4 Foundation

Recently, knowledge management has received a lot of attention in scholarly as well as in practitioner-oriented literature and in professional services companies as well as in business organizations of all industrial sectors. Due to the large demand for concepts and theories to support a systematic intervention into the way an organization handles knowledge, the field has attracted researchers from different disciplines and has absorbed a wide array of research questions and approaches to solve these questions. This chapter is devoted to give an overview of the roots of knowledge management, the historical development of the literature and practice in some of its predecessors, especially organizational learning and organizational memory approaches.

Having set the perspective on knowledge management with ICT as the enabling factor, the term knowledge will be discussed as it is used in knowledge management. Research on the term knowledge has a long tradition in philosophy, but also in the social sciences. A brief historical overview shows the influences of various disciplines on the view of knowledge as taken in knowledge management. Then, several classifications of knowledge will help to define what exactly it is that is addressed in a knowledge management system and what consequences different perspectives have on their design.

The chapter then turns to knowledge management systems and sets the definitional focus for this book on the basis of a brief historical review of the technological roots of these systems. ICT in general and KMS in particular play the role of an enabling technology for knowledge management, but have to be viewed as only one part in an integrated, holistic knowledge management initiative (McDermott 1999a). Thus, strategic, organizational and economical issues of the use of KMS have to be discussed in the later chapters of this book[1].

4.1 Knowledge management

The importance of knowledge for societies in general and organizations in particular is rarely questioned and has been studied for a long time[2]. Thus, it is not surprising that the field of knowledge management has drawn insights, ideas, theories, metaphors and approaches from diverse disciplines. This section briefly reviews the history of knowledge management. The tracing of the roots helps to understand the perspective which knowledge management has or can have on organizations.

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1. See chapters 5 - “Strategy” on page 93, 6 - “Organization” on page 153 and 8 - “Economics” on page 395. A detailed discussion of knowledge management systems, their architecture, functions contents and a classification can be found in chapter 7 - “Systems” on page 273.
2. The foundation for the Western thinking about knowledge can be traced back to the Greek philosophy, Heraclitus, Sokrates, Plato and Aristoteles, see also section 4.2 - “Knowledge” on page 60.

4.1.1 From organizational learning to knowledge management

The roots of the term knowledge management can be traced back to the late 60s and the early 70s in the Anglo-American literature (Zand 1969, Rickson 1976). However, although Zand strikingly closely foresaw the emergence of the knowledge society, the transition to knowledge workers and the huge changes that would be required to manage this new type of knowledge organization in his 1969 article, he did not exactly speak of knowledge management, but of *management of the knowledge organization*. And Rickson, a sociologist, actually used the term knowledge management, but in a different context. He studied the role that big industrial corporations played in the creation and application of technical knowledge on the aggregated level of society. Thus, the term knowledge management was used to analyze the processes of development and application of knowledge *in societies*, not organizations. Thus, it is not surprising that the term did not get much resonance and was neither used in theoretical nor in practitioner-oriented literature. It took almost 20 years until the term emerged again in the mid 80s in the context as it is still used today (e.g., Sveiby/Lloyd 1987, Wiig 1988, 104ff[3]). This time it got a tremendous amount of attention.

The underlying concepts used and applied in knowledge management, though, have been around for quite some time. There have been a large number of fields and disciplines dealing with the handling of e.g., knowledge, intelligence, innovation, change or learning in organizations. It is important to analyze the literature from these fields and disciplines that may provide a number of concepts useful for KM (also e.g., Teece 1998a, 289). However, it is the *organizational learning* literature and tradition and its more recent structural counterpart—the *organizational memory* or the *organizational knowledge base*—that influenced knowledge management most.

Various management approaches and scientific disciplines have played a role in the development of the theory of organizational learning and organizational memory, some of which enjoy a long and respected tradition of their own. The most profound effects have come from the following research disciplines[4]: organization science and human resource management (HRM), computer science and management information systems, management science, psychology and sociology.

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3. Many early ideas can be traced back to a series of roundtable conferences with the title *Managing Knowledge Assets into the 21st Century* started in 1987 and hosted by Digital Equipment Corporation (DEC) and the Technology Transfer Society at Purdue University (Wiig 1997b, 10, Amidon 1999, 15). One of the first published documents that presents a general KM concept was a keynote address given at the Technology Assessment and Management Conference of the Gottlieb Duttweiler Institute Rüschlikon/Zurich (CH) in late 1986 by Karl M. Wiig (Wiig 1988). At about the same time, Karl Erik Sveiby and his colleagues Anders Riesling and Tom Lloyd (Sveiby/Lloyd 1987) published their book *Managing know-how.* The book contains a number of early ideas on knowledge management and particularly on the intellectual capital approach developed from 1983 on as a Swedish-English cooperation based on the analysis of several hundred "know-how organizations". The results of this analysis influenced many Scandinavian companies (the best known being Skandia, Sveiby 1998, 254ff).

Within these disciplines, several fields can be distinguished that have had a profound impact on knowledge management. These will be discussed in the following.

4.1.1.1 Organization science and human resource management

Organization science has a long tradition in looking at organizational change processes from a variety of perspectives. The most important influences on knowledge management come from the fields organizational change and the management of change, from organizational development, particularly from organizational learning and organizational memory, from organizational intelligence, organizational culture and from theories of the evolution of organizations. Additionally, the field of knowledge management is based on approaches from HRM that have a long research tradition in areas highly relevant for KM such as developing employee's skills, recruiting and retaining talent.

Organizational change, management of change. Generally, a large number of approaches in organization science are concerned with changes within organizations and changes of organizations. Organization scientists' interest in change has risen steadily during the last 25 years. There are many schools of thought in organizational change. Examples are the natural selection view, the system-structural view, the strategic choice view and the collective-action view (Wiegand 1996, 85). Within these schools of thought there are various fields some of which are described in more detail subsequently: e.g., organizational development, organizational learning, theories of the evolution of organizations, and management theories such as innovation management. Theories and approaches of organizational change can be characterized by (1) the extent of change they conceptualize (first order versus second order change), (2) the change processes and (3) factors that trigger or influence change (Wiegand 1996, 155ff).

Organization development (OD). OD is a long-range effort to improve an organization's problem-solving and renewal processes with respect to personal, interpersonal, structural, cultural and technological aspects. This is achieved particularly through a more effective and collaborative management of organization culture with special emphasis on the culture of formal work teams. OD efforts are initiated by consulting and planned by management with the assistance of a change agent, or catalyst, and the use of the theory and technology of applied behavioral science, including action research (French/Bell 1978, 14). Building on Lewin's well-known phases of social change—unfreeze, change (move), refreeze (Lewin 1947, 34f)—OD has the individual as the most important element of organizations and intends to improve participation, learning through experience, development of personality

4. For an overview of some of the roots of knowledge management or the two most prominent underlying concepts organizational learning and organizational memory e.g., Huber 1991, Frese 1992, Lehner et al. 1995, 165ff, Nonaka/Takeuchi 1995, 1997, Schüppel 1996, 13ff and 186f, Spender 1996, Wiegand 1996, 77ff, Kieser 1999, 133ff, 253ff, Tuomi 1999, 21ff, Lehner 2000, Roehl 2000, 88ff.

of the individuals and performance and flexibility of the organization[5]. Among other characteristics specific to OD (French/Bell 1978, 18) is the distinction between a *change agent* and a *client system* with the first being the catalyst to support the planned change of the second, the social system, which actively participates in the change process (Thom 1992, 1479).

Over time, the concepts and approaches discussed under the term organization development have varied increasingly which has rendered a clear definition of the field virtually impossible.

Organizational learning (OL). Even though OL has emerged as a field only in the 70s and 80s itself, it soon became a recognized way of looking at change processes in organizations[6]. Many authors explicitly base their theories in part on concepts of the sociology of knowledge. OL theories and approaches can be classified according to the primary theoretical orientations as found in the literature body of organizational science: behaviorist theories, cognitive theories, personality/dominance oriented theories, systemic theories (Schüppel 1996, 14).

These different theoretical perspectives share the common hypothesis that phenomena of change in organizations are connected with collective or inter-personal processes of learning. The definitions of OL differ with respect to the question whether behavioral change is required for learning or whether new ways of thinking and, thus, new possibilities for action, are enough. "An entity learns if, through its processing of information, the range of its potential behaviors is changed" (Huber 1991, 89) is an example for the first category. Entity in this definition can refer to a human, a group, an organization, an industry or a society. "First, organizational learning occurs through shared insights, knowledge, and mental models [...] Second, learning builds on past knowledge and experience—that is, on [organizational] memory" (Stata 1989, 64) is an example for the second category.

There are clear differences between traditional organization development and OL. For example in OL, change is considered the rule, not the exception as in OD. OL views change as endogenous, as part of the organization's processes, and the—indirect—management of change is considered an organizational competence in OL rather than an (external) expert's competence as in OD (also Schreyögg/Noss 1995, 178ff). However, it is hard to clearly distinguish between modern OD and OL approaches as modern OD approaches consider some of the earlier critics to OD. In spite of the different perspective on change, OD concepts—and their per-

5. See for example Trebesch 1980, 1982 for a comprehensive list of OD definitions and approaches, French/Bell 1978, 14ff, Wohlgemuth 1981, 51ff, Thom 1992, Wiegand 1996, 146, Schubert 1998, 19ff.
6. For early approaches on organizational learning see e.g., Cyert/March 1963, March/Olsen 1976, 54ff, Argyris/Schön 1978, Duncan/Weiss 1979, Jelinek 1979; see also e.g., Stata 1989, Brown/Duguid 1991, Geißler 1991, Reber 1992, Kim 1993, Probst/Büchel 1994, Geißler 1995, Nevis et al. 1995, Geller 1996, Wahren 1996, Wiegand 1996, Klimecki/Thomae 1997, Pawlowsky 1998a, Schreyögg/Eberl 1998, Crossan et al. 1999, Kieser et al. 1999, Nothhelfer 1999, Wilkesmann 1999.

ceived limitations—can be seen as one of the most important driving forces of OL (Wiegand 1996, 146ff).

OL processes aim at the connection of individual knowledge into organizational knowledge and can be classified into *micro-organizational learning* (i.e., learning in groups) and *macro-organizational learning* (i.e., learning on the organizational level, Reber 1992, 1247ff). Individual experiences and learning potentials are organizationally connected mostly in groups which represent the smallest micro-social unit of organizational learning. The macrostructure represents the core of OL. It connects the groups' learning results and thus turns individual and microsocial learning results into organizational learning success (Reber 1992, 1243). From a management perspective, OL approaches provide concepts, methods and instruments to support organized *collective learning (processes) in organizations* (Wilkesmann 1999, 15ff).

The term *learning organization* was coined in order to stress an organization's skills in performing organizational learning[7], in more detail: its "skills at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights" (Garvin 1993, 80). This definition already shows how closely later OL or LO approaches resemble to the early definitions of knowledge management[8].

Organizational memory (OM). The basic idea of the organizational memory[9] approach, also called *corporate memory*[10]*, organizational knowledge base*[11] or an *organization's DNA*[12] is as follows[13]: Learning, no matter whether individual or organizational, is not possible without memory. In general, the term memory is defined as a system capable of storing things perceived, experienced or self-constructed beyond the duration of actual occurrence, and of retrieving them at a later point in time (Maier/Lehner 2000, 685). Using this metaphor, organizational memory is repeatedly proposed as a prerequisite for organizational learning as the corresponding individual memory is a prerequisite for learning of individuals.

As with many metaphors, the analogy between organizational and individual memory is a weak one and the corresponding processes are entirely different on the individual versus on the organizational level. Thus, the intuitive understanding of the term organizational memory is often misleading, e.g., regarding the OM as a

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7. See e.g., Senge 1990, 1990a, Garvin 1993, 80ff, Schreyögg/Noss 1995, 176ff, Lang/Amelingmeyer 1996, Güldenberg 1997, 105ff, Wieselhuber et al. 1997.
8. See section 4.1.4 - "Definition" on page 52.
9. See e.g., Hedberg 1981, Nelson/Winter 1982, 99ff, Huber 1991, 90, Walsh/Ungson 1991, 61ff, Sandoe/Olfman 1992, Kim 1993, 43, Stein 1995, Stein/Zwass 1995, Walsh 1995, Buckingham Shum 1998, Eulgem 1998, 144ff, Herterich 1998, Eulgem 1999, Cross/Baird 2000, Lehner 2000, 160ff.
10. See e.g., Kühn/Abecker 1997, Dieng et al. 1998.
11. See e.g., Duncan/Weiss 1979, 86f, Pautzke 1989, Müller-Stewens/Pautzke 1991, 192, Probst/Büchel 1994, 17ff, Amelingmeyer 2000, 39ff.
12. See Spear/Bowen 1999.
13. For the following explanation of organizational memory see also Lehner 2000, 75ff, Maier/Lehner 2000.

"brain" to which organizations have access or the more technical interpretation which uses the often cited, but nevertheless in many respects unsuited analogy between computers and brains[14]. The term is simply meant to imply that the organization's employees, written records, or data contain knowledge that is readily accessible (Oberschulte 1996, 53). However, this static definition of memory is not very useful in the context of OL. Emphasis has shifted to active memory—that parts of the OM that define what an organization pays attention to, how it chooses to act, and what it chooses to remember from its experience: the individual and shared mental models (Kim 1993, 43f).

Moreover, the static perspective does not take communication into account. Communication is the central constituting factor determining social systems in general and organizations in particular[15] and the complex phenomena taking place when groups or organizations jointly "process" knowledge[16]. Many approaches have been developed which claim to guide organizations to use their common or shared memory in a more efficient way[17]. Existing approaches focus on organizational issues and consider the OM as a resource, which has to be managed like capital or labor (e.g., Lehner 2000).

Organizational intelligence (OI). The OI approach[18], also called *competitive intelligence*[19] or *enterprise intelligence*[20] provides a slightly different focus on organizational information processing than OL with an emphasis on collective processing of information and decision making (Lehner et al. 1995, 241ff) or, alternatively, on the organization's ability to learn, the organizational knowledge and the organizational memory (Oberschulte 1996, 46ff).

Organizational culture. Concepts, such as trust, norms and standards, unwritten rules, symbols or artifacts, are investigated under the lens of organizational culture. These concepts are shared by the members of an organization and provide orientation in a complex world. Organizational culture is to a large extent an implicit phenomenon and thus hardly observable and up to interpretation (Schein 1984, Schreyögg 1992, 1526). It is the result of a learning process and is handed on to new members of the organization in a process of socialization (Schreyögg 1992, 1526). Organizational culture impacts the behavior of members of the organization

14. See e.g., Spitzer 1996, 12ff and 209ff who compares the functioning of computers and of brains.
15. See Luhmann's definitions of social system and organization (Luhmann 2000, 59); see also Krause (1999, 26ff and 39f).
16. See for example the interesting concepts and theories regarding e.g., transactive memory systems (Wegner 1986), group remembering (Hartwick et al. 1982), and the social cognition theory (Pryor/Ostrom 1986); see also Kim 1993, 43ff, Maier/Kunz 1997, 5ff.
17. See also section 4.3 - "Knowledge management systems" on page 82.
18. See e.g., Matsuda 1992, Müller-Merbach 1996, 1998, 1999, Oberschulte 1996, Schuhmann/Schwaninger 1999, Tuomi 1999, 22ff, also mentioned in March/Olsen 1976, 54 and Huber 1990.
19. See e.g., Vedder et al. 1999, 109.
20. See e.g., Jacobsen 1996.

in general and—in this context of particular interest—their willingness to share knowledge (e.g., Hofstede et al. 1990). A supportive organizational culture is considered one of the most important success factors for faster organizational learning (Schein 1993) or the implementation of a KM initiative (e.g., Davenport et al. 1998). It positively affects knowledge creation and especially knowledge sharing, even across sub-cultures, such as the ones of executives, engineers and operators (Schein 1996). A supportive organizational culture has been conceptualized as a resource[21] reflecting the character of social relations within the organization: organizational *social capital* (Leana/van Buren 1999). However, the concept is only vaguely defined and it remains largely uncertain if, how and to what extent organizational culture can be assessed and influenced in a systematic way (for a critic e.g., Drumm 1991).

Theories of the evolution of organizations. This field comprises a large number of approaches which apply for example evolution theories originally developed in the disciplines philosophy, biology[22] and the social sciences to organizations. Examples are the population-ecology approach, approaches describing the internal evolution of organizations, approaches to describe the long-term evolution of organizations, self-organizing systems and evolutionary management[23]. Early evolution theoretic concepts disregarded learning processes because structural inertia hindered organizations from (risky) changes. However, later approaches have taken critics into account and provide concepts for the explanation of possible processes and effects of organizational learning and knowledge management as well as of the sometimes positive effects of inertia with the help of the concepts variation, (goal-oriented) selection, retention and isolation.

A particularly interesting concept within the theories of evolution of organizations is the concept of *organized chaos* which postulates that management should draw its attention to the organization's perception of relevant environmental changes, their (internal) communication and processing. Chaos theory is applied in that quick changes in organizations require quantum leaps (small cause, great effect). This includes viewing organizations as open social systems where manag-

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21. See also the resource-based view in strategic management discussed in section 5.1.1 - "From market-based to knowledge-based view" on page 94.
22. The biological theory of evolution (Wallace, Darwin) was based on earlier work on evolution theories by philosophers and social scientists (Mandeville, Hume, Adam Smith, Ferguson). The success of the biological theory of evolution motivated the development of an abstract, general *synthetic evolution theory* which can be applied to generally explain phenomena of adapting development, not only biological phenomena. The biological theory of evolution in the 20th century was widely used as a model for evolution theories in the social sciences, e.g., anthropological approaches, macro-sociological approaches, approaches describing the evolution of behavior and sociobiological approaches. These approaches represent the basis on which theories of the evolution of organizations are built (Segler 1985, 88ff, Kieser 1992, 1758ff, Hayek 1996, 103ff).
23. See e.g., Weick 1969, 54ff, Greiner 1972, Hannan/Freeman 1977, 1984, McKelvey/Aldrich 1983, Astley 1985, Segler 1985, 168ff, Maturana/Varela 1987, Probst 1987, Ulrich/Probst 1988, Lutz 1991, 105ff, Kieser 1992, 1999, 253ff, Wiegand 1996, 93ff, Weibler/Deeg 1999.

ers have to "manage self-organization" in the sense that they encourage structures and a culture which are suited for the observation of the market and for the implementation of the necessary organizational changes (Heitger 1991, 118ff). Thus, the concept is closely related to self-organizing systems.

Human resource management (HRM). In addition to theories and approaches of organization science which explain the behavior of social systems, people-oriented approaches represent a central element in KM. Employees create, hold and apply knowledge. New employees bring their knowledge and ideas to an organization. Individuals that are already members of the organization learn individually as well as in teams and networks and participate in organizational training and development programs. Employees who leave the organization take their knowledge with them. These are only some examples where HRM strongly interrelates with knowledge management[24], provides concepts for a strategic knowledge or competence management or is even transformed into a knowledge- or competence-oriented HRM (Bruch 1999, 132f and 137ff).

HRM in an institutional sense denotes an organizational subsystem (e.g., HRM department) that prepares, makes and implements personnel decisions which are economically legitimated, basically to secure availability and effectiveness of personnel (Kossbiel/Spengler 1992, 1950). HRM provides concepts and approaches to describe functions such as planning of personnel demand, selection/recruiting, training and development, compensation and benefits as well as outplacing of individuals and to explain for example individual behavior, motivation, performance, leadership (e.g., Staehle 1991, 718ff, Drumm 2000) which all influence the handling of knowledge in organizations. Moreover, it is the personnel development function of HRM which is affected most by concepts of OL and KM. Examples are the recent founding of corporate universities in business organizations, e.g., at Lufthansa or DaimlerChrysler, aiming at an integration of these concepts into institutionalized personnel development (e.g., Heuser 1999).

On the other hand, HRM can help to identify the crucial knowledge base, knowledge barriers and gaps as needed to define a KM strategy (e.g., Ryan 1995, 9). OL and KM approaches tend to use a decentralized approach to personnel development with an emphasis on individual members of the organization and collectives. Examples for collectives are work groups, teams as well as networks and communities in which members learn on the job, share knowledge and thus learn from each other. At least in a more centralized implementation of KM strategies, a systematic, methodical planning of education and training measures will still be a necessity and thus require traditional HRM in an institutionalized sense (Drumm 2000, 414f). HRM then shares a great part of its responsibilities with an enterprise-wide KM initiative (Wiig 1999, 159). HRM departments might be well positioned e.g., for knowledge identification and mapping, to identify knowledge gaps and

24. See e.g., Freimuth et al. 1997, Sattelberger 1999, 18ff and 149ff, Bullinger et al. 2000, 79f, Vorbeck/Finke 2001a; for an overview of HRM software to support KM see Koubek et al. 2000.

barriers, for general education and training programs and to foster an organizational culture supportive for KM and thus ensure the success of KM initiatives (Soliman/Spooner 2000, 337 and 343f).

4.1.1.2 Computer science and management information systems

Information and communication technology represents a key enabler for knowledge management initiatives[25]. Consequently, both, computer scientists and MIS researchers show substantial interest in the field. This is especially true for both, researchers and practitioners in the field of AI who have changed their research focus from expert and knowledge-based systems to knowledge management systems. The theory most notably used as the underlying basis of socio-technical system research in general is systems theory. Additionally, the perspective on organizations as knowledge processing systems provides useful insights for knowledge management.

