Knowledge Management Essentials: Reflections on the Core of the Discipline and Future Outlook

Peter Heisig

Abstract

Reflecting on the history and development of the knowledge management discipline from an academic and applied research perspective, this chapter will outline the KM essentials as core of the discipline and open questions to be addressed in the future. Secondly, the author will discuss in particular the role of KM within organizational practice in regard to the overall societal challenges all organizations are facing today globally. Thirdly, the chapter will provide an outlook of the discipline in the light of future developments and suggests some research topics to be addressed by interdisciplinary KM research in the future. Beside on drawing on more than 35 years of experience in the KM field, this contribution will profit from previous research undertaken on the future of KM (2002 and 2012), contributions to guidelines and standards for KM (e.g., CEN, DIN, ISO), as well as from working with European Fortune 500 companies over the past 25 years.

Keywords

Knowledge management framework · KM history · KM methods · Critical resource · KM ethics · Future of KM · Human experiences · Artificial intelligence

1 Introduction

Knowledge management cuts across literally every sector of our societies, every industry, as well as every organizational function, which makes it a very exciting discipline for every open-minded person. It is a continuous learning journey for

P. Heisig (✉)
University of Applied Science Potsdam, Potsdam, Germany
e-mail: peter.heisig@fh-potsdam.de

C. Bratianu et al. (eds.), *The Future of Knowledge Management*, Knowledge Management and Organizational Learning 12,
https://doi.org/10.1007/978-3-031-38696-1_5

academics as well as practitioners. Furthermore, its interdisciplinary roots and character make it even more interesting but also much more challenging given the multitude of interrelationships among the different factors and dimensions involved in KM practice. Finally, knowledge plays a distinctive role on each social level from the individual, the group, and organization toward the society and global level. This makes it difficult to find and keep a focus and carries an inherent danger of misunderstandings between different academic backgrounds and practice contexts.

The highly interdisciplinary character of the KM field makes it a difficult choice for academics as the "normal" career paths in academia are still taking place within established disciplinary boundaries and promotion is based on publications earned from "mainstream" journals. Luckily the leading KM journals have improved their impact scores offering platforms to publish original research for future generations of KM researchers and academics. In addition, funding bodies are more open to interdisciplinary research proposals which might also help the KM discipline to address the open questions in the future based on properly funded research projects.

2 History and Development of the Knowledge Management

Given the cross-cutting nature of knowledge across different levels of analysis (individual, group, organizational, sector, society, global), also the history and development of KM could be observed and described on those different levels. Historical descriptions found in the literature narrate the history of KM back toward the early days of our civilization when humans started to convey their experiences by oral stories toward the next generations supported by first graphical visualizations and symbols assigned to certain meanings. Jashapara (2004) describes the history of KM in his textbook, starting from the oral traditions and the first writings in Mesopotamia. These developments are followed by the ancient Greek and Roman traditions of books and libraries, continued in the monastic and cathedral libraries in the Middle Ages with the emergence of first universities. As the turning point, he regards the invention of the printing press by Gutenberg around 1455 combined with the first indexing and classification system by Conrad Gesner hundred years later. The final leap are the inventions related to modern computers and the Internet in the last two centuries. A similar trajectory was described by Dalkir (2005:12–16).

On the societal level, phenomena such as the so-called knowledge explosion triggered by the increase of research output (Machlup, 1962; Mokyr, 2002) have been related to KM. Contrary to the generalized perception of an increasing amount of knowledge every 8 to 3 years (de Solla Price, 1963), Stuhlhofer (1983:169) concluded that "our knowledge is doubling every 100 years" based on the comparison of textbooks in the natural sciences measured by the content of a textbook known in previous times. An analysis of the growth and quality of mathematical literature (on determinants, published between 1820 and 1920, $n = 1995$) concluded that only 14% produced "new results and ideas," while 43% were considered as "trivia" and 21% as "duplicates" (May, 1968). To the knowledge of the author, there is only one

single PhD dissertation (in German) addressing the *half-life time phenomenon* of technological knowledge (Vanini, 1999). The "knowledge explosion" or the ever-decreasing half-life time of knowledge is used to justify KM; I am wondering if those claims are more a like plausible myth or a fact based on properly researched evidence. Combined research with historians of science should be undertaken to critically evaluate these phenomena.

