge management.

Richard Hull, a researcher at the Centre for Research on Innovation and Competition (CRIC) at the University of Manchester, tried to approach knowledge management "practices in general" through an explorative study. He gave up the approach to evaluate validity of the different identified types of knowledge (or knowledge processes), instead he addressed his interview partners with the question: "What happens in practice?" (Hull 1998: 27).

Following Hull (1998: 27-29), knowledge management practices are characterized by four attributes: (1) what process the knowledge is subjected to—or at least, the intended process—, (2) the knowledge domains or topics, (3) the overall strategic rationale, and (4) the format, i.e. its degree of formality. Hull (1998: 29-30) identifies 132 knowledge management practices that could be aggregated to

80 different knowledge management practices. About half of the distinct knowledge management practices identified by Hull are of informal character, i.e. they are ad-hoc, reliant on initiative rather than being directed, or possess a low degree of specification, standardization or specialization (see Hull 1998: 30). Thus, he reveals by the analysis of a large number of case-studies that the popular classification of the four different components of knowledge management presented above provides a poor picture of the empirical practices of knowledge management which are indeed finer-grained and show more diverse characteristics (see Hull 1998: 30). However, in a previous report of the results of these case studies, the knowledge management practices identified are grouped into five main clusters (see Coombs and Hull 1997):

1. R & D management,
2. mapping knowledge relationships,
3. human resource management,
4. managing intellectual property, and
5. information technology management.

These main knowledge management practice clusters are of particular interest for this thesis since they are grouped in terms of the relationships between particular knowledge management practices and some of the main functional activities within processes of innovation. The work presented here especially focuses on theoretic approaches and method development within the cluster of knowledge relationships. As Hull writes in an endnote, this cluster "is not immediately apparent as a main functional activity within innovation processes." He continues: "However, it emerged from our case-studies as a strong focus for a considerable number of activities" (Hull 1998: 29, endnote 47). The persisting relevance of this focus as one of the major challenges of knowledge management and its importance for innovation processes is supported by the findings of the expert survey presented in section 2.4.

2.5.3 The Conceptual Role of Information and Communication Technologies in Knowledge Communication and Management: Limits and Potentials

As outlined in section 2.3, the first wave of knowledge management until the end of the 1990s was characterized through a strong orientation toward (or even an occupation by) solutions based on information and communication technologies (ICTs). Swan and Scarbrough (2002) prove evidence of this finding by a macro-quantitative analysis that tracked the numbers of articles on knowledge management published over an eleven-year period (from 1990 until 2000) in the popular

and academic journals across different professional domains (information technology and systems, organization theory and human resource management, strategy, artificial intelligence, accounting, and "other general management"). As they illustrate their findings, "the IT/IS [information technologies/information systems] community appears as very dominant in the diffusion of KM" (Swan and Scarbrough 2002: 12). More than 41 per cent of all the articles analyzed in the 11-year period were written by and for computer or IT/IS professionals. They speak of the "IT community" (broadly defined as encompassing IT managers, IT suppliers, consultants and academics) as an "important professional patron of KM". And although the general agreement as found in the literature is that technology is only one (of many) enablers for knowledge management, many still shift rapidly to a narrow focus on "KM systems". As a result of this agreement, they identified a second wave of knowledge management in the discourse in the late 1990s, and a backlash of criticism against emphasis on technology. Thus, social and behavioral concerns became much more central to the agenda of knowledge management research and practice. However, they state a broad cleavage between these social approaches to knowledge management and technology oriented solutions: "where these concerns were discussed, there was relatively little reference to IT, except to note its limits. Our analysis suggests, then, a polarization in the literature between 'KM as systems' and 'KM as people'" (Swan and Scarbrough 2002: 12).

To not further reinforce this separation between technology and people that is unhelpful for the actual practice of knowledge management, the conceptual role of information and communication technologies in knowledge management must be acknowledged appropriately, indeed. Although the perspective of this thesis puts its focus on the social aspects of knowledge communication and, according to the knowledge management practices as identified above, information technology management belongs to a different cluster, the importance of information and communication technologies for knowledge management should not be neglected. Therefore, their conceptual role is introduced here very shortly and discussed with regard to its limits and its potentials.