Information processing approach. This approach views organizations as knowledge and/or information processing systems[26] and develops a model explaining individual behavior (e.g., problem solving, decision making) based on findings of cognitive psychology using concepts such as attitude, personality and definition of the situation as well as short term and long term memory[27] (Kirsch 1970, Reber 1973, 354ff). Thus, individuals are considered as information processing systems. The information processing approach has influenced MIS views substantially. Even though it is hard, if not impossible, to translate these concepts to organizational information or knowledge processing, some of the ideas can be used to frame the context for individuals participating in OL or KM initiatives. An example is the similarity of individual attitudes and possibly the joint definition of situations within a community or network[28].

Systems theory. Concepts of systems theory provide the (implicit or explicit) basis for many investigations, theories and concepts developed within computer science and MIS, e.g., in order to explain the application of technology, particularly information and communication technology, in organizations. Systems theory is an entire scientific discipline that aims at the formulation of general laws and rules about states and behaviors of systems (Heinrich/Roithmayr 1989, 459). In its modern form, systems theory and cybernetics can be traced back to the works of von Bertalanffy (1949) and Wiener (1948). Systems theory studies the static structures as well as dynamics and functions of closed and open systems (Lehmann 1992, 1839ff). The term *system* is used in a variety of ways within systems theory, although there is a common core that views a system as a set of elements that can

25. See also section 4.3 - “Knowledge management systems” on page 82.
26. In German: Informationsverarbeitungsansatz; introduced into business administration theory in German speaking countries by Kirsch (1970).
27. In German: *Einstellung*, *Persönlichkeit*, *Definition der Situation, Kurzzeit-* and *Langzeitgedächtnis*.
28. See also section 6.1.3 - “Groups, teams and communities” on page 177.

be described with attributes and relationships which determine the states and behavior of the system and can be characterized by the exchange of energy, matter and information (Lehmann 1992, 1839). The extensive literature on systems theory has received much attention within e.g., information management (e.g., Heinrich 1996, 23), systems analysis and design, system dynamics and socio-technical systems theory (e.g., Heinrich 1994). The latter has also been used by some authors in order to reframe existing research questions in knowledge management, such as the "processing" of knowledge in technology-equipped social systems (e.g., Spender 1996a, 54ff).

Artificial intelligence (AI). Together with its psychological sibling, the *cognitive sciences*, the field of artificial intelligence has tried to establish the analogy between human and computer problem solving[29]. The promise in the 50s, 60s and 70s of the last century was that in a matter of years we would see machines that could think and that were as intelligent as human beings (e.g., Dreyfus/Dreyfus 1986). As a consequence, there were substantial philosophical questions to be discussed. For example, knowledge would no longer be bound to individuals, machine learning would resemble human learning. However, even though there were significant success stories about the use of specialized *expert or knowledge-based systems* mainly in the 80s[30] and even though there is still research going on trying to build thinking machines, the original AI research goals were abandoned to a large extent. Instead of trying to build androids or general problem solvers, most AI research institutes nowadays apply AI methods, tools and techniques, e.g., mathematical logics, pattern recognition and search heuristics, to a wide variety of problem domains, e.g., image processing, robotics, speech analysis, expert systems (Heinrich/Roithmayr 1989, 285).

Recently, knowledge management has gained increasing attention as one of these problem domains[31]. Advanced AI technologies, such as neural networks, genetic algorithms and intelligent agents, are readily available to provide "intelligent" tools e.g., for semantic text analysis, text mining, user profiling, pattern matching. Packaged in comprehensive KMS solutions, these tools can be considered as technologies enabling organization-wide support for the handling of knowledge and, thus, for knowledge management.

4.1.1.3 Management science

As pointed out in the introduction[32], the transformation of businesses into knowledge-based or knowledge-intensive businesses and intelligent organizations also has a profound impact on organizations in general and management in particular.

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29. See e.g., the architectures of general systems and computer simulations trying to explain cognition in Anderson 1983, 2ff.
30. See e.g., Hertz 1988, Kleinhans 1989, 49ff for an overview of the use of AI technologies and expert systems for businesses.
31. For a detailed analysis of the relationship between knowledge-based systems and KM see Hendriks/Vriens 1999.
32. See chapter 1 - "Motivation" on page 1.

Due to the importance of these developments, a number of authors have attempted to make knowledge the basis of a new theory of the firm (e.g., Spender 1996a). During the last decade, knowledge and competencies have also been investigated in strategic management as the resource-based view of an organization. In addition to strategic management, other management approaches and concepts also influence knowledge management which is by definition a management function itself.

Strategic management. The concept of strategic management determines the long-term goals and positioning of an organization, its policies as well as instruments and ways to achieve these goals (e.g., Staehle 1991, 563) and is based on the concept of planned evolution (Staehle 1991, 571). It encompasses strategy formulation, implementation and evaluation and has, as an ultimate objective, the development of corporate values, managerial capabilities, organizational responsibilities, and administrative systems which link strategic and operational decision-making, at all hierarchical levels (Hax/Majluf 1984, 72). On the basis of the resource-based view of the organization (Wernerfelt 1984, Grant 1991), several authors conceptualized the strategic relevance of knowledge in general and knowledge management in particular.

Knowledge in this view is a strategic asset (e.g., Zack 1999c, vii) or the principal productive resource of the firm (Grant 1996a, 385), and an organization's speed and efficiency in integrating knowledge and in extending its knowledge base, termed the organizational capability, is critical for creating competitive advantage (Grant 1996a, 385). Resources in general and knowledge—or competencies—in particular have to be valuable, rare, inimitable and reasonably durable in order to provide sustained competitive advantage[33].

Thus, knowledge management comprises the organization's ability—or capability—to create and sustain the knowledge resource (von Krogh/Venzin 1995). A knowledge strategy (e.g., Bierly/Chakrabarti 1996) or knowledge management strategy has been seen either as an (important or principal) part of the business strategy or as a perspective in its own right suggesting to view organizations as networks of (core) competencies (Prahalad/Hamel 1990): the knowledge-based view of the organization[34].

Other management approaches. There are a number of management concepts, theories and approaches that focus certain aspects of knowledge management, such as *innovation management* (e.g., Hauschildt 1993) or *management of change*[35]. Other management approaches provide an alternative view on management, such as *systemic or system-oriented management* and *evolutionary management* (e.g., Ulrich/Probst 1988). For example the *"management by" approach* provides a

33. See Barney 1991, 106ff; see also chapter 5 - "Strategy" on page 93.
34. See e.g., Grant 1996b, Spender 1996a, Zack 1999b, see also section 5.1.1 - "From market-based to knowledge-based view" on page 94.
35. Management of change has strong interdependencies with organization science, see section 4.1.1.1 - "Organization science and human resource management" on page 23.

framework for the development of managerial systems to integrate knowledge-oriented aspects into management instruments. One representative of the management by approaches, the management by objectives (MbO) approach (e.g., Odiorne 1971, Staehle 1991, 892), was extended to the definition of knowledge goals and was called the management by knowledge objectives (MbKO) approach (Probst et al. 1998, 88ff).

4.1.1.4 Psychology and sociology

Organizations have long been the central focus of active fields of psychology and sociology, called organizational psychology and organizational sociology. The fields deal with behavior of human beings in organizations from an individual and a collective perspective. Many concepts and ideas have found their way from organizational psychology and sociology into organization science in general and more recently into knowledge management. Additionally, the concepts developed in the sociology of knowledge provide a basis for the explanation of socially constructed knowledge as used in organizations which can be found frequently as the underlying implicit foundation of KM approaches.

Organizational psychology. The field has its roots in the mid 60s in the works of e.g., Katz and Kahn (1966), Pugh (1966), Bass (1965) and Schein (1965). It gained massive attention in the 70s and 80s, as a shift from an exclusive focus on individual behavior in work settings towards a more broadly defined contextual framework was proposed[36]. Organizational psychology studies human behavior and experience in organizational settings and explicitly considers the system characteristics of organizations with different levels of abstraction—individual, group or subsystem and organization[37]. Organizational psychology is sometimes also termed *sociological psychology* (e.g., Berger/Luckmann 1967, 186) and *social psychology of organizing/in organizations* (Weick 1969, 1995, Murninghan 1993). The latter combines the study of individuals with an emphasis on context, e.g., in the form of other individuals, their immediate space, the greater society, to study organizations and organizational phenomena (Murninghan 1993, 1). Last but not least, in the mid 80s a new area of cognitive psychology emerged which is called *knowledge psychology*. This field can be characterized by its close ties to computer science in general and artificial intelligence in particular (Spada/Mandl 1988).

Organizational sociology. This field of sociology analyzes the structural similarities of organizations which are seen as social systems of activity (Pfeiffer 1976, 9). Organizational sociology shares its research object—the organization—with many other fields and even disciplines, and is thus in itself, though tied to sociology, an interdisciplinary field. The boundaries, notably to organizational psychology, are blurred and at least in the 60s the two terms were in some cases used to denote the

36. See Nicholson/Wall 1982a, 6 and the literature cited there.
37. See Nicholson/Wall 1982a, 6ff; see also Gebert/Rosenstiel 1996 for an overview of organizational psychology.

same area (Shimmin 1982, 237). Organizational sociology deals with a wide variety of research questions that for example question the assumption of rationality in organizational behavior (socially constructed systems of activity), investigate organizations as permanently moving phenomena (dynamics of organizational theories; development, selection and learning models) or study cultural phenomena and political processes in organizations (Türk 1992, 1639ff).

Research results of organizational sociology influenced organization theory, e.g., in the form of theoretical perspectives such as contingency theory, resource dependence theory, neo-Marxist theory and institutional theory (Scott 1994, xv) or tried to influence organizational practice (e.g., Johns 1973, ix) and vice versa. Thus, a strict separation of these two fields is not possible, although the primary research interest in organization science is not so much a descriptive and explanatory interest, but aims at the normative design of effective and efficient organizational structures and processes (Pfeiffer 1976, 10f). Organizational sociology offers a variety of perspectives and approaches to interpret events and processes in organizations, whereas the state of research does not allow for practical recommendations for "organizational design" (Türk 1992, 1646). Organizational sociology influences knowledge management because the latter also analyzes social phenomena on an organization-wide level (e.g., Weick 1995, Willke 1998),

Sociology of knowledge. The theories of the sociology of knowledge view knowledge as socially constructed on the basis of a world view (Weltbild) and comprise theories of social construction of reality which in both, terminology and conceptualization, influenced organizational learning and knowledge management theories[38].

4.1.1.5 Summary of conceptual roots

Table B-1 summarizes the variety of the research fields and disciplines that fuel developments in the knowledge management field. The fields will only be briefly characterized instead of defined. In most cases, a commonly accepted definition is not available. Also, fields such as organizational change, organizational development, organizational learning and organizational intelligence as well as organizational psychology and organizational sociology do not evolve separately, but researchers are aware of the advancements in other fields and thus the boundaries are permeable. There seems to be a trend towards convergence in all organizational sciences with researchers including methods from other fields and disciplines into their studies which seems all the more the case in increasingly realistic problem-centred investigations with less emphasis on purely theoretical or methodological considerations (Nicholson/Wall 1982a, 8). Knowledge management can be seen as

38. For the roots of the sociology of knowledge see Mannheim 1924, Scheler 1924; see also Berger/Luckmann 1967 for a theory of social construction of reality and for a good overview, development and critics Curtis/Petras 1970, Ant 1991; finally, see e.g., Brosziewski 1999, Degele 2000 for recent discussions of the concepts under the perspective of knowledge management or knowledge society.

one of these problem-centred domains in which methods and perspectives of many, if not all of the fields described in Table B-1 are applied.

TABLE B-1. Summary of research fields that form roots of KM

research field	characterization
organizational change	is concerned with changes within organizations and changes of organizations with the help of development, selection and learning models and thus represents an umbrella term for fields such as organizational development or organizational learning.
organization development (OD)	is a methodical strategy for intervention, initiated through consulting and planned by management with the assistance of a change agent, which supports the development of organizations with respect to personal, interpersonal, structural, cultural and technological aspects.
organizational learning (OL)	approaches share the common hypothesis that (observable) phenomena of change in organizations are connected with (unobservable) collective or inter-personal processes of learning on a micro-social (group) as well as a macro-social level (organization).
organizational memory (OM)	is used in analogy to an individual's memory to denote the collective memory of an organization which is capable of storing things perceived, experienced or self-constructed beyond the duration of actual occurrence, and then retrieving them at a later point in time.
organizational intelligence (OI)	provides a slightly different focus on organizational information processing than OL with an emphasis on collective processing of information and decision making.
organizational culture	is to a large extent an implicit phenomenon only indirectly observable with the help of concepts such as trust, norms, standards, unwritten rules, symbols, artifacts which the organization's members share and which provide orientation. The organizational culture is the result of a learning process and is handed on in a process of socialization.
theories of the evolution of organizations	apply evolution theories originally developed in the disciplines philosophy, biology and the social sciences to organizations, e.g., the population-ecology approach, self-organizing systems, organized chaos and "evolutionary management".
human resource management (HRM)	in an institutional sense denotes an organizational subsystem that prepares, makes and implements personnel decisions to secure availability and effectiveness of personnel, e.g., planning of personnel demand, recruiting, training, development, laying off of employees.
information processing approach	develops a model explaining individual behavior (e.g., problem solving, decision making) based on findings of cognitive psychology using concepts such as attitude, personality and definition of the situation as well as short term and long term memory.

TABLE B-1. Summary of research fields that form roots of KM

research field	characterization
systems theory	is an entire scientific discipline that aims at the formulation of general laws and rules about states and behaviors of systems and provides the basis for many investigations, theories and concepts developed within organization science and MIS.
artificial intelligence (AI)	has tried to establish the analogy between human and computer problem solving and applies a common set of methods, e.g., mathematical logics, pattern recognition and search heuristics, to a wide variety of problem domains.
strategic management	determines the long-term goals and positioning of an organization and encompasses the complete process of formulation, implementation and evaluation of strategies to link strategic and operational decision-making.
other management approaches	focus on certain aspects of management, such as innovation management, or provide an alternative view on management, such as systemic or system-oriented management, and evolutionary management.
organizational psychology	is a field that studies human behavior and experience in organizations and was later extended to explicitly consider the system characteristics of organizations with different levels of abstraction: individual, group or subsystem and organization.
organizational sociology	is a field of sociology that analyzes the structural similarities of organizations which are seen as social systems of activity. Organizational sociology offers a variety of perspectives and approaches to describe and interpret events and processes in organizations.
sociology of knowledge	views knowledge as socially constructed on the basis of a world view[a] and comprises theories of social construction of reality which in both, terminology and conceptualization, influenced organizational learning and knowledge management theories.

a. in German: Weltbild

Apart from these roots of knowledge management which in large parts influenced the literature on knowledge management, the topic is also discussed in other disciplines, such as pedagogy (e.g., Mandl et al. 1994) or anthropology (e.g., Harrison 1995). Figure B-2 shows the conceptual roots of knowledge management that were discussed above and the main concepts and constructs playing a role under the umbrella of this field.

Knowledge management renews an old promise of a great part of the organization science literature, especially organizational development, namely to provide concepts to improve the systematic handling of knowledge in organizations. Fried and Baitsch see the difference between OL and KM basically in a more centralized approach to explicit existing knowledge in KM rather than the decentralized approach aimed at generating new knowledge as in OL (Fired/Baitsch 2000, 36ff).

However, this perspective fails to consider that KM concepts are not limited to a centralized organizational unit managing the processes of gathering, organizing and handling explicit knowledge, but also comprise a (large, if not larger) decentralized part[39].

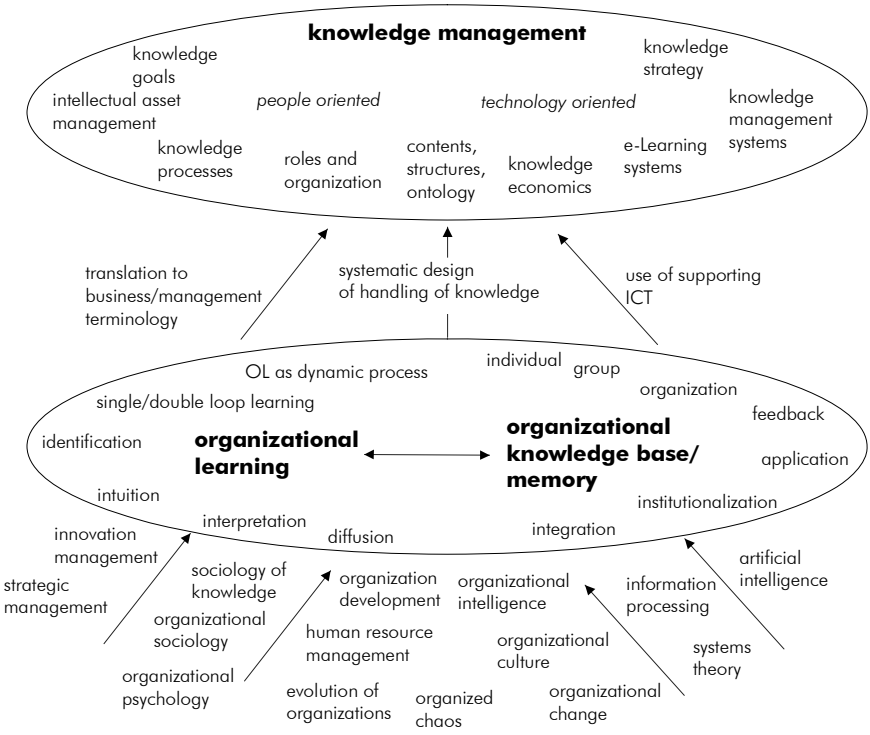

FIGURE B-2. Conceptual roots of knowledge management

Thus, knowledge management can basically be viewed as a *translation* of organizational learning and organizational memory approaches to management terms and an integration with management concepts, such as strategic management, process management, HRM, information management. The management focus also encourages the *goal-oriented design of the handling of knowledge, capabilities or (core) competencies* on a strategic, organization-wide level. Finally, central to knowledge management is the *use of modern information and communication technologies* as an enabler, a catalyst for the organizational instruments implemented to improve the way an organization handles knowledge. This implies that especially practitioners expect that knowledge management produces expectable, manageable improvements in the handling of knowledge. As this is a recent inter-

39. See also the empirical results presented in part C which show that KM in organizations is a decentralized, though often systematically supported approach.

pretation of knowledge management it is understandable that although the term knowledge management has been around for a long time, it is only recently that it has received greater attention.

Since the late 80s and the early 90s there has been a tremendous growth in the number of publications about knowledge management. A large number of books and papers focusing on knowledge management have been published[40]. Additionally, several management journals have produced special issues on knowledge management[41]. Specialized journals with knowledge management or knowledge organization in the title have mushroomed[42] and numerous Web portals have been created that specialize on knowledge management both in the Anglo-American world and the German-speaking countries[43]. These developments are paralleled by a vivid interest in the topic from professional consultants who, among other things, present their own articles, case studies and entire Web sites on the topic[44]. The field has absorbed and developed a substantial influx of ideas from a variety of fields and disciplines[45]. It seems as if managers—and scholars—have awakened to the power of viewing organizations from a knowledge perspective and now engage

40. Some examples for books or papers focusing on knowledge management, knowledge flow management, managing know-how or the organization of knowledge are Sveiby/Lloyd 1987, Hertz 1988, Wiig 1988, Kleinhans 1989, Stata 1989, Nonaka 1991, Kogut/Zander 1992, Quinn 1992, Albrecht 1993, Hedlund/Nonaka 1993, Strasser 1993, Wiig 1993, Blackler 1994, Hedlund 1994, Nonaka 1994, Schreinemakers et al. 1994, Zucker/Schmitz 1994, Blackler 1995, Davenport 1995a, Nonaka/Takeuchi 1995, Bierly/Chakrabarti 1996, Grant 1996b, Schmitz/Zucker 1996, Schneider 1996, Schreyögg/Conrad 1996, Schüppel 1996, Allee 1997, Demarest 1997, Güldenberg 1997, Ruggles 1997, Skyrme/Amidon 1997, Wiig 1997, Allweyer 1998, Baecker 1998, Brown/Duguid 1998, Choo 1998, Davenport et al. 1998, Davenport/Prusak 1998, Dieng et al. 1998, Pawlowsky 1998, Probst et al. 1998, Willke 1998, Bach et al. 1999, Bullinger et al. 1999, Duhnkrack/Bullinger 1999, Hansen et al. 1999, Weggemann 1999, Zack 1999a, Zack 1999c, Amelingmeyer 2000, Astleitner/Schinagl 2000, Bach/Österle 2000, Despres/Chauvel 2000, Götz 2000, Krallmann 2000, Lehner 2000, Mandl/Fischer 2000, Mandl/Reinmann-Rothmeier 2000, Roehl 2000, Alavi/Leidner 2001, Eberl 2001, Mertins et al. 2001, Schreyögg 2001, Haun 2002, Hanged 2002, Ackerman et al. 2003, Holsapple 2003.
41. Examples are the Strategic Management Journal, Winter Special Issue 1996, Spender/Grant 1996, Gablers Magazin, August 1997, Probst/Deussen 1997, the California Management Review, Spring 1998, Cole 1998, the Journal of Strategic Information Systems, Fall 1999, Galliers 1999, and Fall 2000, Leidner 2000, the journal IEEE Intelligent Systems and their Applications, O'Leary/Studer 2001, and the Journal of Management Information Systems, Summer 2001, Davenport/Grover 2001, or in the German-speaking countries, the journal Informationsmanagement, January 1998, e.g., Allweyer 1998, the journal Personalwirtschaft, July 1999, Jäger/Straub 1999, the journal HMD, August 1999, Heilmann 1999.
42. Examples are the Journal of Knowledge Management, the Electronic Journal of Knowledge Management, the Knowledge Management Magazine, Knowledge and Process Management or the Journal of Intellectual Capital, see Table D-5 on page 710.
43. Examples are: URL: http://www.kmworld.com/, http://www.knowledgeboard.com/, http://www.brint.com/km/, http://www.knowledgeMARKT.de/ (see also Table D-6 on page 710).
44. Examples are URL: http://www.sveiby.com.au/, http://www.krii.com/, http://www.entovation.com/, http://www.skyrme.com/.
45. See "From organizational learning to knowledge management" on page 22.

in knowledge practice across industries, functions and geography[46]. Wiig (1997b, 6 and 10f) gives numerous examples of events and publications showing the increasing attention that scholars and practitioners pay to the topic. Shariq (1997) even proposes to develop a *knowledge management discipline*.