From an organizational perspective, the history of KM (Wiig, 1997; Lambe, 2011) was triggered by technological inventions such as computing technologies (personal computers) and networks (Arpanet, Internet), while the theoretical concept of the "learning organization" (Huber, 1991; Garvin, 1993; Örtenblad, 2001) helps to conceptualize organizational processes linked to the handling of knowledge. Since the emergence of the concept "knowledge management" (Henry, 1974; Lambe, 2011), the development of KM has been labeled either as "generations" (McElroy, 2000; Laszlo & Laszlo, 2002) or different "stages" (Snowden, 2002; Firestone & McElroy, 2003), "phases" (Lehner, 2019; Pawlowsky, 2019), or even "eras" (Dixon, 2010). There is no consensus which generation or stage (e.g., KM 3.0; WM4.0; fifth generation; sixth phase) the KM field is currently in. Nevertheless, the characteristics associated with the current phase of KM show some commonalities like "data-driven" (Lehner, 2019); "Big Data, artificial intelligence, and Internet of Things" (Pawlowsky, 2019); or "digital transformation" (North et al., 2018). These characteristics point to new capabilities related to increased processing capacities of IT applications supporting individuals and organizational functions (e.g., research, marketing, sales). I will return to this aspect later in the chapter regarding future research needs.

Finally, on the individual level, the term "personal knowledge management" (Reinmann & Eppler, 2008) was coined in order to highlight the importance of individual skills (TFPL, 1999; Heisig & Finke, 2003) in KM. This aspect of KM is mostly overlooked by the organizational KM, and it's a black spot in KM practice as its hardly addressed in KM projects and KM programs. In the last 25 years, the author came just once across a pharmaceutical company which based their KM approach on three pillars, one being the assessment of KM related skills and providing focused training toward the R&D staff. KM research and KM practice could profit from the research in related fields like "personal information management" (Jones, 2017) and more recently on "digital literacy" (Michel & Heisig, 2020).

3 Knowledge Management Essentials

Reflecting on the discipline taking into account previous research on KM (e.g., Heisig & Mertins, 1999; Mertins et al., 2003; Scholl et al., 2004; Heisig, 2009, 2015) and practical experiences with several companies from different sectors, there are three core essentials in KM: (1) understanding of knowledge, (2) an evidence-based practical KM framework, and (3) knowledge about the KM portfolio of methods, tools, and instruments including their requirements, usefulness, and in particular their limitations. A good conceptual understanding of those core essentials will not

only help to manage expectations on KM by users and managers but also safe organizational resources like time and financial investment as the author was able to observe in practice.

3.1 Knowledge

A comparative analysis of KM frameworks ($n = 160$) found that only three quarters explicitly describe the term knowledge with a dominance of dichotomies such as explicit and implicit/tacit used, while the classical data-information-knowledge (DIK) hierarchy is used by one in five frameworks (Heisig, 2009:7–8). Previous research (Scholl et al., 2004) surprisingly found that the classical distinction of explicit and implicit/tacit knowledge (Polanyi, 1966) was not regarded as a promising theoretical and practical approach. The need for more theoretical and empirical research was identified by a large panel of KM academics and KM practitioners ($n = 222$) aimed to avoid misinterpretation, to reduce confusion, to guide practice, and to increase understanding of the complexity (Heisig, 2015:157–160). The aim of further research should, rather than leaning toward defining a consensus, create awareness of the different perspectives on knowledge (e.g., Blackler, 1995) and its implications for organizational KM.

Despite the criticism if tacit knowledge could be considered knowledge at all (Schreyögg & Geiger, 2007), it is paramount for KM practice to be aware about the "tacit dimension" that "we know more than we can tell" (Polanyi, 1966). Furthermore, attention should be paid to the mostly overlooked perspective as the embeddedness of knowledge in practice or knowledge as "knowing in practice" (Orlikowski, 2002; Gherardi, 2000) referring to Schon's (1983) observation that "our knowing is *in* our action." Despite the early references of this perspective to knowledge in organizations, hardly anyone of the large panel of KM academics and KM practitioners (Heisig, 2015) referred to the concept of "knowledge in practice" while asked about their understanding of knowledge.

Still, KM practice should take this view very seriously as it points to the limitations of several KM methods or KM tools which overemphasize the explicit and implicit dimensions of knowledge but missing its strong relationship or the "embeddedness" in working practices. If the knowledge is in our actions, KM methods such as shadowing, learning-by-doing, joint problem-solving, and other approaches which makes employees working together or side-by-side or teaching each other would require more support than investment into technical applications and infrastructure. In this regard, Hislop's (2009) textbook about KM in organizations provides a good introduction. Unfortunately, those human-based KM approaches often lack the support by decision-makers which are often inclined toward new IT-based KM solutions.

3.2 Knowledge Management Framework

In the European Guide to Good Practice in KM issued by CEN (2004:11), a framework was defined as a description of "the most essential factors (assets, people, processes, tools) influencing the success or failure of a KM initiative, and their interdependent relationships." Rubenstein-Montano et al. (2001) distinguished between descriptive, prescriptive, and a combination of both called hybrid frameworks. Given these functions for practice, KM frameworks should be considered an essential part of KM.