Following Heckert (2002), two approaches of role and use of ICTs in knowledge management can be distinguished according to their focus: the focus can be put on the (1) strategic role of ICTs in knowledge management, or on (2) use and applications of specific ICT instruments for knowledge management tasks. Heckert categorizes the different approaches of Zuboff (1988), Merlyn and Välikangas (1998), and Rehäuser and Krcmar (1994) as approaches focusing on the strategic role of ICTs in knowledge management (see Heckert 2002: 54-59). Zuboff (1988: 10-11) describes two strategies for the use of ICTs called "automating" and "informating" which can be summarized as follows (see Heckert 2002: 54-55):

- "Automating" is the substitution of manpower through ICT systems. With regard to knowledge and its management, "automating" assumes that it is possible to codify existing knowledge and to apply this codified knowledge repetitively. In this context, "automating" aims at increasing efficiency of knowledge application.
- "Informating" relates to the use of information for the development of innovative, i.e. new products and applications. "Informating" as utilization of information is assumed to create new, useful knowledge. Thus, "informating" aims at increasing the knowledge of the employees of an organization and thus, increasing effectiveness.

This approach distinguishes between the use of existing knowledge and the generation of new knowledge. Moreover, as Heckert notes, this approach systematically integrates organizational perspectives (see Heckert 2002: 55) which is an important step toward a holistic concept of knowledge management.

Merlyn and Välikangas (1998) do not provide insights remarkably different from those by Zuboff. While they basically distinguish between information and knowledge technologies, the approach of Rehäuser and Krcmar (Rehäuser and Krcmar 1994) contributes a lot more to an integrative perspective of social aspects and technological aspects of knowledge communication that is fruitful for the further development of this thesis. As outlined by Heckert (2002), Rehäuser and Krcmar (1994: 36) distinguish between three levels of strategic use of ICT systems for knowledge management:

1. application and utilization of knowledge and information,
2. knowledge carriers, information and communication systems,
3. infrastructures for knowledge and information processing and communication.

At the level of application and utilization of knowledge, demand and supply of knowledge are managed. Commonly, this is the task of the upper management in organizations. Information and knowledge resources are management at the medium level. This is subject to the operative management. The lower level provides communication infrastructures and other infrastructures for knowledge and information processing. From a top-down perspective, the higher level specifies its requirements to the level below, while from a bottom-up perspective, the lower level provides support to the level above. Rehäuser and Krcmar do not only integrate different management levels from an organizational perspective but also relating ICT systems. This leads to an integration of the two stages of strategic planning and of operative implementation as well. While this integration must be acknowledged positively, the authors focus only on ICT systems of artificial intelligence but do not discuss utilization of other technologies, especially those of

communication technologies that are central to social aspects of knowledge communication as stated here.

This critical remark leads to the second focus on the role of ICTs in knowledge management: use and applications of specific ICT instruments for knowledge management tasks. Here, this focus is mentioned only very briefly, since a large variety of literature about use of ICT instruments in knowledge management exists (to mention just a small selection, see, e.g., Stein and Zwass 1995; Jacobsen 1996; Borghoff and Pareschi 1998; Gentsch 1999; Thiesse and Bach 1999; for an overview and critical discussion see Heckert 2002: 60-67) and it is not necessarily useful to illustrate it here. On the one hand, most of these approaches focusing on use of ICT systems in knowledge management do not recognize the role of the organizational and management level. On the other hand, most of the ICT systems are not systematically included into the studies but are more or less selected due to pragmatic reasons. According to Heckert (2002: 67-68), the following problem areas can be identified and must be addressed with regard to use and application of specific ICT instruments in knowledge management:

1. concretion of the relation between business processes and knowledge processes,
2. systematic selection and analysis of ICT instruments according to the specified knowledge management tasks,
3. adjustment between utilization of ICT instruments and organizational methods.

To support organizational knowledge communication, social network analysis is a method that helps to address these areas and supports the finding of solutions for use and application of specific ICT instruments (see chapter 5 and particularly table 5.33).