The extensive literature produced since then has tempted some authors, though mostly on conference panels or in public newspapers, to question whether knowledge management was just a passing "management fad", a "buzzword" or an "overhyped label" (e.g., Roehl 2000, 79, Schneider 1996, 7, Skyrme/Amidon 1997, 29). It has to be admitted that especially in the mid to late 90s there was an inflation of "new" and heterogeneous approaches to knowledge management. Since then, some definite trends have emerged, several authors have attempted to classify KM approaches in order to show the breadth of the concepts developed[47] and most authors agree on a *common core of concepts* which make up knowledge management, although the field is still far from being consolidated. The common core of concepts that has been developed can also be observed in relatively broad agreement among leading practitioners or practitioner-oriented literature about best and good practices in knowledge management[48].

Now, at the beginning of the new millennium there is still considerable and growing interest in the topic and the number of authors, scholars and practitioners, optimistic about a positive impact of knowledge management on organizations seems to grow as well (e.g., Cole 1998, 20, Miles et al. 1998, 286, McCampbell et al. 1999, Götz 2000, Alavi/Leidner 2001, Mertins et al. 2001). Expectations have settled to a more realistic level, though.

The growing number of success stories from organizations applying KM in general and adequately designed ICT in particular have fueled the interest in the topic. Information and communication technology is one, if not *the* enabling factor for an improved way of handling knowledge in organizations which can support organizations to deal with the problem of how to implement changes prescribed by orga-

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46. See Amidon (1998, 45 and 52) who coined the term "Ken awakening" in this context. The english word *ken* means to know, to recognize, to descry, to have an understanding as a verb and perception, understanding, range of vision, view, sight as a noun. According to Amidon ken ideally characterizes the joint way of thinking of many executives during the last decade that has the power to fundamentally transform businesses (Amidon 1999, 15ff).
47. See e.g., Binney 2001, 34ff who identifies six categories of KM applications in what he calls the KM spectrum: *transactional KM* (case based reasoning, help desk and customer service applications, service agent support applications), *analytical KM* (e.g., data warehousing and mining, business intelligence, customer relationship management), *asset management KM* (e.g., intellectual property, document and content management, knowledge repositories), *process-based KM* (e.g., based on TQM and business process reengineering programs, best practices, process improvement and automation, lessons learned), *developmental KM* (e.g., skills development, staff competencies, teaching and training) as well as *innovation and creation* (communities, collaboration, discussion forums, networking, virtual teams)
48. See the empirical studies cited in chapter 10 - "Related Empirical Studies" on page 439; see also e.g., Skyrme/Amidon 1997, Davenport et al. 1998, Skyrme 1999, Skyrme 1999a, Wiig 1999, Sveiby 2001.

nizational learning or knowledge management concepts effectively and especially efficiently into organizational practice.

Put in a nutshell, knowledge management seems to be a lasting phenomenon with concepts applied systematically and consciously by an increasing number of organizations and its lessons learned are here to stay. The share of organizations that take advantage of this approach therefore should increase. Additionally, the support by information and communication technologies is on the rise as well. The following hypothesis will be tested:

Hypothesis 1: The share of organizations with a KM initiative has increased compared to earlier studies

Even though generally the application of KM has great potentials in all industry sectors, it is supposedly the service sector where KM penetrates the organizations most. This is expected because of the higher share of knowledge workers in service organizations than in industry organizations (see also part A) and the higher share of non-routine business processes in service organizations. As a consequence, access to KM-related systems should be targeted at a higher portion of employees in service organizations than in industry organizations:

Hypothesis 2: Service organizations have a higher share of employees with access to KM-related systems than industrial organizations

4.1.2 From data to knowledge management

In addition to the interdisciplinary perspective on KM as presented in the last section, there is yet another quite popular conceptualization which compares knowledge management to data management and information (resource) management (e.g., Kleinhans 1989, 26f, Lehner 2000, 76ff, Rehäuser/Krcmar 1996). This is especially true for the German *business informatics* literature that claims data and especially information management as its primary research object (e.g., Heinrich 1996, 12). The corresponding *information function* is seen in analogy to other business functions such as purchasing, production, sales and marketing, finance or HRM (Heinrich 1996, 8) and is represented in many organizations by a Chief Information Officer – CIO. The CIO is (primarily) responsible for the development and administration of information and communication systems and infrastructure. Thus, there is a clear focus on ICT.

Consequently, the perspective on KM in these approaches can be characterized as primarily technology-oriented. Basically, many MIS researchers and quite a few researchers from the field of Artificial Intelligence try to translate the findings and ideas of the more human-oriented KM approaches to the development of so-called knowledge management systems. In this view, ICT is regularly considered the driving force for the successful implementation of KM initiatives. In the following, this perspective will be applied to briefly survey the development from the management of data to the management of knowledge.

In most cases, the terms data, information and knowledge are still ambiguous and vaguely defined[49]. This is especially true if definitions are compared between different research disciplines (e.g., philosophy, sociology, natural sciences, MIS

and computer science[50]. However, many authors who went to the trouble of making a clear distinction between these terms within the MIS discipline, seem to agree on some form of a *hierarchical relationship between data, information and knowledge*[51]. Each higher level is based on or extends the preceding one. This conceptualization is used to postulate different demands for management (goals, approach, organizational roles, methods, instruments) and different resulting systems (data base systems, data warehouses, information and communication systems, knowledge management systems) on each of these levels.

Historically, in the seventies and the beginning of the eighties the focus certainly was on data management (see Figure B-3). In the following, the steps will be discussed subsequently.

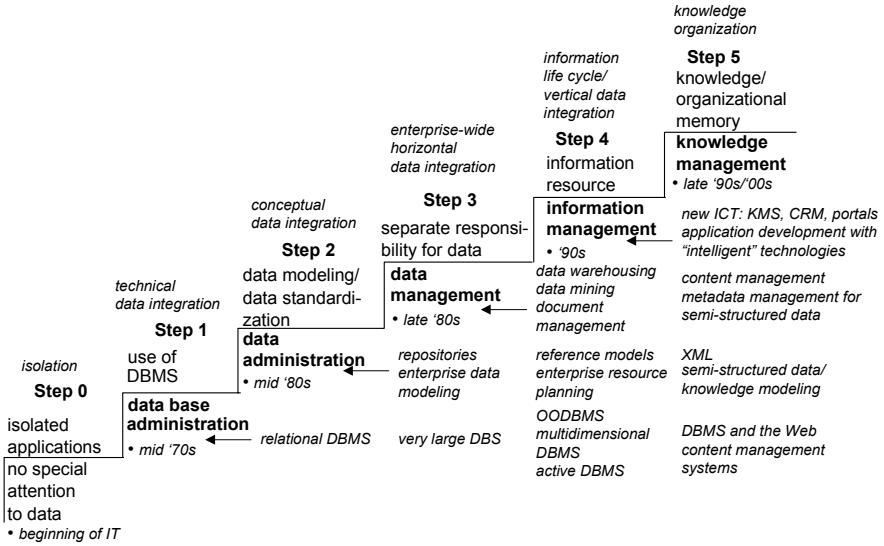

FIGURE B-3. Historical development of information processing[52]

Step 0: isolated applications. The starting point for the historical development of information processing can be described by a joint consideration of program logic and data. There is no special attention being paid to data. Application systems hold their own data storages leading to redundancies and inconsistencies between different application systems.

49. For a survey on the different definitions used see Lehner/Maier 1997.
50. See also section 4.2.1 - "History and related concepts" on page 60.
51. Examples are Augustin 1990, 15f, Eulgem 1998, 24, Greschner/Zahn 1992, 14, Willke 1998, 13.
52. The figure is based on Ortner 1991.

Step 1: data base administration. In the first step, technical issues therefore mattered most. Data base administration is concerned with the technical integration of previously isolated data storage units. Examples for tasks are to guarantee efficient data storage avoiding or controlling redundancies, to implement and administer the data base management systems (DBMS) that provide instruments for technical integration between application systems or to tune the performance of data base systems.

Step 2: data administration. As DBMS penetrated organizations, semantic or conceptual data integration, data modeling and data handling were the most important questions to be resolved. These tasks together provide semantic data integration which is the primary goal of step 2.

Step 3: data management[53]. Separate organizational units were institutionalized, which were responsible for the co-ordination of data management tasks throughout an organization. Often, this coincided with the development of enterprise data models which were seen as an instrument for the integration of project or departmental data models on an organization-wide level. Sophisticated methods for data modeling and data base modeling have been developed, many data base languages have been introduced, SQL became the industry standard for the definition (data definition language), manipulation (data manipulation language) and query of data structures (query language) as well as the administration of user privileges (data control language).

With the advent of an organization on a certain step, tasks introduced at a previous step still play a role. For example data base administration on step 1 covers not only hierarchical and network DBMS, but also relational DBMS (step 2), very large DBS (step 3), object-oriented, active and multidimensional DBMS in step 4 as well as content management systems and the access of DBMS from the Web (both Internet and Intranet) in step 5 (see Figure B-3). Data management tasks have been extended during the introduction of information management and knowledge management as well. Information management requires for example the introduction of a data life cycle, responsibilities for data elements and sophisticated systems and procedures for the provision of data supporting decision making: data warehousing and data mining technologies.

Figure B-4 shows a simple data life cycle model which gives an overview of the most important technologies the data part of which has to be handled by data management: transaction processing systems (TPS) and data base systems, data warehouses and business intelligence tools and systems (especially OLAP, reporting and data mining tools) which support decision making.

Soon it became clear that data could not be the sole focus of a *data resource management* which claimed to be on the board of executives and therefore on the

53. Due to their importance for KM, the following three steps will be discussed in more detail.

same hierarchical level of the organization structure as traditional management functions such as production management or marketing/sales management. Data had to be accessible by the users in a way which supported the tasks that users had to fulfil.

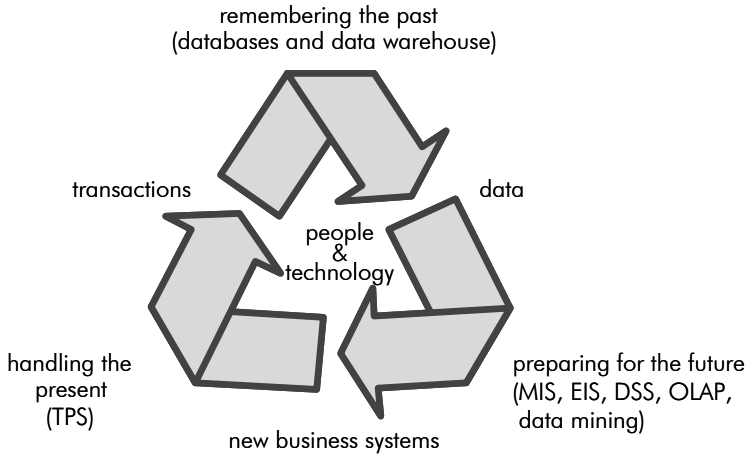

FIGURE B-4. "Closed loop" of data handling in an organization[54]

Step 4: information management. As a consequence *information* was understood as a production factor which had to be managed like other production factors (capital, labor). Thus, the scope of the *information resource management* was a much broader one as compared to data management[55]. The most important aspects were the extension from the management of syntactic and semantic to pragmatic aspects of information understood as an instrument for preparing decisions and actions, information logistics, the contingency approach to information—the different interpretation of information in different situations—and the perspective-based approach to information which means that different groups of users might interpret the same data differently.

From an organizational perspective, information management was understood as the management of the information life cycle (see Figure B-5, also Krcmar 2003, 76ff): (1) the systematic acquisition of *information sources*, (2) which are

54. Source: Watson 1999, 11.
55. A large number of books and papers on information management or information resource management have been published with a peak in the 80s and beginning of the 90s of the last century. More recently, there is less talk about information (resource) management. However, the basic ideas are applied, updated and extended in fields such as management of information systems, strategic planning for information systems, strategic information systems or information systems leadership. For recent collections of material on information management and related areas see e.g., Galliers/Leidner 2003, Heinrich 2002, Krcmar 2003, Pearson 2001, Ward/Peppard 2002, Watson/Brohman 2003).

then made physically accessible as *information re-sources* and thus provide (3) the *information supply* which is compared to (4) the *information demand* of the organization. These ideas of information logistics (Levitan 1982, Lehner et al. 1995, 232ff) and an internal information market (Kuhlen 1995) are supported by (5) the management of the *information and communication infrastructure* as well as the application systems in support of the organizational processes, rules and regulations.

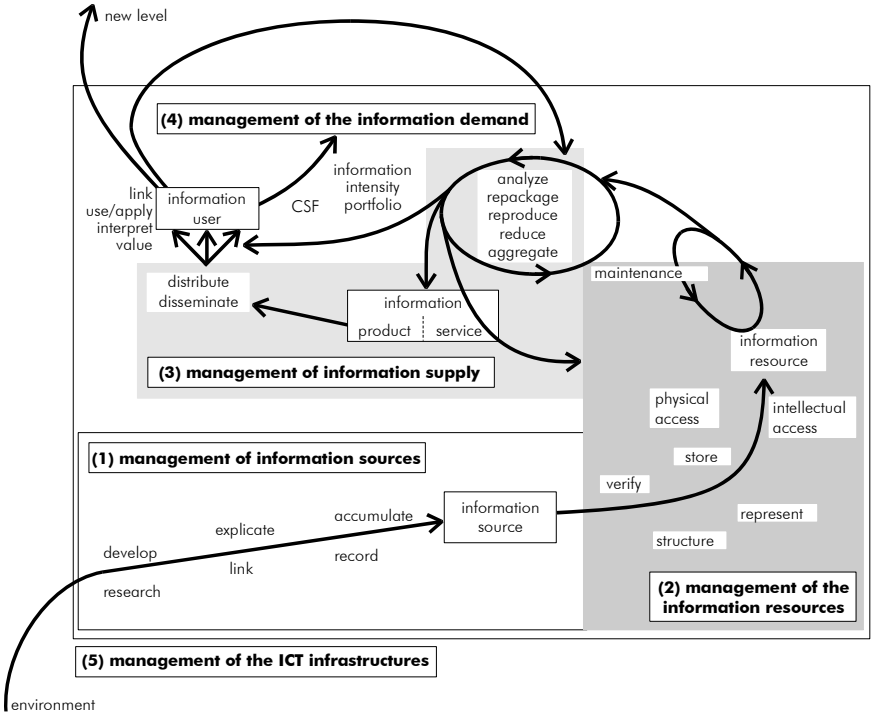

FIGURE B-5. The life cycle model of information management[56]

The recent approaches in the field of business process modeling and their technical counter-part, workflow-management systems, reflected the respective developments in organization science, namely the orientation towards business processes: *business process management* or *business process (re-)engineering*.

As a consequence, organizations invested heavily in business process reengineering (BPR) programs (e.g., Hammer/Champy 1993, 1995, Grover/Kettinger 1995) in order to orient their organizational structures towards customers, both internal and external ones. Effective and efficient business process management was considered a dynamic organizational core competence (e.g., Osterloh/Frost

56. Source: Krcmar 2003, 77.

1996, 175ff). Only recently, the smooth functioning of business processes has become a kind of a commodity in many industry sectors. ICT support for business processes, especially routine business processes, has been widely applied in the form of *workflow management systems*[57]. Much effort has gone into the translation of business processes into workflow models so that new or changed designs of business processes could be implemented highly effectively and efficiently (e.g., Galler 1997, especially 31ff).

Wide application of business process reengineering and management produced as a result fierce competition based on prices and (delivery) time. In order to improve organizational goals such as profitability and growth, executives focused speed of innovation as the most important competitive factor because new products and services would stimulate demand and thus increase the overall market whereas otherwise growth was only possible at the cost of competitors.

In the course of this changed focus, it was often cited that only "fast" organizations would survive. "Fast" in this case means the ability to quickly react to opportunities and threats from the environment and to produce innovative ideas and turn them into products and services at a quicker pace than the competition. Organizations identified learning and knowledge as the key concepts that had to be focused on. As mentioned before, organizations started to apply the extensive literature from organization science about innovation, change and organizational learning to design improved flows or processes of knowledge. *Knowledge management* entered the management community.

Step 5: knowledge management. Whereas organizations have realized substantial benefits from BPR in terms of quality of products and services, productivity, throughput time and in terms of customer satisfaction, knowledge has proven to be difficult to manage. Knowledge work and knowledge-intensive business processes have been difficult to reengineer (Davenport 1995b, 8). BPR has provided a number of instruments which could also be applied to the improvement of knowledge processes and some authors have tried to pave the way to an integration of BPR with more traditional approaches to organizational change known from organization science[58]. However, their successful implementation requires a different focus or perspective on organizations, the focus on knowledge and knowledge processes. This perspective spans business processes rather than focusing on exclusively one business process. The reason for this is that whereas the flow of knowledge within a business process is (1) easier to determine and (2) easier to optimize, it is the flow of knowledge between business processes, the interfaces between different organizational units and topics that might provide the highest potential for innovation and competitive advantages. Thus, it is expected that organizations support several, if not all business processes rather than focusing on one single business process. The following hypothesis will be tested:

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57. See also section 4.3 - "Knowledge management systems" on page 82.
58. For example Osterloh/Frost 1996, Kock et al. 1997, Liebmann 1997.

Hypothesis 3: Knowledge management activities span business processes rather than focusing on exclusively one business process

An organization's ability to learn or handle knowledge processes (process view) or its ability to handle knowledge (product view) have been considered the new key success factor. This has required new organizational design alternatives and also new information and communication systems to support the smooth flow of knowledge which consequently have been called knowledge management systems.

Already existing tasks on lower steps have been once again extended. With the advent of advanced data base and network technologies as well as the availability of sophisticated AI technologies for purposes such as text mining, user profiling, behavior analysis, pattern analysis, semantic text analysis, *knowledge management* extended the focus of *information management* to the handling of new information and communication technologies as well as to enrich *application development with intelligent technologies* (see Figure B-3 on page 40).

With respect to data, knowledge management needs to handle networks of semi-structured, context-rich data, experts, participants and their combination. *Data management* has been once again extended to cover *meta-data and content management* for semi-structured data on an enterprise-wide level. This includes the design and the handling of meta-data for the corresponding new tools and systems such as content management systems, tools and procedures to support data exchange and data access between a multitude of new systems and technologies, e.g., Web and Intranet technologies, mobile technologies, document management technologies. Certainly, KMS cannot be reduced to their data and meta-data structures, but offer a new variety of ways to support the handling of knowledge in organizations[59].

To sum up, in many organizational contexts and several approaches in the literature, knowledge management is simply viewed as the next consequent step in the development of organizational information processing[60]. Indeed, from a data-oriented perspective, this view can be justified and has its advantages. It explains, for instance, what data management tools and methods, what information logistics and ICT infrastructures are required in order to effectively build knowledge management systems.

However, the concepts of knowledge management also require a much broader view which includes organizational functions and processes traditionally not viewed as part of information management[61]. As opposed to the first four steps in the model, the last step, knowledge management, consequently is not implemented

59. See section 4.3 - “Knowledge management systems” on page 82.
60. For an approach that is most closely related to information management see the model for the management of knowledge presented in Rehäuser/Krcmar 1996, 20 who reuse the life cycle model presented in its latest version in Krcmar 2003, 77 which was originally developed for the management of information, see also Figure B-5 on page 43.
61. See section 4.1.1 - “From organizational learning to knowledge management” on page 22.

by adding tasks to an already existing organizational unit, in this case an IT department. In organizations, this gap between information management and knowledge management is reflected by the fact that generally, if a separate organizational unit is created held responsible for knowledge management, this unit is not positioned in the realm of an IT function. For example, the departments headed by a Chief Knowledge Officer (CKO)[62] of pioneering professional services companies were separated from the IT departments headed by a Chief Information Officer (CIO).

Both historical roots of KM—the interdisciplinary field of organizational learning and the step model tracing the management of knowledge back to the management of data and information—have to be considered for a definition of KM.

4.1.3 From traditional work to knowledge work

As mentioned in section 1 - "Motivation" on page 1, the transformation of society and economy into a knowledge society and a knowledge economy has substantially changed the work places of the majority of employees. The concept of knowledge work was coined in order to stress the corresponding changes in the work processes, practices and places of employees and thus the differences to more traditional (often manual) work. In the following, the concept of knowledge work is briefly discussed from the perspective of an (ICT supported) KM initiative. This focus is also used to visualize the differences to more traditional work, such as routine office work.