Dozens of KM Frameworks have been proposed from different authors from academia, consultants, standardization bodies, professional associations, as well as KM practitioners from different sectors (see overview in annex in a study by Heisig & Orth, 2007). One example is the widely referenced model in the German-language area called the KM building block model developed by Probst et al. (2000) containing six operative knowledge processes plus two management processes providing a good starting point for the analysis phase of a KM project. Reports from KM practice (Vogel, 1999) indicate that the lack of a systematic integration of key success factors to be considered during design and implementation of a KM solution shows its limitation. The SECI model containing four knowledge conversion processes developed by Nonaka and Takeuchi (1994) and the core of the knowledge creation theory has been criticized by different authors (Nonaka & von Krogh, 2009). For instance, Ribeiro and Collins (2007) analyzed the bread-baking case used by Nonaka and Takeuchi (1994) as evidenced to support the conversion process of externalization of tacit knowledge. They conclude that such process doesn't happen as the machine only mimics some rather mechanical actions of the human bread-maker. Several other KM frameworks and KM approaches have been proposed by Wiig (1993), Snowden (1998), Firestone and McElroy (2003), some consultants (Arthur Andersen and APQC, 1996), or standardization bodies (BSI, 2001, CEN, 2004, DIN, 2012, ISO 30401/2018).

Based on empirical studies (Heisig, 1999; Scholl et al., 2004), multiple case studies (partly published Mertins et al., 2003, 2005) and an extensive comparative analysis of 160 KM frameworks, as well as dozens of KM projects with different European Fortune 500 companies (e.g., aerospace, energy, finance, manufacturing, software, steel, etc.), within public administration (e.g., government, police) and research organizations, the author designed the GPO-KM Framework (Heisig, 1999, 2005, 2007) composed of three analytical layers:

(1) The business or **tasks focus** is the core at the center of the framework. The work tasks within organizational processes represent the application contexts where employees and managers fulfill their tasks, solve problems, and take decisions. Knowledge is applied as well as created like two sides of a coin. In this application context, individual knowledge as well as team and social knowledge is regarded as a **resource**, while the persons involved acquire **experiences** as a kind of tacit "knowledge product" from the actions taken every day.

(2) The **knowledge activities** form the second layer comprised of a minimum of four core activities labeled "create," "store," "share," and "apply" knowledge. It needs to be emphasized that these activities are understood as *analytical* categories to trigger reflection and guide analysis of current organizational processes and routines to assess how knowledge is handled within those processes. Furthermore, these four activities are meant to guide the search, selection, and design of a KM solution including the assessment of KM methods and KM tools to improve the handling of knowledge from the broad KM solution portfolio. With the implementation of the approved KM solution, the selected KM methods and KM tools should become an integrated part of the organizational (work) process which should be improved with the KM solution.

Two aspects should be noted: (A) The activity "store" is sometimes misunderstood as a codification task. This interpretation overlooks research on transactive memory that indicates that knowledge is shared and stored in the distributed memories of team members (Austin, 2003). (B) The description of the KM activities as a sequence of activities or building blocks (Probst et al., 2000) resemble those of the information life cycle (e.g., Floridi, 2010) which could be misleading if interpreted and implemented as a rigid "knowledge" workflow. KM solution is about creating an environment which enables and supports the systematic handling of knowledge labeled with those core activities. Other KM frameworks (Heisig, 2009) propose up to 12 single activities which would further increase effort for data gathering and analysis and might increase the complexity of the solution design.

(3) The third layer addresses the **enablers** which are derived from research on key success factors for KM from meta-analysis of empirical studies (Helm et al., 2007) as well as the analysis of KM frameworks (Heisig, 2009). These enablers represent in the GPO-KM framework the following six areas of **analysis and design**: "culture," "strategy and leadership," "skills and motivation," "information technology," "organization and roles," and "controlling and measurement" (Fig. 1).

This third layer with the enablers derived from research on key success factors are particularly challenging due to the interactions and interdependencies between the different design areas: How does the *usability* (IT) of a KM platform or another software application supporting KM activities affects the *engagement* (motivation) of staff. The answer requires expertise about UX-Design and theories of motivation in the KM context. Which *leadership* style(s) is(are) most suitable for KM and which are the key components? Which governance (*organization and roles*) structure is suitable to KM and how different structures affect *culture*, *motivation*, and *leadership*? How does *controlling and measurement* influence the engagement (*motivation*) of knowledge workers? How do the different dimensions of the organizational *culture* influence the other areas like *leadership*, *measurement* approaches, *governance*, and vice versa?