2.5.4 Organizational Knowledge Communication and Knowledge Transfer as the Focal Point of Knowledge Management

The conception of the organization as an evolving system of interactions (see White 1992) puts its focus on communication as the organizational core. Barnard (1951 (1938): 91) already denoted that communication occupies a central place in organizational theory because "structure, extensiveness, and scope of the organization are almost entirely determined by communication techniques". Bavelas and Barrett (1951: 368) concluded that communication "is the essence of organized activity and is the basic process out of which all other functions derive". Rogers (1983: 5) defines communication as the "process in which participants create and share information with one another in order to reach mutual understanding." And

he continues: "This definition implies that communication is a process of con-
vergence (divergence) as two or more individuals exchange information in order
to move toward each other (or apart) in the meanings that they ascribe to certain
events".

In their analysis of knowledge management literature, Swan and Scarbrough
(2002: 11) reveal that the paradox of knowledge management is that "[k]nowledge
[m]anagement itself suffers from the problems it is trying to address—i.e. prob-
lems to do with the distribution and lack of integration of knowledge across, in
this case, disciplinary boundaries". It could be added that the distribution and in-
tegration of knowledge across disciplinary boundaries is an important, but not the
only problem knowledge management tries to address. More general, knowledge
management tries to address the distribution and integration of knowledge across
manifold boundaries. Therefore, knowledge communication and knowledge trans-
fer can be identified as the central task of knowledge management (this argument
is supported, e.g., by Heckert 2002: 111-119).

Difficulties with regard to knowledge communication arise due to the socially
and cognitively bounded nature of knowledge (see 2.2). Moreover, from a purely
technical perspective, difficulties arise with regard to knowledge transportation
between the communication partners, i.e. the codification of knowledge and the
medium of transportation. Kriwet (1997: 178-208) distinguishes three phases of
the knowledge transfer process:

1. preparation (or: initiation),
2. knowledge flow,
3. integration.

Following these three phases of knowledge transfer, on a very simple level the
process of knowledge communication can be conceptualized within the framework
presented in figure 2.6.

Although not clearly referenced by the authors, this framework strongly reminds
us of the early concept of communication structures as formulated Lasswell (1964
(1948)), modified only by additionally taking contextual factors into account. Nev-
ertheless, its simplicity allows us to systematically analyze the different aspects
of knowledge communication as well as tools and methods to support knowl-
edge communications. Thus, barriers of knowledge communication systematically
identified within this framework are (modified and extended version of the scheme
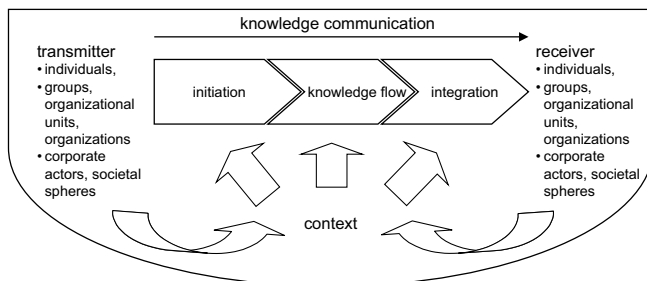presented by Heckert 2002: 113-119):

Figure 2.6: Framework of Knowledge Communication (following the approach by Krogh and Köhne 1998: 238 and its modifications by Heckert 2002: 111)

1. Person-related barriers

   a) Barriers by the transmitter
      - lack of the willingness to share knowledge,
      - lack of the ability to share knowledge,
      - lack of good reputation,
      - lack of trust.

   b) Barriers by the receiver
      - lack of the willingness to absorb new knowledge,
      - lack of the ability to absorb new knowledge,
      - lack of the ability to preserve new knowledge,
      - lack of trust.

2. Knowledge-related barriers
   - (cognitively, organizationally, socially) bounded nature of knowledge,
   - causally determined ambiguity,
   - lack of evidence of utility.

3. Channel-related barriers
   - lack of connectivity and / or common standards,
   - noise,
   - loss of data.

4. Contextual barriers
   - resistant societal setting,
   - resistant organizational setting,
   - resistant social setting (e.g., lack of trust between transmitter and receiver),

- low level of transparency with regard to knowledge resources and deficits,
- lack of resources.