Knowledge work can be characterized as follows[63]:

- *target*: solves ill-structured problems in complex domains with a high degree of variety and exceptions,
- *content*: is creative work, requires creation, acquisition, application and distribution of knowledge and bases inputs and outputs primarily on data and information,
- *mode of work*: consists of a number of specific practices, e.g., creating new knowledge, interpreting, integrating, representing, retaining and securing it, producing and reproducing knowledge or, in Schultze's (2003, 50f) terms, practices of informing, such as expressing or extracting experiences, monitoring what can be learned from happenings, translating knowledge to other domains, interpreting and absorbing knowledge and networking with other people,
- *personal skills and abilities*: uses intellectual abilities and specialized knowledge rather than physical abilities and requires a high level of education, training and experiences resulting in skills and expertise,
- *organization*: is often organized decentrally using new organizational metaphors, such as communities of specialized knowledge workers, has strong communication, coordination and cooperation needs and is highly mobile, flexible and distributed,

62. See section 6.1.2.1 - "Knowledge manager (CKO)" on page 163.
63. See also Kelloway/Barling 2000, Hayes 2001, 81f, Schultze 2003, 43.

- *ICT*: requires a strong yet flexible personalized support by information and communication technologies.

Knowledge work can be defined as work that creates, translates or applies new knowledge. This definition is a rather narrow one so that only a small percentage of actual work being done in organizations would qualify as knowledge work. The broader term, information work, takes into account that not all work with information necessarily generates, translates or applies new knowledge and comprises knowledge work, management work and data (service) work (Drucker 1993, Schultze 2003, 45).

Data or service work relies on established procedures, is well defined and does not require equally high levels of education than in the case of knowledge work. Management work is performed by business owners, executives, legislators, senior officials and supervisors whose daily work practices comprise the processing, communication and translation of (abundant) information and the preparation, taking and execution of decisions[64]. In this narrow view, knowledge work is restricted to (re-)producing new knowledge whereas data (service) work transforms information, but does not produce new knowledge. However, in actual work practices, it might be difficult to separate knowledge work from data or service work so that actual KM initiatives or KMS might be most useful when supporting information work in general and not be limited to restrictively to a narrow definition of knowledge work.

A number of authors have used the concept of knowledge work to classify occupations or positions of actual workers into knowledge and non-knowledge workers or routine, manual etc. workers[65]. This distinction, however, is not without trouble because on the one hand all human work requires some kind of knowledge and on the other hand even within one profession actual workers might differ widely according to the portion of their work that qualifies as knowledge work. The term knowledge work refers to (Kelloway/Barling 2000):

Professions. Occupations or job positions are classified into knowledge workers and non-knowledge workers or routine, manual etc. workers. This distinction is not without trouble because on the one hand all human work requires some kind of knowledge and on the other hand even within one profession actual workers might differ widely according to the share of their work that qualifies as knowledge work.

Group characteristics. Education, training and years of work experience are a necessity for a worker to be called an expert. In this case, knowledge work refers to experts' work and thus defines a group of individuals who share certain characteristics, e.g., the ones mentioned above. However, on the one hand experts might not always be engaged in knowledge work, but also have to do for example routine

64. See Drucker 1993, 5ff and 75ff who elaborates on the characteristics and productivity of knowledge workers and service workers; see also Schultze 2003, 45.
65. One example is Machlup 1962, Wolff 2005; see also Schultze 2003 and the literature cited there.

data work and on the other hand less experienced employees might be engaged in just the same type of work than experts are. This would then require just the same organizational and ICT design, so that the distinction is not appropriate for defining a target group of individuals for KMS design.

Activities/behavior. Thus, knowledge work should not be restricted to a certain class or group of employees. It should rather be used as a concept that allows a focus on commonalities across professions and positions for the application of KM instruments, KM-oriented organizational design and ICT support. As an increasing portion of employees is engaged in this type of work (Wolff 2005), the corresponding design of an ICT environment throughout an organization gains importance.

In this book with its focus on (ICT supported) KM initiatives, knowledge work relates to this latter category of specific activities and behavior that require specific organizational and ICT design. Table B-2 compares the traditional, routine work environment of an office employee with the work environment of a knowledge worker. It shows the changed requirements for the organizational design and the ICT support for knowledge work that have to be considered by a KM initiative and some aspects of economics that affect the management of knowledge work.

Organizational design. When compared to traditional work, knowledge work can be characterized by stronger communication needs, weakly structured and less foreseeable processes, the assignment of multiple roles to one person rather than a single job position per person and the increasing importance of teamwork in the form of project teams, networks and communities in addition to work groups and departments. These changes are reflected by a decentral organizational design that uses the metaphors of a network, a spider's web or a hypertext organization[66] in addition to the traditional hierarchy and that strengthens the position of decentral units.

Business process reengineering and business process improvement programs aim primarily at highly structured, deterministic processes as can be found in more traditional work settings. In the realm of knowledge work, however, knowledge processes cannot be designed as easily so that other management techniques are required. Examples are knowledge management and knowledge process redesign. The latter aims at combining the positive experiences made in BPR efforts with the promises of knowledge management.[67] The boundaries of an organization are blurry and knowledge workers are engaged in a large number of communication, coordination and cooperation processes and practices that cross the organizational boundaries. Alliances, clusters, joint ventures, (virtual) networks and professional communities are some examples for types of institutional settings that have been developed to organize these exchanges. More recently, so-called knowledge cooperations are cooperations between independent legal organizations which have been established in order to overcome specific knowledge problems the goal of

66. See section 6.1 - "Structural organization" on page 158.
67. See section 6.3 - "Process organization" on page 207.

which is to develop new, applicable knowledge as product or as process by a combination and integration of existing, possibly secured knowledge that the partners hold or by joint knowledge development[68].

TABLE B-2. Traditional office work versus knowledge work

criterion	traditional office work	knowledge work
organizational design		
orientation	data-oriented	communication-oriented
boundaries	organization-internal focus	focus across organizational boundaries, (knowledge) cooperation[a], co-opetition, (virtual) networks
centralization	central organizational design	decentral organizational design
structure	hierarchy	network, hypertext organization[b]
process	highly structured, deterministic processes; pre-structured workflows	weakly structured, less foreseeable processes; ad-hoc workflows
(re-) design	business process reengineering, business process improvement	knowledge management, knowledge process redesign
group	work group, department	project team, network, community
role	one job position per person	multiple roles per person
ICT support		
type of contents	structured data, e.g., tables, quantitative data	semi-structured data, e.g., content, links, hypertext documents, container, messaging or learning objects, workflows
storage	(relational) data base management systems, data warehouses	document and content management systems, Weblogs, Wikis, experience data bases, learning repositories, newsgroups, mail folders etc.
data handling	coordination of accesses, integrity, control of redundancy	synchronization, information sharing, distribution of messaging objects, search and retrieval
coordination	workflow management system	messaging system, Groupware
modeling	data, business process, workflow	ontology, user profile, communication, activity/work practice
workspace	fixed workspace	mobile office, virtual office, multiple workspaces

68. See also Badaracco 1991, Doz/Hamel 1998, Aulinger 1999, Moser 2002, Maier/Trögl 2005.

TABLE B-2. Traditional office work versus knowledge work

criterion	traditional office work	knowledge work
equipment[c]	personal desktop computer; poor resources	laptop, personal digital assistant, mobile phone; rich resources
applications	small range of applications	wide range of applications, including Web applications
connectivity	isolated; stand-alone	connected; permanent, fast network connections, mobile devices
economics[d]		
management focus	finance, past orientation, periodic reporting	balanced set, future orientation, instant access
location of value	things	flows
tangibility	tangible	intangible
metrics	production statistics, metrics for reporting	innovation statistics, metrics for managing
standardization	standards; standard products and services	common, yet customized products and services

a. See Maier/Trögl 2005.
b. See Nonaka 1994, 32ff and section 6.1 - "Structural organization" on page 158.
c. For a more detailed description of hardware and basic software differences between early personal computers and today's personal ICT equipment of knowledge workers and the consequences for the design of a supportive infrastructure see Maier/Sametinger 2002, 2003.
d. See also Skyrme 2000, 322.

ICT support. From an ICT perspective, the main changes in the requirements occur due to the considerably higher complexity of data and the focus on organization-wide and inter-organizational communication and mobility of personally responsible knowledge workers. Storage and handling of semi-structured data, e.g., hypertext documents, messaging and learning objects, experiences or skill directories require additional ICT systems, such as document and content management systems, e-learning platforms, messaging systems etc. in addition to the traditional relational data base management systems and data warehouses. Consequently, the challenges in the handling of data are no longer restricted to the provision of integrity, control of redundancy and coordination of accesses as in the relational data base world. New challenges are complex synchronization needs of mobile workspaces, information sharing within and across organizational boundaries as well as search and retrieval in documents and messaging objects that are encoded in a large number of heterogeneous formats for semi-structured data and reside in a variety of data and document sources spread throughout the organization.

Coordination in traditional office work is provided by workflow management systems that implement operative business processes. The lesser structured knowledge work can be coordinated by messaging systems and Groupware. Consequently, modeling used to focus largely on data (entity relationship modeling), objects and classes (object-oriented modeling) and business processes (business process modeling). Knowledge work requires content- and communication oriented modeling techniques that define meta-data and provide taxonomies, ontologies, user models, communication diagrams, knowledge maps and diagrams that show what objects, persons, instruments, roles, communities, rules and outcomes are involved in the main knowledge-related activities[69]. Finally, the increased mobility of knowledge workers requires multiple, virtual workspaces that can be personalized according to the demands and practices of their users.

This fundamental change in ICT support is backed by a corresponding major shift in the ICT infrastructure. PCs are no longer equipped with weak resources and used in an offline, stand-alone mode. Computers have rich resources, provide information-rich modes of interaction with the user, permanent, fast network connections as well as highly flexible wireless and mobile connections and comprehensive communication features. Mobile appliances, such as notebooks, PDAs and mobile phones are equipped with a wide range of applications.

To sum up, this calls for (1) the systematic, flexible handling of context, (2) intelligent functions to handle the vast amounts of substantially extended types of contents, i.e. semi-structured data in the organizational "knowledge base", and (3) extended functionality for collaboration. These functions have to be realized in or seamlessly integrated with the knowledge workers' personal workspaces[70].

Economics. Correspondingly, management focus has shifted from a mere periodical financial focus with its past orientation to a flexible and balanced set of criteria that show the current status of the organization's resources, processes, innovation and performance. The interest thus has shifted from tangible to intangible assets, from things to flows as Skyrme (2000) puts it, from standards and standard products and services to common yet customized products and services. Metrics are required not simply for reporting the production statistics of goods and services, but to manage the innovation process(es) in the organization. Knowledge management in this realm provides for more visibility of organizational resources, skills and knowledge processes and allows for a more systematic strategic management of (core) competencies in an organization[71].

Consequently, KM initiatives primarily aim at fostering an organizational and ICT environment that is suited for knowledge work[72]. The substantially changed

69. See section 6.6 - "Modeling" on page 237.
70. See also section 4.3 - "Knowledge management systems" on page 82 for a discussion of knowledge management systems and their differences to more traditional information systems.
71. See section 5.1.1 - "From market-based to knowledge-based view" on page 94.

work practices of their largely increased main target group, the knowledge workers, together with recent innovations in ICT infrastructure demand a strategic initiative, knowledge management, that not only improves organizational effectiveness, but systematically realizes the potentials of a learning- or a knowledge-intensive organization for creating and sustaining superior competitive positions.

4.1.4 Definition

Knowledge management is still a young field with multidisciplinary roots. Thus, it is not surprising that there seem to be almost as many definitions to the term than there are approaches or "schools" of authors contributing to the field. On the one hand, this situation can be characterized as a positive development because the lack of clear boundaries has allowed the free influx of ideas, concepts and approaches. On the other hand, the blurry and vague boundaries led to considerable confusion, especially among practitioners, regarding the question what exactly they would have to do in order to "implement knowledge management" into their organizations. Neither the goals were clarified which could be set for a KM initiative, nor were there strategies, a comprehensive list of instruments, procedures or methods how to implement these instruments, their value propositions and how to measure the results of this approach. Apart from general statements, both, the question as well as the answers which knowledge management provided, were unclear.

This situation has changed, both in the literature and to a large extent in practice. Many branches have emerged from the healthy KM tree which more or less build on the same basis. Recently, several authors went to the trouble to review the various approaches of knowledge management more or less extensively. They tried to elicit the prevalent lines of development and to classify the KM approaches[73]. Generally, there is agreement about the distinction between *human* and *technology oriented KM approaches* which basically reflects the origin of the approaches, either in a human/process-oriented organizational learning, organization science background, or on the other hand in a technological/structural organization science, a MIS or computer science/artificial intelligence background[74].

There is also agreement that there are more holistic KM conceptualizations which encompass both directions. However, even the more holistic concepts do not really integrate the two directions. Most holistic approaches seem to focus on the human oriented side and *mention* technology as *one* of the enabling factors without really integrating it. Recently, technology-oriented concepts pay more attention to the human side with the help of knowledge processes and business processes and

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72. Knowledge work is the primary target of knowledge management, but corresponding organizational instruments and ICT tools and systems might also aim at improving information work which includes management and data or information service work.
73. Examples are Schneider 1996a, 17ff, Schüppel 1996, 187ff, Güldenberg 1997, 231ff, Roehl 2000, 88ff, Amelingmeyer 2000, 15ff, Swan 2001, 1f, Swan/Scarbrough 2001, 10, Walger/Schencking 2001.
74. The distinction between human-oriented and technology-oriented approaches has a long tradition in organization science (e.g., Trebesch 1980, 10 uses the framework to distinguish approaches for organization development).

the integration of "packaged" instruments[75]. Figure B-6 shows the two sides of knowledge management and some examples for concepts developed in holistic approaches aimed at their integration.

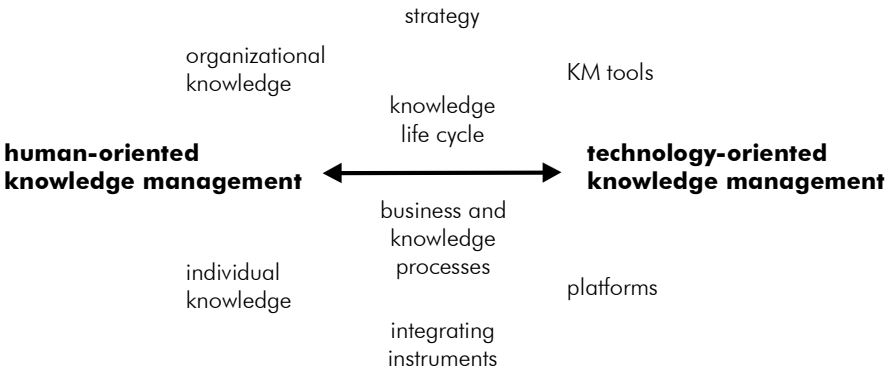

FIGURE B-6. Human versus technology-oriented KM and approaches to their integration

In the following, this basis shall be discussed with the help of a brief review of definitions. Recently, many authors have concentrated on the development of a specific idea or concept without even trying to define knowledge management. The definitions presented here were selected and classified to provide an overview of the most important (in terms of citation) and the most promising (in terms of the current and foreseeable developments of KM in practice) approaches of defining the subject in the literature. They will then be summarized in a working definition for knowledge management.

Definitions focusing on a life cycle of knowledge tasks, functions or processes. These approaches view knowledge management as a life cycle or a complex organizational "function", "task" or "process" and basically break it down into subtasks, sub-functions, sub-processes or (process) activities. The goal of knowledge management is to improve these sub-tasks, in most cases the creation or generation; acquisition; identification or capture; validation and evaluation; conversion; organization and linking; formalization or storage; refinement or development; distribution, diffusion, transfer or sharing; presentation or formatting; application and evolution of knowledge, with the help of systematic interventions, instruments or measures[76].

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75. See also section 6.3.2 - "Knowledge management processes" on page 212.
76. See Wiig 1988, 104ff, Schüppel 1996, Güldenberg 1997, 247ff and 370ff, O'Dell/Grayson 1997, 11, Choo 1998, 18ff and 105ff, Mentzas/Apostolou 1998, 19.3, Probst et al. 1998, Rey et al. 1998, 31f, Amelingmeyer 2000, 28, Nissen et al. 2000, Pawlowsky 2000, 115ff, Roehl 2000, 154ff, Alavi/Leidner 2001, 115ff, Bhatt 2001, 71ff, Mertins et al. 2001a, 3f.

Examples: Knowledge management comprises all possible human and technology oriented interventions and measures which are suited to optimize the production, reproduction, utilization and logistics of knowledge in an organization[77] (Schüppel 1996, 191f).

Fraunhofer Berlin defines knowledge management on the basis of their benchmarking study as comprising methods, procedures and tools which support the core activities generate, transfer, store and apply knowledge. Knowledge management contributes to business goals as a closed core process in all areas and levels of the organization[78].

Strategy- or management-oriented definitions. These definitions elaborate on the management side of KM and focus the strategic relevance of a KM initiative, program or agenda.

Example: "Applying Knowledge Management broadly throughout [the] organization [...] requires taking a systematic and holistic view of the knowledge agenda—understanding the strategic role of knowledge, linking it to key management decisions and business processes, and improving processes for knowledge creation, sharing and use" (Skyrme/Amidon 1997, 30).

Technology-oriented definitions. These perspectives build on the concepts of data and information management and thus represent an MIS viewpoint. Authors of these approaches usually extend the object of information management to include knowledge, both in the form of somewhat more valuable information or context-enriched information to be stored and distributed with the help of information and communication systems, and in the form of knowledge in people's heads (e.g., Kleinhans 1989, 26f, Rehäuser/Krcmar 1996). As a consequence, knowledge management has to fulfill some functions traditionally attributed to HRM. Some technology-oriented definitions encompass a technology-oriented version of the life cycle of knowledge tasks, functions or processes mentioned above[79] (e.g., Allweyer 1998, 44). Additionally, there are several authors who define KMS or technologies in support of KM and implicitly presuppose a KM definition[80].

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77. The original definition in German is: "Wissensmanagement ist [...] als ein Entwurf zu verstehen, der alle möglichen human- und technikorientierten Interventionen und Maßnahmenpakete umfaßt, die dazu geeignet sind, die Wissensproduktion, -reproduktion, -distribution, -verwertung und -logistik in einer Organisation zu optimieren" (Schüppel 1996, 191f).
78. The original definition in German is "Wissensmanagement umfaßt alle Methoden, Verfahren und Werkzeuge, die die Kernaktivitäten fördern und als geschlossener Kernprozeß in allen Breichen und Ebenen der Organisation zur Realisierung der Organisationsziele beitragen." (Heisig/Vorbeck 1998, 3, see also section 10.1.8 - "Fraunhofer Berlin" on page 444).
79. See "Definitions focusing on a life cycle of knowledge tasks, functions or processes." on page 53. Regularly, the life cycle of knowledge functions is extended to include the "deletion" or "archiving" of knowledge as in the technology-oriented definitions explicit knowledge is considered storable and thus is not bound to a person as in people-oriented definitions.
80. See "Multiple definitions and no explicit definition at all." on page 55 below.

Example: Knowledge management comprises the management of data, information and knowledge processing in organizations. Knowledge and information are viewed as objects which generally can be handled and which are stored on knowledge or information media in material form (as data). Knowledge management is not confined to the technical realm like traditional data and information management. It includes the personal and institutional knowledge potentials and their processing. Thus, it takes over certain functions of HRM[81] (Kleinhans 1989, 26).

Definitions focusing collective or organizational knowledge. These approaches view the organization as a social system and as the primary object of knowledge management. Goal of KM initiatives or strategies is to improve the collective intelligence or collective mind of organizations so that the resulting systematic coordination of knowledge and intellect throughout the organization's often highly disaggregated network of individuals is applied to meet customer needs (also Quinn 1992, 72).

Example: Knowledge management means all organizational strategies to create an "intelligent" organization. These strategies comprise (1) with respect to individuals the organization-wide level of competencies, education and ability to learn of the members of the organization, (2) with respect to the organization as a system creating, using and developing collective intelligence and the collective mind and (3) with respect to the technological infrastructure if, to what extent and how efficiently the organization uses ICT suitable for the organization's way of doing business (Willke 1998, 39).

Multiple definitions and no explicit definition at all. In addition to this broad variety, there are also quite a few authors who give more than one definition in order to show different challenges or solutions which would be out of the boundaries of either one of the definitions. Additionally, there are quite a few articles, especially technology and/or practitioner-oriented ones, which present specific ideas about knowledge management and do not define this term at all[82]. Their implicit definitions all fall more or less in one of the categories mentioned above.

Example: (1) KM comprises "the practices and technologies which facilitate the efficient creation and exchange of knowledge on an organization-wide level in order to enhance the quality of decision making", (2) "KM enables the re-use of information and experience to increase the velocity of innovation and responsive-

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81. The original definition in German is "Wissensmanagement umfaßt das Management der Daten-, Informations- und Wissensverarbeitung im Unternehmen. Wissen und Informationen werden dabei als grundsätzlich handhabbare Objekte angesehen, die direkt oder indirekt über Wissens- bzw. Informationsträger in materieller (Daten-)Form vorliegen. Wissensmanagement beschränkt sich jedoch nicht nur auf den technischen Problemkreis, wie das traditionelle Daten- und Informationsmanagement, sondern es verwaltet auch insbesondere die personellen und institutionellen Wissenspotentiale und deren Verarbeitung. Es übernimmt damit spezielle Funktionen des Personalmanagements."
82. Examples are Abecker et al. 1998, Bach 1999, Bach/Österle 1999, Nedeß/Jacob 2000, 94, Wildemann 2000, 65ff.

ness. Knowledge in these definitions is seen as "the information resident in people's minds which is used for making decisions in previously unencountered circumstance" (both definitions are taken from Delphi 1997, 12).

A comprehensive definition for knowledge management which can serve as a basis and context for the subsequent investigation into the potentials of systems supporting such an initiative, thus has to consider the following areas (for details see also the following chapters):

Strategy. The definition has to show that systematic interventions into an organization's knowledge base have to be tied to business strategy. The resource-based view in general and the knowledge-based view in particular provide a suitable theoretical basis.

Knowledge life cycle tasks. In order to give a more detailed picture about what KM is about, the definition can list a number of functions, tasks or processes which a KM initiative supports or tries to improve. Examples are[83]:

operative or *specific knowledge management tasks* such as the identification, acquisition, creation, capturing, collection, construction, selection, evaluation, linking, structuring, formalization, dissemination, distribution, retention, evolution of, access to and last but not least the application of knowledge or

(strategic) knowledge management tasks such as the anchoring of knowledge orientation in the vision and mission of the organization, the support of a knowledge-oriented organizational culture, the setting of knowledge goals and the selection of knowledge strategies to achieve these goals, the identification of knowledge gaps or barriers, the (economic) evaluation of the handling of knowledge in an organization, the implementation of knowledge strategies with the help of a (re-) design of KM tasks, roles, processes or ICT infrastructure.

Instruments. The same argument as in the case of tasks is also true for KM instruments. Pioneering organizations developed new instruments to promote the handling of knowledge in the course of the implementation of their knowledge management initiatives which show what knowledge management (currently) is about. Examples are[84]: expert yellow pages, skill data bases, communities, balanced scorecards, learning laboratories, distance, tele or Web based training and education, expert networks or intellectual Webs[85], new roles such as knowledge brokers or subject matter specialists, knowledge maps, lessons learned, best practices, mentoring and coaching, space management, competence centers, integration of external knowledge media (persons, material, ICT) and the management of legal aspects of knowledge (patents, licensing, appropriability of knowledge). Instruments affect the objects of knowledge management, usually a combination of objects.

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83. See section 6.3.1 - "Knowledge management tasks" on page 207.
84. See also Probst et al. 1998, Roehl 2000, Amelingmeyer 2000, 118ff and chapter 6 - "Organization" on page 153.
85. Quinn et al. 1996, 78.

Objects. Depending on the perspective on knowledge management, objects can be *objectified knowledge resources*, *people*, *organizational* or *social structures* and *knowledge-related technology* (especially ICT). In the case of the view of knowledge as a resource, there are plenty of taxonomies distinguishing between different types of knowledge, e.g., tacit versus explicit, declarative versus procedural, narrative versus abstract, internal versus external[86].

Linking to organizational or collective learning. Knowledge management is not exclusively about individual learning. It is the collective learning processes as theorized in the OL literature, that make this approach so interesting. Collective learning is of differing types (e.g., single loop, double loop, deutero learning), takes place on different levels of the organization (e.g., work group or project, community or network, organization, network of organizations) and in different phases (e.g., identification or creation, diffusion, integration, application, feedback). One of the most important facets of the OL approach is the idea that all the processes of learning in collectives are different from individual learning. Thus, it is the dynamics of OL—sometimes called the OL cycle—that is of interest here.

None of these areas explicitly focuses on the *contents*, that is the actual subjects, topics or knowledge area(s) around which a KM initiative builds a supportive environment. The reason for this is that the definition of KM should be general enough so that all kinds of different knowledge areas can be supported by strategies and instruments. Certainly, a specific KM initiative has to define what concrete knowledge areas will be supported, to what extent this knowledge is readily available in an the organization and how much knowledge has to be created or acquired[87]. Box B-1 presents the definition for knowledge management as used here.

> Knowledge management is defined as the management function responsible for the regular selection, implementation and evaluation of goal-oriented knowledge strategies that aim at improving an organization's way of handling knowledge internal and external to the organization in order to improve organizational performance. The implementation of knowledge strategies comprises all person-oriented, organizational and technological instruments suitable to dynamically optimize the organization-wide level of competencies, education and ability to learn of the members of the organization as well as to develop collective intelligence.

BOX B-1. **Definition of knowledge management**

The term management is used here in a *functional sense* (managerial functions approach) in order to describe the processes and functions, such as planning, organization, leadership and control in organizations as opposed to the institutional

86. See section 4.2.2 - "Types and classes of knowledge" on page 66.
87. See also chapter 5 - "Strategy" on page 93.

sense (managerial roles approach) which describes the persons or groups that are responsible for management tasks and roles (Staehle 1991, 64).

In the more recent approaches to knowledge management, most authors suggest to follow a holistic approach overcoming the distinction between human-oriented and technology-oriented knowledge management as discussed above (see Figure B-6 on page 53). Consequently, a KM initiative should combine organizational and technological instruments. For example Ruggles (1998, 88) suggests to keep a balance of 50% people-oriented, 25% process-oriented organizational measures and 25% technological measures from the start of a KM initiative. This leads to the following hypothesis:

Hypothesis 4: Organizations with systematic knowledge management that has been established for at least one year are more likely to have installed KMS than organizations without systematic knowledge management.

Organizations with an established formal KM initiative supposedly apply an in-depth approach to knowledge management and thus should be aware of the positive results that are expected from a joint application of organizational and ICT measures for KM. However, this might not be true for the first year of implementation as it takes some time until complex ICT is selected to support the initiative.

4.1.5 Critique to knowledge management

Is knowledge manageable? Is knowledge management just another passing management fad? Is it too complex a concept for being researched rigorously? What are the main research barriers to the utilization of knowledge? What is it about knowledge management that is distinctly different from older theories and concepts such as organizational learning, organizational change etc.? These are some of the questions knowledge managers and researchers face. Moreover, more traditional software like document management systems, data warehouses and analysis tools and data bases are marketed increasingly as knowledge management systems. Thus, as with every emerging discipline or field of research, there is considerable variety in the perspectives taken and there is no consensus yet what knowledge management is all about and how to proceed.

Many authors have criticized knowledge management and/or suggested new directions for research. Some examples are: Miles et al. identify general conceptual and research barriers to knowledge management (Miles et al. 1998). Holtshouse and Teece propose some research directions for knowledge management intended to overcome these shortcomings (Holtshouse 1998, Teece 1998a). Teece also suggests to view knowledge management as an umbrella to integrate work in accounting, economics, entrepreneurship, organizational behavior, marketing, sociology, and strategy (Teece 1998a, 289). Roehl questions the manageability of knowledge and suggests to focus on the (social) environment instead in which knowledge is generated, shared and used (Roehl 1999). Nonaka and Konno present quite a similar idea with their concept of *Ba*, a shared space for emerging relationships, a platform for knowledge creation which has to be fostered by management (Nonaka/

Konno 1998, 40, 53f). Schmitz/Zucker warn that many knowledge management approaches tend to view knowledge as an object and suggest to rename management *of* knowledge into management *for* knowledge (Schmitz/Zucker 1999, 181). Fahey and Prusak reflect their experiences gained in over one hundred "knowledge projects" and come up with eleven "sins" of knowledge management (Fahey/Prusak 1998). On the basis of two case studies, Swan et al. (1999, 265ff) show the dangers of IT-led KM initiatives that neglect the pre-existing organizational structures, norms and cultural values and as a consequence might even reduce the sharing of *tacit knowledge* in an organization (i.e., knowledge that is not easily communicated, section 4.2). Finally, Pawlowsky (2000) asks provocatively why we need knowledge management at all.

Most of these authors agree that there are substantial benefits to be gained from the systematic and conscious treatment of knowledge-related processes in organizations. The diversity, interdisciplinary nature and dynamics of the field have resulted in a large variety of KM approaches some of which seem to fail to recognize the abundant "lessons learned" in the approaches that form the roots of KM, namely organizational development, organizational learning and strategic management. As a consequence, organizations eager to improve their way of handling knowledge are confronted with several theoretical "schools of thought" on the one hand (human-oriented versus technology-oriented approaches, but also the intellectual capital approach, newer forms of organizational learning approaches, HR approaches etc.) and a vast and not transparent market supply of KMS on the other hand. Moreover, a theory-driven implementation of ICT to support a strategically relevant KM initiative not only has to select a KM perspective and often a combination of KM tools and systems, but also integrate organizational design- and culture-oriented instruments with the supporting technology.

In other words, even though many authors regularly put emphasis on the (individual and organizational) human side of KM, it is technology that all too often is employed as an enabler, a catalyst, a vehicle to complement or implement the concepts that should change the way organizations handle knowledge. Information and communication systems are used as enablers because they provide a cost-efficient and time-efficient way of changing organizational routine or at least managers believe so. Even though KMS can act as catalysts for KM initiatives, it has to be warned against an implementation of such systems without considering the human and organizational side. Instead, a careful coordination with a corresponding strategy, an organizational design and people-oriented measures is required in order to provide a systematic and potentially successful intervention into an organization's way of handling knowledge.

4.2 Knowledge

The term *knowledge* is used widely, but often quite vaguely within business administration[88] and MIS in general and within the field of knowledge management in particular. There are a large number of definitions of this term with varying roots and backgrounds which unfortunately differ not only between scientific disciplines contributing to KM, but also within these disciplines (e.g., Lehner et al. 1995, 165ff, Lehner/Maier 1997) and consequently also within the KM field. Moreover, the different definitions of the term knowledge lead to different perspectives on organizational knowledge and, thus, to different concepts of interventions into an organization's way of handling knowledge (Schneider 1996a, 17ff).

There are also related concepts such as (core) competence(ies) (e.g., Prahalad/Hamel 1990), organizational capability(ies) (e.g., Grant 1996a) or know-how. They all play a role in knowledge management. It is well worth to briefly review these concepts because the distinctive definitions of knowledge (and related concepts) help to understand the different perspectives taken in the literature and also allow for a characterization of KM approaches. It is neither intended to give a comprehensive overview of knowledge definitions because even a limited review of the work done e.g., in philosophy and sociology would fill bookshelves, nor is it intended to give an all-encompassing definition of knowledge. Instead, the most important conceptualizations of knowledge will be reviewed (section 4.2.1) which have made their way into the various classes of KM approaches as described above (section 4.2.2)[89]. Then, important facets of the term knowledge will be selected to discuss the implications on the definition, the design and the implementation of KMS (section 4.2.3). Finally, the term knowledge will be defined for the following investigation, keeping its limitations well in mind (section 4.2.4).

4.2.1 History and related concepts

The many connotations and meanings attributed to the term knowledge and the difficulties that both, science and also every-day life, experience in defining this concept are reflected by a multitude of terms that all denote a particular piece or process in the scope of knowledge[90]. Examples are: ability, attribution, capability, competence, conviction, discovery, estimation, evidence, experience, explanation, finding, hunch, idea, intelligence, interpretation, intuition, invention, know-how,

88. The term "business administration" is used here to describe the discipline represented by the corresponding programs at business schools (Master of Business Administration, MBA), in German "Betriebswirtschaftslehre" and comprises e.g., controlling, finance, HRM, management science, marketing, organization science, production and logistics, strategic management etc. Management information systems are in most business schools considered as a part of the MBA program, but are treated separately here. Due to the integration of information and communication technologies MIS reflects a different perspective on knowledge management than the rest of business administration does.
89. See section 4.1 - "Knowledge management" on page 21.
90. See e.g., Rich 1981a, 38, Prahalad/Hamel 1990, Weick 1995, 17ff, Grant 1996a, Lehner 2000, 141.

observation, opinion, persuasion, proficiency, proof, sensemaking, skill, tradition, understanding, wisdom. Thus, it is not surprising that so far none of the definitions of knowledge has succeeded in bringing all these conceptions under one umbrella. However, it is doubtful whether such an all-encompassing definition could still be operationalized and would remain meaningful for all the different disciplines that deal with this concept in the sense that it could be used as a basis for subsequent studies[91].

Traditionally, knowledge has been at the core of philosophical considerations. Philosophy has striven for a common and accepted definition or conceptualization of knowledge for centuries with great philosophers contributing to the subject. Examples are[92]:

Greek philosophy. Heraclitus, Sokrates, Plato and Aristoteles among others laid out the foundation for the European thinking of the term knowledge and conceptualized the process of knowing or acquiring knowledge. The most important distinction to today's (scientific) use of the term knowledge is that the Greeks did not believe in certain types of knowledge, but in harmony that was achieved through the unification of physical, ethical and political thought. Most of these philosophers believed in the notion of an *objective reality* which would be *knowable* by a systematically or scientifically observing and analyzing subject and therefore knowledge would represent objective *truth*,

Revolution of thought. Bacon, Descartes, Hobbes, Hume, Leibnitz and Locke among others challenged in the 17th and 18th centuries the commonly held equivalence of *knowledge* and *faith* and the Church as the *one institution* responsible for determining what was "true". Kant and Hegel tried to integrate the various new philosophical fields, namely rationalism and empiricism (best visible in Kant's concept of *justified true belief*),

Multi-perspectivism. Since the 19th century many philosophical schools of thought have emerged. Examples are:

- *positivism* argues that knowledge is gained from the observation of an objective reality, thus distinguishing between an observing subject and an observed object, in this case an organization and its environment. Positivism, represented e.g., by Comte, is the basis of natural science also extensively applied as the foundation of management science.
- *constructivism* claimed the idea that all our knowledge is constructed in our minds therefore challenging the notion of an objective reality. Constructivism is

91. See also Grant 1996a, 110 who argues that the "right" definition for knowledge has to be selected for each specific purpose and research goal.
92. Many authors have made the philosophical roots of their definitions of knowledge visible. Examples are Gardner 1985, Musgrave 1993, Rich 1981a, 12ff, Spender 1996a, 47ff and the sources cited there, also Ayer 1982, Coreth et al. 1993, Fleischer 1996, Lutz 1999, Russel 1961, Scruton 1984 for an extensive overview of the general contributions of the Western philosophers.

a term originating in art and architecture used differently in the Anglo-American versus the German literature and is represented for example by the Erlangen school in Germany[93].

- *critical theory* was developed from a critical attitude towards traditional theory. Critical theory tried to overcome the tension between traditional theory which is developed in separation of the reality of society and the real, societal function of science. The normative elements of theory have to be integrated into the theory itself. Critical theory was developed by the Frankfurt school, represented by Horkheimer, Adorno, Habermas.
- *critical rationalism* developed the argument that all our knowledge is tentative and must be open to empirical falsification and is represented by Popper[94].
- *empiricism* is based on the assumption that knowledge can be created solely from experiences and thus only natural sciences and mathematics can offer secure knowledge and undoubted truths. Empiricism is represented by Hobbes, Locke, Hume and Russel who called it logical atomism and was convinced that the smallest elements of reality can be perceived and named.
- *sociology of knowledge* viewed knowledge as *socially* constructed and was founded by Mannheim and Scheler who built on ideas of Francis Bacon[95].
- *pragmatism* is not concerned with universal truth, but with a more immediate concept of knowledge representing the local reality of our experience since no practice ever engages more than a fraction of the universe ("what works"). Pragmatism was developed by e.g., Peirce, James, Lewis and Dewey[96].

These are just some prominent philosophies which had a profound effect on the conceptualization of knowledge in KM and on the implementation of KM initiatives in practice. These schools of thought have presented competing approaches about the construction of knowledge and truth in societies and there has been a long and substantial debate about the "right" perspective (e.g., Hayek talks 1974 in his Nobel Memorial Prize Lecture about the pretence of knowledge of scientists in the social sciences, Hayek 1996, 3). However, the different schools have not found a consensus in the sense of a common understanding of knowledge (yet). Russel thinks that some vagueness and inexactitude of definitions of concepts, such as knowledge, truth or believe, are inevitable (Russel 1948, 170). The main research questions have always circled around (objective) truth, the limitations of the human mind and belief.

Due to the fact that these philosophical research interests are quite different from the research goals in knowledge management, it can be doubted that either

93. See e.g., Berger/Luckmann (1967) for the Anglo-American perspective, see the Erlangen school, Lorenzen, Kamlah and their disciples for the German perspective, also Hayek 1996, 17, Scherer/Dowling 1995, 218f.
94. See Popper 1972, 1994 for his ideas on objective knowledge.
95. See also section 4.1.1.4 - "Psychology and sociology" on page 32.
96. See Ayer 1982, 69ff and Spender 1996a, 49 who analyzes perspectives on knowledge of pragmatism and other philosophies as the basis for a theory of the firm.

one of the philosophical perspectives can provide a solid basis for investigations into aspects of knowledge management systems[97], though the philosophical concepts certainly have influenced KM perspectives on the term knowledge. One difference between philosophical considerations and KM is that the philosophical definitions tend to restrict the term to (verbally) expressed or expressible (scientific) knowledge which can be challenged by peers whereas organization science also considers those experiences and ideas that implicitly guide actions and communication, but of which the individual is either not aware or which the individual cannot (or chooses to not) express: the so-called *tacit knowledge*[98].

Even the conceptualizations of knowledge in the *cognitive sciences*[99], which can be seen as one of the leading fields in the definition of knowledge within the social sciences (e.g., Wiegand 1996, 164), are not suited as exclusive definitions for knowledge management. One reason for this is that these definitions are restricted to the individual or the individual brain as opposed to the focus on *collective knowledge, networks of competencies* or the *organizational knowledge base* as conceptualized in organizational learning and knowledge management.

This view is based on the perspective as outlined in the philosophical field *constructivism* and its counterpart in the social sciences: the *sociology of knowledge*[100]. In the latter, knowledge is considered as socially constructed, that is as influenced by a society's "Weltanschauung" (world concept)[101]. Thus, it postulates that a particular language structure implies a unique world view and perception of reality. Social processes influence the "process of knowledge" (generation, application). As a consequence, knowledge cannot be described as objective truth (even though we might strive for that), but as what a social system considers as being true.

These approaches were a product of their time and particular interests and were criticized heavily (e.g., by Popper 1970). Still, the *concept of socially constructed knowledge* has been well received within the OL and KM community. Business organizations regularly do not strive for "objective truth" which is the primary goal of science[102] (see also Luhmann's system of functions of societies, Reese-Schäfer 1999, 176f). Instead, in many cases organizations pragmatically look for knowl-

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97. The danger of simply borrowing the philosophical definition of knowledge for psychology was analyzed e.g., by Musgrave (Musgrave 1993, 62f).
98. See section 4.2.2 - "Types and classes of knowledge" on page 66, also Polanyi 1966, Wiegand 1996, 164.
99. E.g., Gardner 1985 who even uses the subtitle "A History of the Cognitive Revolution" in his book "The Mind's New Science", also Payne 1982, Squire 1987, Mandl/Spada 1988, Singley/Anderson 1989.
100. For literature on the topic see section 4.1.1.4 - "Psychology and sociology" on page 32; see also e.g., Curtis/Petras 1970 for a good overview on early and also later developments.
101. Later, the term Weltanschauung was extended to cover not only societies, but also social groups within societies.
102. As mentioned above, there are a number of schools of thought that conceptualize objective truth or objective knowledge differently. Scientific knowledge can be thought of as being the most dependable, most definite, the *best* knowledge that we have (Bentley 1935, 131) *at a certain point in time*.

edge that can be applied efficiently (in terms of "cash value", Spender 1996a, 49) to support the objectives of business organizations[103]. Moreover, business organizations rather strive for sufficient (in terms of efficiency) than for absolute or complete knowledge about their practice (see also Simon's concept of rational behavior and rational decision making in organizations, Simon 1957a).

In *business administration*, the term knowledge in and of organizations is also used in a variety of ways and a variety of relationships to other concepts and to the concept of organization itself[104]. Examples are:

Knowledge as production factor. Knowledge can be viewed as an immaterial potential factor (e.g., Wittmann 1982) along with creativity, good-will, image, capacity for problem solving or other factors which are hard to quantify. Organizational knowledge receives high attention within organizations as it is the basis for all decisions and organizational activities. Due to the increasing knowledge intensity of society in general and business in particular, knowledge is often considered to be the key production factor that has to be handled accordingly. This conceptualization is most prominent in the knowledge-based view (e.g., Grant 1996a, Grant 1996b, Spender 1996a), a specialization of the resource-based theory of the organization (Grant 1991), where knowledge is also seen as key resource for the provision of competitive advantages and, thus, as a success factor. However, it is the services that can be offered with the help of managerial knowledge that produce competitive advantages[105].

Knowledge as product. Knowledge not only guides organizational actions, but can also be sold. For example, professional services companies sell knowledge services. Pharmaceutical companies hold *patents* and license the production of drugs. Knowledge can also be part of *intelligent*, *smart, knowledge-based* or *knowledge-intensive products* (e.g., Davis/Botkin 1994, 165, Glazer 1999, 59) which then can be seen as *knowledge medium*, as "frozen knowledge" (Probst et al. 1998, 170),

Knowledge and its relation to decision and action. Apart from the fact that many authors do not make an explicit distinction between knowledge and information, the most prominent perspective in the German business administration literature is Wittmann's definition of information as being "knowledge oriented towards a purpose" (Wittmann 1959). This perspective views information as a (situational or purpose-specific) subset of knowledge. Both, knowledge and information guide organizational interpretation and action in the sense of activities. On the one hand,

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103. These objectives can be e.g., to increase the shareholder value and/or stakeholder value of the organization, to survive and be profitable, to increase customer and/or employee satisfaction. Certainly, there are ethical responsibilities that managers have to consider. However, according to Spender most U.S. executives these days declare themselves as pragmatists (Spender 1996a, 49). Thus, knowledge in organizations is oriented towards a purpose and has to be (efficiently) applicable in the local reality of the organization handling it.
104. See also e.g., Lehner et al. 1995, 170ff, Roehl 2000, 11ff.
105. See also chapter 5 - "Strategy" on page 93.

knowledge is the basis for organizational action. On the other hand, organizational activities generate knowledge which in turn influences future activities. The effect of knowledge and to a much greater extent the effect of information on decision making in organizations has been studied in decision theory for years (e.g., Mag 1990, Gersbach 1991).