Focusing on knowledge communication and transfer as the central core of knowledge management activities, we need to purposefully address these barriers and try to overcome them by systematic rules:

- Person-related barriers need to be met, for instance, by an organizational "knowledge culture", trust-building activities, team building, communication trainings, localization and transparency of expertise, etc.
- Overcoming knowledge-related barriers aims at methods of knowledge codification, translation, evaluation and integration into knowledge-related processes.
- Channel-related barriers are addressed by suitable infrastructures as well as by information communication tools that facilitate and enable processes of knowledge transfer.
- Contextual barriers exist on the various levels of individual, organizational, and societal relationships and their environments and demand institutional, cultural, and structural rules, solutions, and settings.

Basically, all the above mentioned activities aim at establishing connections and facilitating knowledge communication between the individual members of an organization, between organizational sub-groups and organizations, and between the organization and the various environments. Therefore, overcoming barriers of knowledge communication and transfer means facilitating social networks with regard to their different dimensions as outlined below in the knowledge networks reference model (see section 2.5.5 and table 2.3).

2.5.5 Networks as Institutionalized Intermediaries of Knowledge Communication

Seufert et al. (1999a) construct a knowledge networks reference model (see table 2.3) using Giddens' conceptualization of the duality of structure as outlined in his theory of structuration (Giddens 1984: 25-28; see also Giddens 1979: 1-48). The duality of structure describes the structural properties of social systems as both medium *and* outcome of the practices they recursively organize. Seufert et al. (2003: 110) understand knowledge networks "as a coming together of institutional frameworks (i.e., structures) and modalities or aids, where actors engage in social interactions and in which they conceptualize interaction processes". From this perspective, a referential model of knowledge networks consists of processes and relations between its members, tools and resources that are available

to them, and surrounding facilitation conditions (control mechanisms, operating procedures, norms and rules, and communication patterns).

Building on this model, knowledge management functions as an institutionalized intermediary for knowledge communication on the different levels of the individual worker, the organization and society. Within this model, social network analysis can be applied for studying processes and structures of a knowledge network. Thus, it focuses on the individual network members, their positions and roles, as well as on the relationships between them and the structure of the whole network. Using the knowledge networks reference model, it is obvious that social network analysis is a method for leveraging knowledge communication within social networks (see chapter 5). It provides a basis for decisions on appropriate tools for the use within and the shape of social relationships (knowledge network architecture) and for facilitation of conditions (institutions and environments). Leveraging organizational knowledge communication in social networks means its institutionalization as an intermediary of knowledge communication itself.

Concentrating on the intermediation of knowledge as a central component of knowledge communication, the focus on the individual level is put on the role of knowledge brokers. A variety of literature stresses the importance of knowledge brokers since they play an important role in matching dispersed knowledge sources (see, e.g., Hargadon 2002, or on firms as knowledge brokers see Hargadon 1998) and thus, they foster diversity and new input as critical knowledge resources for innovations. Knowledge brokers facilitate knowledge transfer through a linkage of two or more people. According to Marsden (1982: 202), the process of brokerage is the facilitation of transactions between a person who is lacking access to or the trust of another person by an intermediary person. This perspective is somewhat contradictory to Granovetter's (1973) concept of the "strength of weak ties" since in his concept the weak ties are those that matter to gain access to dispersed resources. Building the role and function of brokerage on the existence of trust means to broker between persons who are strongly tied to the broker—which in return is a constellation of the "forbidden triad" of people (Granovetter 1973: 1363; see also section 4.5.2). This leads to the conclusion, that Marsden's view should be limited on defining brokerage as the sole intermediation of access to certain resources. On the other hand, trust is not necessarily connected with strong relationships but can also exist within weak relationships based on external reference frames of trust, like reputation systems or institutions of trust, for example. It is clear that not every member of an organization is equally well positioned to fulfill the role of a knowledge broker. Different network positions provide different opportunities for the members of its networks to gain access to different knowledge resources (see also Burt (1992) and section 5.7.3).

Environments	**Facilitating conditions**: • (infra)structure • culture • institutions

Processes	**Social relationships**:
	
	• actors:
	    – individual
	    – group
	    – organization
	    – collectives
	    – society
	
	• relationships:
	    – properties
	    – content
	
	• changes:
	    – entrance and exit of actors,
	    – establishment of new and loss of existing relationships

Framework	**Standards, methods, tools**: • common standards (addresses, channels) • organizational methods • information and communication tools

Table 2.3: Knowledge Networks Reference Model
(following with modifications Seufert et al. 1999a: 13)