Rationality of individual decisions is restricted by incomplete knowledge, difficulties in the valuation of future events, limited selection of alternatives and, more recently, information overload. Due to limited rationality, a perfectly knowledge-based decision was characterized as unrealistic (e.g., Hayek 1945, 519ff and 1996, 3ff), even though at least within organizations (and thus in a social setting) human behavior can be described as "intendedly rational" (Simon 1957, 196ff and 1957a, 61ff). The ideal construct of perfect information for decision making was abandoned in favour of an economic information problem guiding organizations under variable imperfect information. The goal is to determine the optimum degree of information with respect to cost and potential benefits of additional information (Albach 1969).

Knowledge as constituent property of a special breed of organizations. Organizations which follow the knowledge-based view or (primarily) manage and/or sell knowledge, are called *intelligent organizations* (e.g., Quinn 1992, Schwaninger 1998, 1999, Tuomi 1999, 105ff), *knowledge-intensive organizations* (e.g., Starbuck 1992, 715ff who uses this term in analogy to capital or labour-intensive, Mahnke 1997, Tuomi 1999, 75ff, Weggemann 1999, 83ff), *know-how organizations* (e.g., Roithmayr/Fink 1997), *knowing organizations* (e.g., Choo 1998), *knowledge-based organizations* (e.g., Willke 1998, 20), simply *knowledge organizations* (e.g., Sveiby 2001), (distributed) *knowledge systems* (Tsoukas 1996, 13), or, in an older terminology, *learning organizations* (e.g., Garvin 1993, 80, Senge 1990a). These concepts all have in common that in these organizations knowledge is considered to be the most important asset which accordingly receives high management attention. Knowledge intensity or the type of knowledge emphasized is also used to distinguish different classes of organizations requiring different KM activities and systems support[106].

Knowledge on the organizational level. Knowledge can also be viewed as the outcome of organizational learning, as information that has been understood by all or at least a critical mass of members of the organization[107]. This perspective distinguishes individual knowledge from organizational knowledge. On the organizational level, information in the sense of an established, institutionalized organizational *information resource* (Levitan 1982) is considered to be a precursor of knowledge. Additionally, organizations base their actions on *opinions* which denote the beliefs, convictions, persuasion and views of the members of the organization, the valued knowledge, etc. Knowledge and information in this perspective

106. See section 4.2.3 - "Consequences for knowledge management" on page 70.
107. For example Matsuda 1992, 1993 calls it intelligence, also Müller-Merbach 1994-1999.

are also part of a life cycle of information production in organizations (Picot/ Franck 1988).

The roots of the term knowledge as used within organizational learning and knowledge management approaches are manyfold and can be traced back to different disciplines. Even within the KM field, knowledge is used in a multi-faceted way. The following section will give an overview of types of knowledge, taxonomies and different viewpoints as used within the OL and KM area.

4.2.2 Types and classes of knowledge

In addition to the abundant definitions of knowledge, there have been many authors who proposed classifications or categorizations of knowledge. Many classifications use a dichotomy to describe one type of knowledge and its opposite. These pairs can be used to describe *knowledge processes* (Romhardt 2000, 10ff). The knowledge processes transform knowledge of one type into knowledge of the opposite type. In the following, a list of knowledge dimensions is presented with respect to the corresponding main "area of intervention", e.g., individual, organization, information and communication system, content, knowledge life cycle. The dimensions are then populated with an amalgamated and extended list of paired types of knowledge[108] (transforming processes are in parentheses):

1. **Content of knowledge or knowledge application:**
   - abstraction: narrative/concrete/surface/every-day/knowledge of the particular circumstances of time and place vs. scientific/abstract/deep knowledge (abstract; illustrate),
   - generalization: particular/specific vs. universal/general knowledge (generalize; specialize),
   - contextualization: contextualized vs. objectified/decontextualized knowledge (generalize; contextualize),
   - form: declarative vs. procedural knowledge (explain; describe),
2. **Holder of knowledge or valuation of an individual:**
   - value: knowledge valuable for storing vs. knowledge not valuable for storing (devalue; value),
   - relation to person: implicit/tacit/background/non-communicable vs. articulated/explicit/foreground/communicable knowledge (externalize; internalize),
   - existence: knowledge vs. not knowledge (forget; learn),
3. **Organizational design:**
   - relevance: relevant vs. irrelevant knowledge (render irrelevant; make relevant),

108. See also e.g., Hayek 1945, 521ff, Hedlund/Nonaka 1993, 118ff, Zucker/Schmitz 1994, 63, Schneider 1996, 8f, 521f, Schüppel 1996, 54ff and 76ff, Thurow 1997, 102, Zack 1999a, 46, Amelingmeyer 2000, 43ff, Frese/Theuvsen 2000, 25ff, Lehner 2000, 139ff, Romhardt 2000, 10ff, Bhatt 2001, 70, Schreyögg 2001a, 9.

- informal support: unsupported/minority vs. supported/dominant knowledge (inter-subjectively approve; disapprove),
- formal authorization: unauthorized/informal vs. authorized/formal knowledge (authorize; remove authorization),
- secrecy: public/open vs. secret/confidential knowledge (classify; publish),
- truth: false/unsupported vs. true/supported knowledge (prove; falsify/disprove),
- organizational scope: knowledge spanning functional areas vs. knowledge restricted to a functional area (specialize; standardize),
- focus: focused vs. scattered knowledge (laissez-faire; focus),
- holder: individual/personal vs. collective/public/social knowledge (teach/collectivize/make available; learn/socialize/individualize),
- integration: knowledge vs. counter-knowledge (exclude; integrate),

4. **Legal system and/or organizational boundaries:**
   - security: unsecured/public vs. secured/private knowledge (patent/protect; expire/open),
   - legality: illegal vs. legal knowledge (legalize; forbid/make unlawful),
   - ownership: organization-external vs. organization-internal knowledge (acquire/buy; disseminate/sell),
5. **Information and communication systems:**
   - access: inaccessible vs. accessible knowledge (make accessible; deny accessibility),
   - medium: not electronic/not computer-resident (e.g., paper- or people-based knowledge) vs. electronic/computer-resident knowledge (store; delete),
   - codability: non-codable vs. codable knowledge (codify; decodify),
6. **Knowledge life cycle:**
   - preservation: preserved vs. newly acquired knowledge (develop; preserve),
   - novelty: existing vs. new knowledge (explore; exploit),
   - refinement: unrefined vs. refined knowledge (format/label/index/sort/abstract/standardize/integrate/categorize; clutter/disorganize/mix/unformat),
   - actuality: obsolete vs. actual knowledge (actualize; decay)
7. **Business processes:**
   - relation to process: knowledge about the process vs. knowledge within the process vs. knowledge derived from the process (derive; model; apply).

In addition to the paired classifications, Table B-3 presents an exemplary list of classifications to give an indication of what differentiations authors think as most useful for organizational theory and practice.

TABLE B-3. Classifications of knowledge

approach	**categories**
Scheler (1926, 250)	1. instrumental knowledge (Herrschaftswissen) 2. intellectual knowledge (Bildungswissen) 3. spiritual knowledge (Erlösungswissen)
Machlup (1962, 21f), builds on Scheler (1926)	1. practical knowledge 2. intellectual knowledge 3. small-talk / pastime knowledge 4. spiritual knowledge 5. unwanted knowledge
Hayek (1945, 521f)	1. scientific knowledge 2. knowledge of the particular circumstances of time and place
Ryle (1949, 25ff)	1. knowing that 2. knowing how
Sackmann (1992, 141f) builds on Ryle	1. dictionary knowledge (what?) 2. directory knowledge (how?) 3. axiomatic knowledge (why?) 4. recipe knowledge (what should?)
Quinn et al. (1996, 72), similarities to Sackmann (1992)	1. cognitive knowledge (know-what) 2. advanced skills (know-how) 3. systems understanding (know-why) 4. self-motivated creativity (care-why)
Anderson 1976, 114ff, 1983, 10ff[a], Squire 1987, 242, Fayol 1994, build on Ryle 1949)	1. declarative knowledge (episodic and semantic knowledge) 2. procedural knowledge 3. meta-knowledge
Heideloff/Baitsch (1998, 69), similarities to cognitive sciences	1. fact knowledge (about things) 2. episodic knowledge (about events) 3. procedural knowledge (about relationships)
Russel (1948, 17ff)	1. individual knowledge 2. social knowledge
Polanyi (1966, 4ff)	1. tacit knowing 2. explicit knowing
Spender (1994, 360), builds on Polanyi (1966) and Russel (1948)	1. conscious knowledge (explicit individual knowledge) 2. automatic knowledge (implicit individual knowledge) 3. objectified knowledge (explicit social knowledge) 4. collective knowledge (implicit social knowledge)
Willke (1998, 63, builds on Polanyi)	1. implicit knowledge 2. explicit knowledge 3. public knowledge 4. proprietary knowledge

TABLE B-3. Classifications of knowledge

approach	categories
Wiig (1988, 102) defines knowledge to be managed in businesses	1. public knowledge 2. expert knowledge 3. private knowledge
Collins (1993, 96ff) classifies knowledge according to its location	1. embrained knowledge (brain) 2. embodied knowledge (body) 3. encultured knowledge (social system) 4. symbol-type knowledge (symbols)
Bohn (1994, 63) suggests stages of knowledge	1. complete ignorance 2. awareness 3. measure 4. control of the mean 5. process capability 6. process characterization 7. know why 8. complete knowledge
Blackler (1995, 1023ff) adapts Collins' classification to summarize OL concepts	1. embrained knowledge (depends on conceptual skills) 2. embodied knowledge (depends on physical presence) 3. encultured knowledge (shared understanding, socialization) 4. embedded knowledge (in systemic routines) 5. encoded knowledge (signs, symbols)
Sveiby (1997, 35) views knowledge as process	1. explicit knowledge 2. skill 3. experience 4. value judgements 5. social network
Baecker (1998, 6ff) categorizes knowledge in organizations	1. product knowledge 2. societal knowledge 3. leadership knowledge 4. expert knowledge 5. milieu knowledge
Hansen et al. (1999), Zack (1999a, 46) view knowledge as manageable	1. knowledge as object (codified, independent of person) 2. knowledge as process (personalized)
Zack (1999b, 133f) categorizes industry knowledge	1. core knowledge 2. advanced knowledge 3. innovative knowledge

a. This differentiation is common in the literature on AI and cognitive sciences. Anderson proposed a general framework for a production system describing the architecture of (human) cognition (ACT) that consists of a *declarative*, a *production* and a *working memory* (Anderson 1983, 19).

These classifications have in common that they use a couple of categories which are thought to provide a comprehensive classification of knowledge in organizations. Generally, the categories are not comparable to each other, although there are

conceptualizations that build on each other or otherwise show similarities (e.g., Machlup builds on Scheler, Quinn et al.'s classification is similar to Sackmann's). There are also homonyms and synonyms and some adaptations do not carry the same meaning as their basis (e.g., Blackler builds on Collins' classification but uses the terms in a different way).

The interested reader may consult the original literature for a detailed description of each of these pairs or classifications. The entire list was presented here to give an indication of the heterogeneity with which the field defines its most important term and, thus, how difficult it is to integrate the views into a single perspective. In the following, the most important distinctions will be briefly characterized which form the basis for the investigation of concepts and scenarios of the application of KMS. A detailed description of the tasks and processes of the KM life cycle and of the operationalization of the distinctions for the empirical study (see part C) can be found in the later sections of this work[109].

4.2.3 Consequences for knowledge management

The variety of definitions of the term knowledge is due to the variety of research subjects which require more or less focus on knowledge. Knowledge is at the center of scientific investigations and an understanding of its philosophical foundation and debates is certainly an anchor in the rough sea of the knowledge management hype. There are still numerous definitions and classifications within the field of knowledge management which are not integrated showing the enormous influx of ideas from related fields. At least to some extent, there is agreement among KM researchers about the most important dichotomies and characteristics of knowledge, such as individual versus organizational, implicit versus explicit, organization-internal versus organization-external knowledge.

In the following, the most important characteristics of knowledge will be summarized which have consequences or provide challenges for the design of knowledge management systems:

"Transfer" of knowledge. Several authors dealing with ICT support for KM have written about KMS which support the transfer or distribution of knowledge. In this area, not only explicit knowledge is considered which can be transferred with the help of knowledge products (See "Knowledge as a product versus knowledge as a process." on page 73 below), but also the tacit side of knowledge. The latter can only be handed on directly from teacher to apprentice (socialization). Knowledge management systems can help

- to locate experts or teachers suited to hand on tacit knowledge to a member of the organization searching for knowledge,
- to pro-actively suggest individuals working on or reflecting about similar subjects to form a network. This improves the efficiency of knowledge creation

109. See chapter 6 - "Organization" on page 153.

through joint observation and inference and communication of results, problems and solutions, and last but not least

- to aid the sharing, dissemination and distribution of knowledge.

According to most definitions of data, information and knowledge[110] *only data can be transported or communicated* which in turn is interpreted by individuals or social systems. Therefore, even KMS essentially contain and support the communication of data only. However, keeping the goals and background of this work in mind, it is opportune to distinguish between the "simple" transmission of data and the "transfer" or "distribution" of knowledge. The latter denotes the simplified and shortened process including the interpretation of the message (information) and the actualization or extension of the knowledge of the receiving system. Figure B-7 shows the complete process of the communication of information and knowledge. Transfer of knowledge implies that the sender is quite certain that the receiver will interpret the data accordingly, (re-) construct the knowledge and use it to actualize the receiver's knowledge in a way that the sender intends.

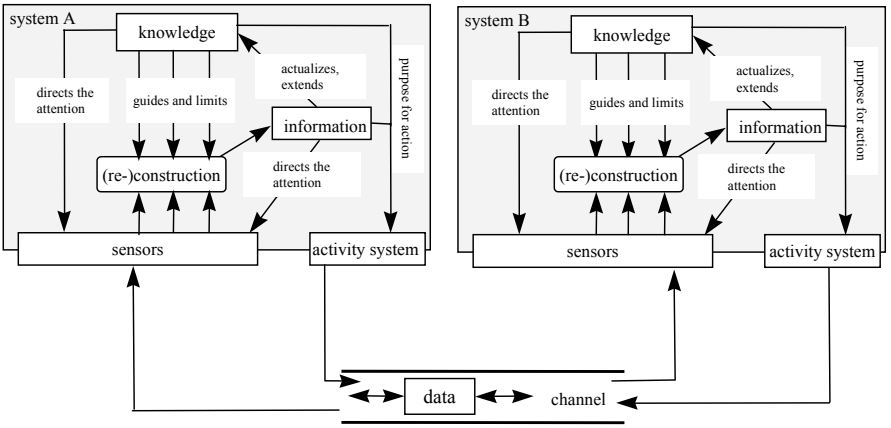

FIGURE B-7. The transfer of information and knowledge

It must be noted that the sender cannot be sure that the receiver will interpret the data in a way that the sender intended. Additionally, according to modern theories in the cognitive sciences with each transfer of knowledge, the knowledge itself is changed not only at the receiving end, but also at the sending end of the communication as it is not just "retrieved" in memory, but reconstructed and the knowledge's context (Cohen 1998, 30ff) is thus changed with each transfer.

Relation to context. Knowledge is developed in a cultural context with social, political, economic and ideological dimensions that exert continual forces on both the substance and the process of scientific knowledge creation (Nelson 1981, 44,

110. See Lehner et al. 1995, especially 170ff for an extensive survey of these definitions.

also Cohen 1998). What has been said about scientific knowledge creation is all the more true in organizational settings. Organizations are not regularly striving for absolute truth, but for a socially constructed reality that allows for successful organizational actions[111]. Knowledge cannot be separated easily from the social context of its generation and reception, both in terms of the environment and situation in which it was generated and in terms of the individuals that created the knowledge.

Economic differences to information. Unlike information, knowledge is not easily transferred between different settings. The costs for the "distribution" of knowledge can be very high (Rehäuser/Krcmar 1996, 11). It takes time until individuals take over knowledge. The corresponding learning processes are complex social phenomena. Knowledge is reconstructed and thus changes when "transferred", as it is newly combined each time when it is handed on. The social process of communication changes the communicated knowledge. Thus, it requires substantially more effort to implement a systematic management of knowledge transfer as compared to the transfer of information. There are a number of institutions that provide an environment conducive to knowledge transfer or learning. This environment can be viewed as an activity system in which "knowledge seekers", "students" or "apprentices" not only directly learn from "knowledge providers", "teachers" or "masters", but also from participating in a community of practice[112] of all the knowledge seekers and knowledge providers in a joint setting (e.g., schools, universities[113], management centers, corporate universities, industry organizations offering apprenticeships). Unlike in the case of information, the transfer of knowledge takes up substantial resources and its outcome is hard to predict.

Protection of knowledge. One of the most important challenges within KM in organizations is the protection of valuable knowledge, e.g., against industrial espionage. Examples for measures that prevent the unwanted use of organizational knowledge are classification or property laws and also organizational instruments such as incentives, conduct rules or postponing of rewards because a great deal of knowledge valuable to an organization resides with (individual) employees (Liebeskind 1996).

In some cases it is opportune for organizations to share knowledge with competition (co-opetition) and thus systematically manage the diffusion of otherwise restricted (patented, classified, confidential) knowledge, e.g., through mechanisms such as visiting each other's production facilities, consortia, benchmarking (Appleyard 1996, 138f). One implication on the design of KMS is that as valuable knowledge must be protected from leaving the organization unintentionally, it might not be appropriate to make it completely transparent (e.g., to publish it on the organiza-

111. See also section 4.2.1 - "History and related concepts" on page 60 for this argument.
112. Lave/Wenger 1991, 54ff, 91ff, see also section 6.1.3.3 - "Communities" on page 180.
113. See Mandl et al. 1994 for a discussion of the applicability of the community approach to university learning.

tion's Intranet), but instead to disaggregate the knowledge so it cannot be taken easily to a competitor[114].

Knowledge as a product versus knowledge as a process. Both concepts have important, though differing implications on the design of KMS. Basically, explicit knowledge can be documented and stored in knowledge repositories whereas (more) implicit knowledge has to be supported indirectly through ICT use to broker and handle communications[115].

"Right" quantity of knowledge. Many KM approaches implicitly hold the presupposition that *the more knowledge* an organization holds*, the better* for the organization (e.g., Davis/Botkin 1994, 168). The application of this simple equation can be dangerous because it does not consider e.g.:

- that the knowledge that is built up in an organization may not be useful,
- that the communication of knowledge expects quite a lot from the receiving system (individual or social), namely that the system rebuilds its knowledge structures,
- that knowledge is in a sense provisional and is held until better knowledge is generated,
- that more measurable knowledge in terms of e.g., publications or documents not necessarily means that the organization can act or interpret more intelligently,
- that the more we know the more we know what we do not know (knowledge increases "not knowledge") which causes the paradox that the more an organization knows the more knowledge it demands which in turn leads to less efficient daily operations (also e.g., Schneider 1996, 7f, Baecker 2000, 107f, Roehl 2000, 292, Soukup 2000).

As a consequence, KMS have to be built with this danger of information overload and inefficient "oversupply" of knowledge in the sense of too much focus on knowledge generation and too little focus on the application in mind. Therefore, attention has to be paid to e.g., contextualization, filtering, profiling and to determining the optimal portion, level and granularity of knowledge that is presented to a knowledge seeking system. This should guarantee that the system can work more efficiently without getting "lost in knowledge space" and being paralyzed.

Knowledge and knowing. Knowledge always undergoes construction and transformation when it is used. The acquisition of knowledge in modern learning theories is not a simple matter of taking in knowledge, but a complex cultural or social phenomenon (Lave 1993, 8, also e.g., transactive memory systems, Wegner 1986, group remembering, Hartwick et al. 1982). Thus, some authors suggest not to

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114. It is not knowledge, but networked knowledge in the sense of an organization's (core) competencies that are hard to imitate for the competition (see section 5.1.1 - "From market-based to knowledge-based view" on page 94.
115. For a more detailed analysis see chapter 7 - "Systems" on page 273, also e.g., Zack 1999a, 46ff.

speak of knowledge with its connotations of abstraction, progress, permanency and mentalism, but of the processes of knowing and doing which take place in a (*socially-distributed) activity system*[116]. These systems provide a new unit for the analysis of the dynamic relationships among individuals, their communities and the conception(s) they have of their activities. Blackler suggests not to study the concepts of knowledge, individuals, organization or factors that mediate between them in isolation, but to focus on the *dynamics of knowing* with the help of the socially-distributed activity system. Knowing in this perspective is a phenomenon which is

- *mediated*: manifest in systems of language, technology, collaboration and control,
- *situated*: located in time and space and specific to particular contexts,
- *provisional*: constructed and constantly developing,
- *pragmatic*: purposive and object-oriented,
- *contested*: interrelated with the concept of power in organizations which are observable in hierarchies of domination and subordination, leadership etc. (Blackler 1995, 1040ff).

To sum up, the concept of knowing rather than knowledge and the concept of socially-distributed activity systems rather than isolated entities (individuals, knowledge, organization and ICT systems) suggest that the crucial aspects of KM might be missed if we concentrate on separable entities too much. As a consequence, KM instruments supported by KMS have to consider the context in terms of the agents and communities which they are applied in (see also part D).

Multi-faceted knowledge. Design and implementation of KMS differ from design and implementation of more traditional application systems. The term knowledge as used here comprises among others valuations, opinions or forecasts, whereas more traditional application systems more or less exclusively focus on hard data. Also, the design of KMS has to consider the multiple electronically available sources of data such as documents, files, messages, contributions in newsgroups, multimedia elements or links to these sources which all might contain useful knowledge once structured, linked and contextualized. Thus, KMS can be combined with an organization's already existing information systems.

Role of knowledge in different types of organizations. Classifications of knowledge can be used to postulate different requirements or perspectives for KM initiatives and supporting ICT. For example, Blackler uses his classification of knowledge (see Table B-3) to distinguish four types of organizations which also require the support of different ICT (Blackler 1995, 1026ff). Table B-4 shows the four types of organizations distinguished.

The distinction uses the organizational level from which the primary contributions to the fulfilment of organizational goals is expected (individual versus collec-

116. Blackler 1995, Spender 1996a, see section 6.6.2 - "Activity modeling" on page 250 for an account of the modeling of socially-distributed activity systems.

tive) and whether the focus is on familiar or on novel problems. Based on a survey of the literature on knowledge work in organization science Blackler suggests trends that organizations are transformed from type I, II and III into type IV organizations (see Blackler 1995, 1029).

TABLE B-4. Characterization of organizations according to types of knowledge[a]

	Type I: expert-dependent	**Type II: knowledge-routinized**	**Type III: symbolic-analyst-dependent**	**Type IV: communication-intensive**
organizational level	focus on individual	focus on collective	focus on individual	focus on collective
type of problems	familiar problems	familiar problems	novel problems	novel problems
type of knowledge	embodied competencies of key members	knowledge embedded in technologies, rules and procedures	embrained skills of key members	encultured knowledge and collective understanding
characterization	performance of specialist experts is crucial; status and power from professional reputation	capital, technology or labor-intensive; hierarchical division of labor and control	entrepreneurial problem solving; status and power from creative achievements	key processes: communication, collaboration, empowerment through integration
example	professional bureaucracy, e.g., hospital	machine bureaucracy, e.g., traditional factory	knowledge-intensive firm, e.g., software house	adhocracy, innovation-mediated production
role of ICT	computer displacement of action skills	computer integrated work systems	information support and XPS design	development of CSCW systems

a. Source: Blackler 1995, 1030.

However crude Blackler's analysis of the role of ICT is, it does not fail to show that different organizations require different supportive KMS. If Blackler's hypothesis is true that all organizations are moving towards type IV, this would mean that current organizations find themselves on different stages of KM maturity (see the knowledge management maturity model proposed by Ehms/Langen 2000, see also APQC's four-stage model of knowledge management development, Lopez 2001, 20ff), and possibly require in the end the same kinds of ICT systems. These systems just comprise an integrated set of technologies suited for all types of organizations, a path on which the vendors of comprehensive KMS seem to follow[117].

117. See chapter 7 - "Systems" on page 273.

This hypothesis can be tested by taking a look at the developments in the application of KMS over time. There should be a trend that organizations converge in their use of ICT to support the handling of knowledge.

The corresponding hypothesis for the empirical study could then be written as follows:

Hypothesis 5: Organizations converge in their use of ICT and increasingly use communication-oriented functions of knowledge management systems.

4.2.4 Definition

Keeping the abundance of classifications of knowledge in mind, it is clear that the conceptualizations influence the design of KM initiatives and the implementation of KMS in many ways. Thus, it is probably best to define knowledge broadly and openly (see Box B-2) and discuss some implications of the term in detail.

> Knowledge comprises all cognitive expectancies—observations that have been meaningfully organized, accumulated and embedded in a context through experience, communication, or inference—that an individual or organizational actor uses to interpret situations and to generate activities, behavior and solutions no matter whether these expectancies are rational or used intentionally.

BOX B-2. **Definition of knowledge**

Actor is meant here in the sense of an agent. Thus, both individuals or social entities such as teams or communities or entire organizations might act as knowledge-processing entities[118]. Examples of knowledge are scientific findings and theories, heuristics, rules of thumb, techniques, experiences, opinions, cultural customs and norms, world views[119]. Actors are always part of a *social context* which influences the processing of knowledge (organization, accumulation and embedding in a context) of the actor and thus both the interpretation and the actions. Put in a nutshell, knowledge can be defined as the *capacity to interpret and act* (also Sveiby 1997, 37, Sveiby 1998, 65).

In the following, this complex definition will be studied in more detail. The definition encompasses almost all of the categories as distinguished in section 4.2.2 - “Types and classes of knowledge” on page 66 and does not make a distinction between implicit and explicit knowledge, although these categories will prove useful in the more detailed considerations in part D. On the contrary, Polany’s tacit

118. The term *actor* is preferred to *agent* as in the MIS literature *agent* regularly also refers to computer systems (intelligent agents). The old question whether computers can “think” and thus process and apply knowledge is out of the focus of this book (for a brilliant treatise of this topic see e.g., Dreyfus/Dreyfus 1986).
119. See also Segler 1985, 138, Wiegand 1996, 163f, Probst et al. 1998, 44, Willke 1998, 11, Zack 1999a, 46.

dimension of knowledge is explicitly included in the definition as expectancies do not have to be used consciously or intentionally.

Knowledge elements are embedded in a contextual network of meaningful experiences of the system (Willke 1998, 11). These experiences have proven meaningful for the survival of the system (individual or social system). In other words, knowledge is what we come to believe and value through experience, communication, or inference (Zack 1999a, 46). Thus, knowledge is always connected to the system's history, to suitable events and episodes and therefore is bound to a memory.

On the organizational level, this memory comprises the individual brains as well as links to documented knowledge and to other individual's brains and their respective links[120]. As opposed to individual "knowledge processing", organizational "knowledge processing" can be viewed as a social phenomenon where individuals commonly process information and "weave" it into a social web of knowledge elements. The constituting element of knowledge on the organizational level therefore is communication. Both, the links and communication are not limited to the organizational boundaries and thus knowledge used for organizational activities comprises organization-internal as well as organization-external knowledge.

The definition of the term knowledge as presented here describes the perspective of knowledge management. As the goals of this work are to investigate concepts and scenarios for the application of KMS as part of knowledge management initiatives, this definition needs further operationalization. This is a difficult task as the discussion of certain aspects of the definition or certain entities that deal with or hold knowledge (individuals, organizations or even documents) will necessarily challenge the definition. Figure B-8 summarizes this discussion and gives an overview of the specifics of the term knowledge as used in this work. The figure shows a selection of seven paired types of knowledge which help to study the possibilities to support the handling of knowledge by KMS. Interviews with knowledge managers in the empirical study suggest that these are the most important types of knowledge that require distinctive treatment in KMS. In the following, the implications of KMS support will be discussed for the various *types of knowledge*, the *medium* to which knowledge is bound as well as the *knowledge content*.

Source. The dimension source distinguishes between *organization-internal* and *organization-external* knowledge. Even though organizational boundaries are increasingly blurry in a time of virtual (project) organizations, cooperations, mergers and acquisitions, just to name a few, the organization as a legal or social institution remains a focal point for the distinction of internal and external knowledge. Internal knowledge is knowledge that originates from within the organization either from members of the organization or in the form of e.g., organizational routines or documented experiences. Organization-external knowledge is brought into the organization, e.g., personally by newly recruited employees, consultants, part-

120. See the perspective of transactive memory systems according to Wegner 1986.

ners, suppliers or customers or in documented form with the help of studies, reports or benchmarking reports.

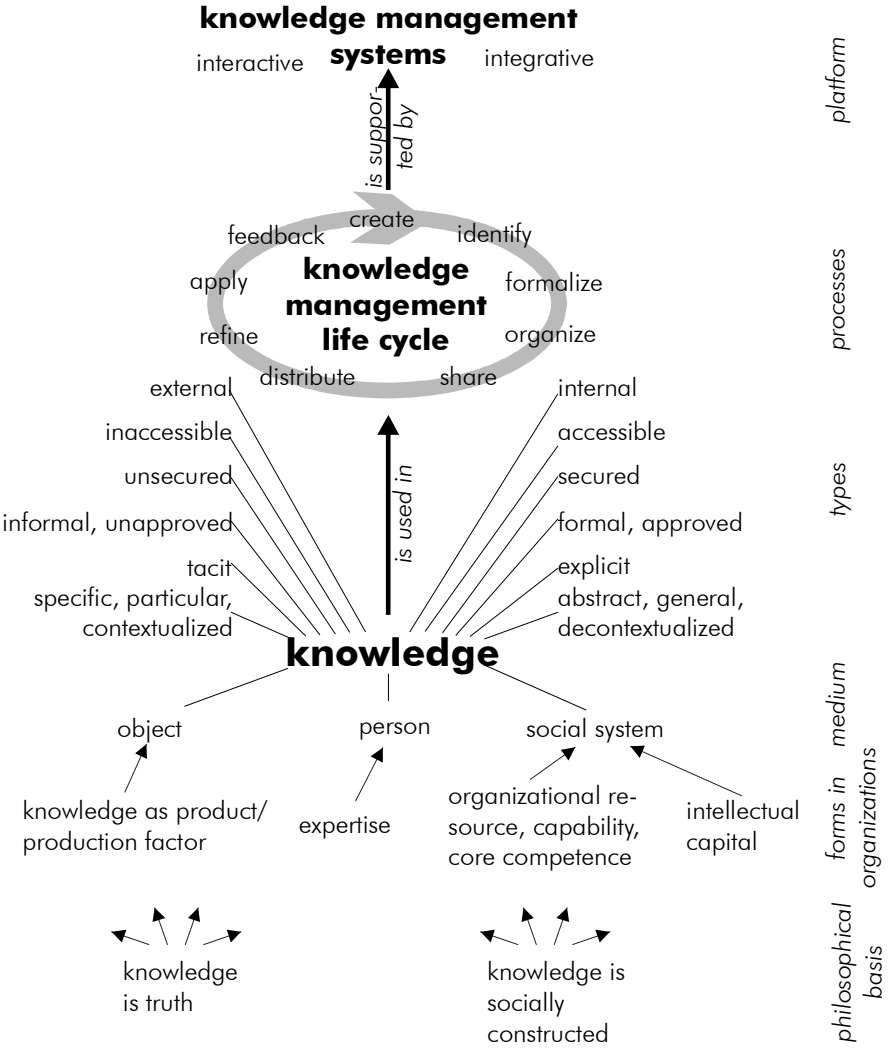

FIGURE B-8. The term knowledge and its application in KM[121]

Accessibility. This dimension contrasts *electronically accessible* and *electronically inaccessible* knowledge. Knowledge that is published e.g., on an organiza-

121. This model has been called the butterfly model of knowledge management by my student assistants Nadine Amende, Stefanie Hain, Alexander Sandow and Stefan Thalmann and features in a WBT on knowledge management available from the author.

tion's Intranet or in a document management system can be accessed by all members of the organization that have access to these systems whereas documented knowledge that is stored on the individual hard disc of one employee cannot be found by interested knowledge seekers. Additionally, it refers to access to experts that hold knowledge about a specific topic. If KMS support the identification of experts, his or her knowledge is thus implicitly accessible.

Security. The dimension security comprises *secured* and *unsecured* knowledge. The current trend in many organizations is towards more transparency of knowledge, a trend from implicit to explicit knowledge (e.g., Spender 1996a, 51). The higher visibility of experts, knowledge, networks and structures increases the risk that important knowledge flows to competitors and threatens an organization's competitive advantages.

Thus, security is an important issue at hand. It refers to legal mechanisms such as patents and licenses, copyrights and trade secrets (e.g., Liebeskind 1996, 95) as well as organizational mechanisms such as incentives to employees, employee conduct rules or job design to secure knowledge. In addition to these measures, KMS have to be designed, e.g., by protecting knowledge by disaggregation. There is also the whole range of IT security issues, e.g., threats from hackers, that have to be considered.

Formality. This dimension distinguishes between *formal, institutionalized, approved* and *informal, unapproved* knowledge and reflects the degree of institutionalization of knowledge in an organization. As today's business organization more or less rely on the hierarchy, rules, roles and (standard operating) procedures, there is a host of institutionalized knowledge which is applied by the organization's members. This knowledge evolves as the person or collective responsible for a certain area of the organization formally approves new knowledge as being part of the standard procedures in the organization. In addition to this type of knowledge, employees develop and apply knowledge independently of the formal approval system and might also share it within their community. This important part of the organization's knowledge base is less transparent than the formally approved one and thus needs special treatment when one considers the implementation of a KMS.

Externalization. Externalization turns *tacit knowledge* into *explicit knowledge*. Ever since Polanyi postulated that "we know more than we can tell" (Polanyi 1966, 4), the tacit dimension has been a popular distinction used in the KM literature, although not in Polanyi's originally intended way. Many authors distinguish between tacit and explicit knowledge[122], whereas Polanyi postulated that *every knowledge* has got a tacit *dimension* (Polanyi 1966, 24f). In the KM literature, tacit

122. One of the best known applications of this distinction is by Nonaka 1991, 16, also e.g., Hedlund/Nonaka 1993, 118ff, Rüdiger/Vanini 1998 and Bonora/Revang 1993, 203ff who call it knowledge abstraction.

knowledge is subconsciously understood and applied, difficult to articulate, developed from direct experience and usually shared through highly interactive conversation and shared experience (*socialization*, apprenticeship, Nonaka 1991, 98f, 1994, 18f). Explicit knowledge can be formally articulated and shared through meetings, conversations, mathematical formulas, models or even documents and the like (*combination*, Nonaka 1991, 99, 1994, 19). If explicit knowledge is documented, it is removed from its original context of creation or use. KMS can help the receivers of explicit knowledge to reconstruct its context.

Nonaka calls the process of turning implicit into explicit knowledge *externalization*[123] and the reverse process of turning explicit into implicit knowledge *internalization* (Nonaka 1991, 99 and 1994, 19). Not any knowledge that is explicable is actually explicated in an organization (Zack 1999a, 47). There might also be inappropriately explicated knowledge (explicated knowledge that is not explicable). The distinction between tacit (or sometimes called implicit) and explicit knowledge helps to postulate different KM activities and different systems to support these activities (e.g., Nonaka/Takeuchi 1997,74ff).

Generalization. The level of context of knowledge defines another continuum which extends from *specific, particular, contextualized* knowledge describing one particular episode or event e.g., in a story to *abstract knowledge, general, decontextualized knowledge* captured e.g., in a mathematical formula. Before knowledge is distributed to a larger group of people, particular experiences can be generalized to lessons learned e.g., by extracting the factors that might have influenced the outcome, aggregating similar experiences to describe a practice (good or best practice). The degree of generalization has to be considered when KMS are used to support the transfer of (the documented part of) knowledge. The more specific a knowledge element is, the more context has to be provided in order for the knowledge seeker to be able to understand, learn and reuse the knowledge.

Medium. The medium on which knowledge resides can be an *object*, a *person* or a *social system*. Person represents *individual* whereas social system represents *collective* knowledge. A central element of most of the OL theories and approaches is the hypothesis that organizations have an inter-personal body of knowledge that their individual members share: collective knowledge, collective practice or organizational knowledge (e.g., Spender 1994, 355ff). Collective knowledge is materialized in organizational routines no matter whether explicit in e.g., bureaucratic rules, role expectations or implicit in the norms, values and shared understanding of the organizational culture. It is separated from individual knowledge held by each individual member of the organization.

Many authors also make a distinction between knowledge as a product and knowledge as a process, especially those who use the definition of the term knowledge for a subsequent analysis of the suitability of ICT to support corresponding

123. In his earlier work, Nonaka called the process of turning implicit into explicit knowledge *articulation (*Nonaka 1991, 99).

organizational processes[124]. Knowledge as an object[125] is independent of a holder whereas knowledge as a process can be viewed as a process of simultaneously knowing and acting (applying expertise).

Knowledge as a product comprises documented experiences. A couple of terms were coined in the practitioner-oriented literature to underline the higher value of documented knowledge as opposed to data or (documented) information. Examples are lessons learned, best practices, experience data bases, benchmarks, customized reports or context-enriched documents. In this perspective, knowledge is basically seen as *information plus context*, as networked information (Rehäuser/ Krcmar 1996, 6). The distinction between information and knowledge is a gradual one, a continuum (e.g., Probst et al. 1998, 36). The common denominator of this perspective is that (a portion of the) knowledge used in organizations can be explicated and externalized (Nonaka 1994, 24f) and as a consequence untied from its creator and made available for "easy" reuse by other members of the organization. However crude and pragmatic this distinction is, it helps to understand why the term KMS is used, what is required for the design and implementation of KMS and what the differences to other information and communication systems are.

Content. In addition to the generalized types of knowledge as discussed so far, organizational knowledge can be divided according to the main organizational area in which it is applied or in which it has been generated: knowledge about products and processes can be attributed regularly to the production division of an organization whereas knowledge about customers and competitors is usually gained in the market-oriented divisions of an organization (marketing, sales, customer service). Examples for contents that can be distinguished in KMS are product knowledge versus market versus expert versus leadership knowledge (e.g., Baecker 1998, 6ff, Glazer 1999, 66).

These different types of knowledge are systematically handled by the tasks of the KM life cycle which in turn is supported by KMS (see Figure B-8 on page 78). The design and implementation of KMS therefore depends on the KM initiative's perspective on knowledge.

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124. Examples are Rehäuser/Krcmar 1996, 14ff, Hansen et al. 1999, Sveiby 2001, Zack 1999a.
125. Some authors mix the notion of *knowledge as an object* and *explicit knowledge* although explicit knowledge not necessarily has to be documented. Thus, we have to distinguish between the dimension *relation to individual* with knowledge either being part of an individual's mind or separate as an object and the dimension *explicitness* with knowledge either being implicit or not reflected by the individual and thus applied unconsciously or knowledge being explicit and thus communicable by the individual. Only explicit knowledge can be documented, though.

4.3 Knowledge management systems

4.3.1 Overview and related concepts

Even though there is considerable disagreement in the literature and business practice about what exactly KM is[126], there are a number of researchers and practitioners who stress the role of ICT as enabler or vehicle for implementating these approaches. KMS should help particularly to overcome the shortcomings of current practices of business engineering with respect to organizational performance. IT-Research forecasted in a study on KM that the market for KM software in Europe and North America would grow from US$400 million in 1999 to around US$1.5 billion in 2002 (NN 2000, 1). There are a number of approaches to define ICT that supports KM. This is reflected by the large number of terms in use, such as:

- *knowledge management system*[127],
- *information and communication systems or technology for knowledge management* or *knowledge management technology*[128],
- *knowledge-based information system*[129],
- *knowledge infrastructure*[130],
- *knowledge services*[131],
- *knowledge management software*[132],
- *knowledge management suite*[133],
- *knowledge management support system*[134],
- *knowledge management tools*[135],
- *knowledge-oriented software*[136],
- *knowledge portal*[137],
- *knowledge warehouse*[138],
- *organizational memory system*[139],
- *organizational memory information system*[140].

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126. See also section 4.1 - “Knowledge management” on page 21.
127. e.g., Neumann et al. 1998, McDermott 1999a, 104, Gray 2000, Mertens/Griese 2002, 47, Meso/Smith 2000, Alavi/Leidner 2001, Staab et al. 2001, 3ff, Hasan/Gould 2003, Riempp 2004.
128. Borghoff/Pareschi 1998, Schultze/Boland 2000, Riempp 2004.
129. Bullinger et al. 1999.
130. Maier et al. 2005, Strohmaier 2005.
131. Conway 2003.
132. Mentzas et al. 2001, 95f, Tsui 2003.
133. Seifried/Eppler 2000.
134. Figge 2000.
135. Borghoff/Pareschi 1997, 1998, Ruggles 1997a, 3ff, Bach/Österle 1999, 22, Böhmann/Krcmar 1999, Astleitner/Schinagl 2000, 173f.
136. Koubek 2000, 16.
137. Firestone 1999, 2003, Collins 2003, Fernandes et al. 2005.
138. Nedeß/Jacob 2000.
139. Rao/Goldman-Segall 1995, Habermann 1999, Lehner 2000, 323ff.
140. Stein/Zwass 1995, Kühn/Abecker 1997.

Some of these terms have been extended by the adjective *enterprise* in order to stress that these systems attempt to create a comprehensive platform for a business or other organization, e.g., enterprise knowledge portal (Firestone 1999) or enterprise knowledge infrastructure (Maier et al. 2005). The adjectives *ontology-based* or *semantic* stress semantic integration as core functionality at the heart of KMS, e.g., ontology-based KM solution (Staab et al. 2003). Lehner (2000, 161ff) focuses on ICT support for organizational memory. He stresses the differing viewpoints of the various disciplines that use *organizational memory systems (OMS)* as their research object which result in quite heterogeneous definitions of the term. Lehner proposes the following six perspectives on OMS which can be used to investigate OMS related phenomena from different viewpoints (Lehner 2000, 163ff): (1) OMS as a new type of the use of application systems, (2) as a concept, (3) in a functional view, (4) as a property of information systems, (5) in a behaviorist view and (6) in a technological view.

Stein/Zwass define organizational memory information system as "a system that functions to provide a means by which knowledge from the past is brought to bear on present activities, thus resulting in increased levels of effectiveness for the organization" (Stein/Zwass 1995, 95, for a discussion of organizational effectiveness e.g., Lewin/Minton 1986). This definition stresses the importance of information and knowledge of the past. Figure B-9 shows an overview of their framework concept. The framework is based on the competing values model (goals of the use of organizational memory information systems) and on a list of mnemonic functions which are founded in psychological memory theories. The functions use the analogy to an individual's memory. The mnemonic functions can be seen as the memory basis for individual learning which in turn is used as an analogy in organizational learning.

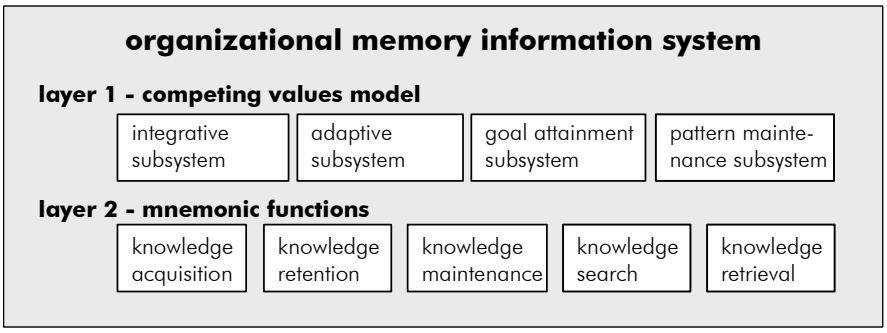

FIGURE B-9. Concept of organizational memory information systems[141]

In addition to the terms organizational memory system and organizational memory information system, many authors use the terms *knowledge management tools*

141. Source: Stein/Zwass 1995, 98.

or *knowledge management system* to describe systems with quite similar intentions and functions. Additionally, there are a number of vendors of software systems that stress that their systems support KM. So far, there has been no clear distinction between these two terms. The terms organizational memory system or organizational memory information system as used in the literature stress more the theoretical basis of organizational learning, the analogy to an individual's memory as well as the dynamics of the application of a collective memory. The terms knowledge management tools or system stress more the resource-oriented view of organizational learning, the business and management aspects introduced by concepts, approaches and theories of knowledge management[142]. However, as with most emerging technologies, neither the literature, nor the market of products, tools and systems clearly distinguish between these tendencies.

Apart from these terms with a clear focus on KM, OL or OM, there is also another group of software systems that provides support for these approaches, e-learning platforms. These are platforms for Web-based teaching and learning environments with roots in computer-based training. Respective approaches are termed e-learning or, in a more recent twist to reformulate the vision and the employed metaphors, particularly in the European Union, technology-enhanced learning[143]. Again, there are a number of terms that are used to denote this group of software systems:

- *corporate learning portals*[144],
- *e-learning suites*[145],
- *integrated curriculum management systems*[146],
- *learning content management system*[147],
- *learning environment*[148],
- *learning management systems*[149],
- *Web-based education systems*[150].

These platforms not only support the presentation, administration and organization of teaching material on the Web or an organization's Intranet, but also support interaction among teachers and students[151] as well as interaction between students themselves (Astleitner/Schinagl 2000, 114). The two categories *knowledge man-*

142. See also section 4.1 - "Knowledge management" on page 21.
143. E.g., Rogers 2002.
144. See for example URL: http://www.teamscape.com/products/learning_portals.htm; see also the list of e-learning platforms on the support Web site for this book http://iwi.uibk.ac.at/maier/kms/.
145. E.g., URL: http://www.hyperwave.com/e/products/els.html.
146. Astleitner/Schinagl 2000, 114ff.
147. E.g., Ismail 2002, 332.
148. E.g., Jonassen et al. 1999.
149. E.g., URL: http://www.saba.com/english/products/learning_enterprise/index.htm.
150. Astleitner/Schinagl 2000, 131ff; Web-based education systems are also called Internet-based learning systems or on-line-learning systems.
151. The terms teachers and students are not limited to the traditional university setting, but also comprise e.g., organized learning in businesses.

agement systems with roots in document management systems or communication systems and *e-learning suites* with roots in computer-based training seem to converge. As turned out in the market survey of KMS, the systems from these two categories already share a substantial portion of functionality[152]. Moreover, on a conceptual level KM concepts are applied in tele-learning concepts (e.g., Trosch/Bickmann 1999).

There has been a shift in perspective of KMS vendors as well as organizations applying those systems from this focus on the explicit side of KM to a combination and integration of the implicit side of KM. Advanced tools supporting collaboration or collectives of people working together (teams, communities), tools linking knowledge providers and seekers as well as e-learning functionality have been integrated into many KMS. Also, several vendors of learning management systems have begun to extend the functionality of their systems to include KMS functions[153]. KMS offered on the market more and more live up to the expectations put forward by theory-driven conceptualizations.

The term knowledge management system is used here as a synonym for organizational memory system. This is particularly important when the term is used within the empirical study to make sure that respondents are not confused by a new term which is not widely accepted in the market. Recently, the terms KM tools or KMS have gained wide acceptance in the literature, whereas vendors of systems still package and market their solutions according to the most recent ICT challenges that have to be solved by companies and organizations. Examples are solutions for business or organizational intelligence, for collaboration, for compliance to risk management regulations, such as Sarbanes-Oxley-act and Basel II, for customer-generated content, for email retention management, for exploiting the promises that are marketed as social software or Web 2.0, for initiatives that are enriched with the adjective "semantic", for just-in-time or on-demand knowledge management, for knowledge integration, (knowledge) portals and other integration initiatives, for knowledge visualization, for technology-enhanced or workplace learning, just to name a few[154]. However, none of these terms have replaced the term KMS and it is still a worthwhile perspective on a portion of the organizational ICT infrastructure and application systems landscape. Thus, the term KMS is used being well aware that there are a number of similar conceptualizations that complement the functionality and architectures of KMS.

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152. An example for a software vendor that integrates a knowledge management platform and an e-learning environment formerly separated is Hyperwave with its KMS solution Hyperwave Information Server and Hyperwave Information Portal on the one hand and the Hyperwave E-Learning Suite on the other hand; see also Maier/Klosa 1999c; see section 7.1 - "Technological roots" on page 273 for examples and a definition of the roots; see also the support Web site for this book http://iwi.uibk.ac.at/maier/kms/ for a list of KM tools and systems as well as e-learning suites available on the market.
153. One example is Centra's Knowledge Server which can be integrated with the company's learning management system Symposium 5.0; see also the support Web site for this book http://iwi.uibk.ac.at/maier/kms/ for details about the software solutions mentioned here.
154. See also section 7.4.9 - "Example: Open Text Livelink" on page 336.

4.3.2 Definition

As in the case of the terms knowledge management and knowledge, knowledge management systems can be viewed from different perspectives. Examples are:

- a focus on ICT support for the KM life cycle and/or for specific organizational instruments which are implemented as part of a KM initiative,
- a focus on the proposed analogy between human and organizational information processing, learning and memory,
- a review of a set of functions that are part of KMS as offered on the market,
- extensions and/or the integration of existing software tools, such as Intranet solutions, document management systems, workflow management systems, Groupware, AI technologies, communication systems.

The KM life cycle provides a basis for the definition of application areas from which KMS are designed and consists of a number of KM tasks, e.g., creation, construction, identification, capturing, acquisition, selection, valuation, organization, linking, structuring, formalization, visualization, distribution, retention, maintenance, refinement, evolution, accessing, search and application of knowledge[155].

The KM life cycle describes the collective development, distribution and application of knowledge and thus can be used to extend Stein and Zwass's definition of organizational memory information system which is limited to the analogy of an individual's memory. It lacks all functions that do not bear this analogy. These added functions are based on *communication* as the constituent property of social systems. Communication also distinguishes the memory of a social system from an individual memory. Therefore, those functions that uniquely occur in collective memory and learning processes are added to the mnemonic functions used in Stein and Zwass' definition. Thus, the definition of KMS used in this book is based on (1) the analogy between human and organizational information processing and (2) the life cycle of KM tasks and processes (see Box B-3).

A knowledge management system (KMS) is an ICT system in the sense of an application system or an ICT *platform* that combines and integrates functions for the *contextualized* handling of both, explicit and tacit knowledge, throughout the organization or that part of the organization that is targeted by a *KM initiative*.
A KMS offers integrated *services* to deploy *KM instruments* for networks of *participants*, i.e. active knowledge workers, in knowledge-intensive business *processes* along the entire knowledge life cycle.
Ultimate aim of KMS is to support the dynamics of organizational learning and organizational effectiveness.

BOX B-3. **Definition of knowledge management system**

155. See also section 4.1.4 - "Definition" on page 52; for a detailed discussion of these KM tasks see section 6.3.1 - "Knowledge management tasks" on page 207.

The main differences between KMS and more traditional ICT systems, such as document management systems, Intranet solutions or Groupware can be characterized along the following lines:

Initiative. Goals are defined by the KM initiative in which the KMS is deployed. Therefore, KMS are designed "with KM in mind", i.e., their implementation is embedded in a comprehensive KM initiative. Stein/Zwass' (1995) definition stresses the primary goal of KMS as to increase organizational effectiveness by a systematic management of knowledge. Thus, KMS are the technological part of a KM initiative that also comprises person-oriented and organizational instruments targeted at improving productivity of knowledge work. KM initiatives can be classified e.g., according to strategy in human-oriented, personalization initiatives and technology-oriented codification initiatives[156] or along several organizational dimensions that will be developed in the next chapters. The type of initiative determines the type of information system for its support which can be regarded as a KMS from the perspective of its application environment.

Context. KMS are applied to managing knowledge which is described as "personalized information […] related to facts, procedures, concepts, interpretations, ideas, observations, and judgements" (Alavi/Leidner 2001, 109, 114). From the perspective of KMS, knowledge[157] is information that is meaningfully organized, accumulated and embedded in a context of creation and application. KMS primarily leverage codified knowledge, but also aid communication or inference used to interpret situations and to generate activities, behavior and solutions. KMS combine and integrate services e.g., for the publication, organization, visualization, distribution, search and retrieval of *explicit* knowledge as well as identification of skills and experts, communication and collaboration in order to support the handling of *implicit* knowledge.

Thus, on the one hand KMS might not appear radically different from existing IS, but help to assimilate contextualized information. On the other hand, the role of ICT is to provide access to sources of knowledge and, with the help of shared context, to increase the breadth of knowledge sharing between persons rather than storing knowledge itself (Alavi/Leidner 2001, 111). The internal context of knowledge describes the circumstances of its creation, e.g., the author(s), creation date and circumstances, assumptions or purpose of creation. The external context relates to retrieval and application of knowledge. It categorizes knowledge, relates it to other knowledge, describes access rights, usage restrictions and circumstances as well as feedback from its re-use (Barry/Schamber 1998, 222; Eppler 2003, 125f). Contextualization is thus one of the key characteristics of KMS (Apitz et al. 2002). Management of context is central to personalizing KMS services for participants and connecting them to KM instruments which in turn are implemented with the help of KM processes.

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156. See Hansen et al. 1999, see also chapter 5 - "Strategy" on page 93.
157. See also section 4.2 - "Knowledge" on page 60.

Processes. KMS are developed to support and enhance knowledge-intensive processes[158], tasks or projects (Detlor 2002, 200; Jennex/Olfman 2003, 214) of e.g., creation, construction, identification, capturing, acquisition, selection, valuation, organization, linking, structuring, formalization, visualization, transfer, distribution, retention, maintenance, refinement, revision, evolution, accessing, retrieval and last but not least the application of knowledge, also called the knowledge life cycle, ultimately to support knowledge work (Davenport et al. 1996, 54). In this view, KMS provide a seamless pipeline for the flow of explicit knowledge through a refinement process (Zack 1999a, 49), or a thinking forum containing interpretations, half-formed judgements, ideas and other perishable insights that aims at sparking collaborative thinking (McDermott 1999a, 112).

Participants. Users play the roles of active, involved participants in knowledge networks and communities fostered by KMS[159]. This is reflected by the support of context in KMS. Systematic management of context is needed in order to provide semantic links between codified knowledge and people or collectives, such as teams, work groups or communities as the holders of knowledge, between the handling of explicit and implicit knowledge and between documented knowledge and meta-knowledge, feedback, valuations and comments about the application of knowledge elements by other participants respectively. Context enhances the simple "container" metaphor of organizational knowledge by a network of artefacts and people, of memory and of processing (Ackerman/Halverson 1998, 64). Communities or networks of knowledge workers that "own the knowledge" and decide what and how to share can provide important context for a KMS (McDermott 1999a, 108, 111ff). KMS designs reflect that knowledge is developed collectively and that the "distribution" of knowledge leads to its continuous change, reconstruction and application in different contexts, by different participants with differing backgrounds and experiences. De- and re-contextualization turn static knowledge objects into knowledge processes (Ackerman/Halverson 1998, 64). Meta-knowledge in a KMS, e.g., in the form of a set of expert profiles or the content of a skill management system, is sometimes as important as the original knowledge itself (Alavi/Leidner 2001, 121).

Instruments. KMS are applied in a large number of application areas, e.g., in product development, process improvement, project management, post-merger integration or human resource management (Tsui 2003, 21). More specifically, KMS support KM instruments[160], e.g., (1) the capture, creation and sharing of best practices, (2) the implementation of experience management systems, (3) the creation of corporate knowledge directories, taxonomies or ontologies, (4) expertise locators, yellow and blue pages as well as skill management systems, also called

158. See section 6.3 - "Process organization" on page 207.
159. See also section 6.1.2 - "Knowledge management roles" on page 162 and section 6.1.3 - "Groups, teams and communities" on page 177.
160. See section 6.2 - "Instruments" on page 195.

people-finder systems, (5) collaborative filtering and handling of interests used to connect people, (6) the creation and fostering of communities or knowledge networks, (7) the facilitation of intelligent problem solving (e.g., Alavi/Leidner 2001, 114; McDermott 1999a, 111ff; Tsui 2003, 7). KMS in this case offer a targeted combination and integration of knowledge services that together foster one or more KM instrument(s).

Services. KMS are described as ICT platforms on which a number of integrated services[161] are built. The processes that have to be supported give a first indication of the types of services that are needed. Examples are rather basic services, e.g., for collaboration, workflow management, document and content management, visualization, search and retrieval (e.g., Seifried/Eppler 2000, 31ff) or more advanced services, e.g., profiling, profile matching and network analysis in order to link participants with similar interests, similar search or communication behavior, or similar learning capabilities, text analysis, classification or clustering to increase the relevance of retrieved and pushed information, advanced search techniques and graphical techniques for navigation, personalization services, awareness services, shared workspaces, (distributed) learning services as well as integration of and reasoning about various (document) sources on the basis of a shared ontology (e.g., Bair 1998, 2; Borghoff/Pareschi 1998, 5f).

Platform. Whereas the foci on initiatives, processes and participants can be seen as a user-centric approach to KMS design, an IT-centric approach relies on instruments as well as services and provides a base system to capture and distribute knowledge (Jennex/Olfmann 2003, 215). This platform is then used throughout the organization. This can be the entire organization or, especially in the case of large multi-national organizations a part of the organization, such as a business line, a subsidiary, or a business function, such as R&D or construction and engineering. The organization-wide focus is reflected e.g., by a standardized taxonomy or knowledge structure (ontology, e.g., Staab et al. 2001) applied throughout the organization or organizational unit. Thus, KMS can be differentiated from Groupware or group support systems which have a narrower focus on work groups or project teams. Also, the KMS is not an application system targeted at a single KM initiative, but a platform that can either be used as-is to support knowledge processes or that is used as the integrating base system and repository on which KM application systems are built. Comprehensive means that the platform offers extensive functionality for user administration, messaging, conferencing and sharing of (documented) knowledge, i.e. publication, search, retrieval and presentation.

Figure B-10 gives an overview of these characteristics. The three characteristics initiative, process and participants can be assigned to the business and user focus. Instruments, services and platform are IT- or function-oriented characteristics. Context is the linking pin connecting business and IT as well as user and function

161. See section 7.3 - “Architectures and services” on page 302.

foci. Goals stated by a KM initiative help to define processes and participants which are implemented with the help of KM instruments that should be supported by the KMS' services on the basis of a comprehensive platform and control their deployment. Participants and communities or knowledge networks are the targeted user groups that interact with KMS in order to carry out knowledge tasks.

The knowledge tasks are organized in acquisition and deployment processes required to establish the KM initiative. The KMS itself consists of a comprehensive platform rather than individual tools with advanced services built on top that explicitly consider the specifics of knowledge, i.e. information or content plus context. The services are combined and integrated in order to foster KM instruments. A KMS has to be aligned (1) with the business environment, i.e. the knowledge-intensive business processes that are affected, (2) the user environment with the expectation of a rich user experience and personalized on-demand KMS services, (3) the IT infrastructure environment which determines the technical base and (4) the function environment that determines the service interfaces for KMS design.

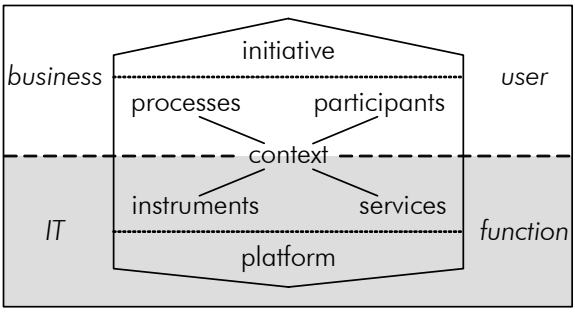

FIGURE B-10. Characteristics of KMS

The characteristics can be used as requirements in order to judge whether an actual system is a KMS or not. Many systems marketed as KMS have their foundations e.g., in document or content management systems, artificial intelligence technologies, business intelligence tools, Groupware or e-learning systems. These systems are more or less substantially extended with advanced services. Thus, actual implementations of ICT systems certainly fulfill the requirements of an ideal KMS only to a certain degree. Therefore, one might imagine a continuum between advanced KMS and other systems that can partially support KM initiatives.

The characteristics discussed in this section can be seen as arguing for a certain set of services. *Platform* requires the inclusion of infrastructure services for storage, messaging, access and security which is built on data and knowledge sources. *Context* calls for the handling of contextualized information which requires integration services that describe resources pulled together from a variety of sources. Advanced *services* build on top of these integration services and provide support for *instruments*. These knowledge services have to support the entire set of acquisition and deployment *processes* defined in a KM *initiative*. From an ICT perspec-

tive, these are services for publishing, collaboration, learning and discovery. The knowledge services need to be tailored on the one hand to the individual needs of participants and on the other hand to the requirements of the roles they perform in business processes and projects. This calls for personalization services. Finally, *participants* might choose to access KMS with a host of appliances and applications for which access services have to offer translations and transformation. These services have to be aligned with each other in architectures for KMS[162].

The definition of KMS corresponds to the functional view combined with the view of KMS as a new type of the use of application systems which realize parts of the organizational knowledge base according to Lehner (2000). The term KMS can be used to describe two different types of systems[163].

KMS as application system. The KMS is built on the basis of an already existing ICT platform that provides basic functionality for e.g., data and document management, office management as well as communication. Examples are an Intranet solution or a Groupware platform, such as Lotus Notes.

KMS as platform. In this case, the KMS not only provides these advanced functions, but also integrates the basic functionality of an ICT platform.

Many KMS offered on the market show a tendency towards the first category as most organizations already have an ICT platform in place. These KMS then provide an integrated set of intelligent tools, functions and services that use the ICT platform's functions. However, there are a number of platform-type customizable solutions as well, e.g., Open Text Livelink[164].

As discussed in the beginning of this section, KMS to support KM initiatives are on the rise. More and more vendors integrate KM functionality into their products or offer specialized KMS. The support of KM initiatives by information and communication technologies in organizations is therefore likely to rise as well. The following hypothesis will be tested:

Hypothesis 6: Compared to earlier studies significantly more organizations use ICT in general and knowledge management systems in particular to support their KM activities.

4.4 Résumé

This chapter investigated the notion of knowledge management and of ICT support for this approach, especially in the form of KMS. The detailed discussion of the historical development was meant to shed some light on the variety of perspectives

162. See section 7.3 - "Architectures and services" on page 302.
163. A more detailed analysis of KMS, their architecture, functions and classification can be found in chapter 7 - "Systems" on page 273.
164. See section 7.4.9 - "Example: Open Text Livelink" on page 336.

on the topic in the literature. Also, the chapter set the focus for the discussion of concepts and approaches for the use of KMS.

It turned out that knowledge management is an inter-disciplinary field that draws from organization science, HRM, management science, psychology, sociology, management information systems, computer science and artificial intelligence. Many KM approaches can be classified with respect to their background as human-oriented or technology-oriented. Neither direction provides a sufficient basis for the implementation and development of KMS. Thus, the challenge will be to bridge the gap between these two directions which has consequences for strategy, organization, systems as well as economics of KM initiatives[165].

The definitions for the term knowledge are as diverse as the concepts and approaches of KM. The main distinction between the wide variety of conceptualizations is whether knowledge is attributed exclusively to people—a position held by the human-oriented KM fraction—or whether knowledge is separable from people and thus can be documented and stored in ICT systems—a position held by the technology-oriented KM fraction.

Finally, the term knowledge management systems was discussed as a powerful metaphor that draws the attention of vendors of tools and systems from a variety of backgrounds. It seems that the KMS metaphor not just draws and integrates a wide variety of technologies. There are also a large number of tools and systems that are termed—or marketed— as KMS, as "KM enabled" or as supporting KM.

In the following, KM initiatives as well as KMS will be investigated in detail. Starting point will be the strategic perspective on knowledge management (chapter 5). Then follows a discussion of the organizational design for the implementation of a KM initiative (chapter 6), of architectures, contents and services of KMS (chapter 7) and, finally, of the economics of knowledge management systems (chapter 8).

165. See also chapter 9 - "Summary and Critical Reflection" on page 434.