An evidence-based approach toward KM would either need to fall back on the root disciplines of KM or use an experimental, pilot-testing approach to find out the

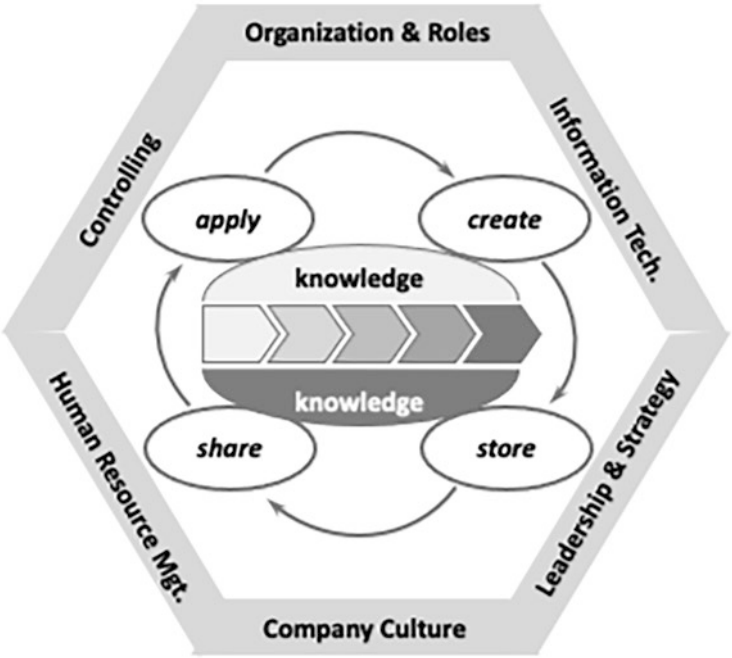

Fig. 1 GPO-WM® framework (Heisig 1999, 2005, 2007)

most appropriate solution. Unfortunately, focused research on those questions raised above hardly exists. It is a huge opportunity to undertake "useful research" (Mohrman et al., 2011) in order to advance theory *and* practice. A first step would be to analyze and summarize the current state and publish more review papers (Heisig, 2015). More could be done by academia in this regard. While such questions point to the true interdisciplinary core of the KM field with large links to sociotechnical design approaches, recognition in academia is still earned within the disciplinary boundaries.

The importance of these success factors and design areas is a well-known fact since the early empirical research (Heisig, 1999) and multiple other studies summarized by Helm et al. (2007). Still today, one can observe that practitioners and decision-makers in KM often either neglect certain areas such as skills, while new IT and software applications for KM attract much more attention as well as resources.

The GPO-KM framework is based on a sociotechnical approach to systems design (Mumford, 2000) and supported by a several instruments like a step-by-step analysis and design guideline using templates and questionnaires to enable broad participation and involvement of staff involved in knowledge work and knowledge handling as well as a database with early 100 KM tools and KM methods (Heisig, 2005, 2008). The approach takes into account earlier research in industrial sociology about the introduction of IT systems in office work in public administration and

industry (Weltz et al., 1986, 1990) as well as research on empirical (tacit) knowledge within experience-based work in the shop floor environment (Böhle & Milkau, 1988; Mertins et al., 1993; Böhle, 1994).

The GPO-KM approach focuses on knowledge handling with work tasks in business or organizational processes. It differs from other process-oriented KM approaches (e.g., Kwan, 1999; Thiesse, 2001; Goesmann, 2002; Remus, 2002; El Sawy & Josefek, 2003; Gronau et al., 2004) which are strongly influenced by business process modeling approaches of the previous decade. During the early development phase of the GPO-KM approach, such modeling was found to require extensive effort (e.g., time for data gathering) and specialized methodological knowledge (e.g., modeling notation and software tool handling) which raises the entry requirements for many organizations in particular for small- and medium-sized companies (Mertins & Seidel, 2009). One example is the KDML knowledge management approach aimed to integrate knowledge conversion and business process modeling (Gronau et al., 2004) for analysis and design of KM solutions. Still, the effort required for data gathering and modeling makes this approach a difficult choice for practitioners with limited resources and lack of methodological knowledge. Feedback from practice from users of the GPO-WM approach in different sectors and countries (e.g., Austria, Finland, Germany, Italy) has shown the usefulness of this approach. The VDI Guideline 5601 *Knowledge Management in Engineering* (VDI, 2009) recommended the use of the GPO-WM approach within KM projects, and the DIN SPEC 91281:2012 references the GPO-WM analysis guide (Heisig, 2008).

3.3 Knowledge Management Methods and Tools: The Core KM Portfolio

Given that "our knowing is *in* our action" (Schön, 1983), the knowledge perspective cuts across all areas and functions within all kind of organizations with huge implications for methods, tools, and procedures used in the work tasks. Therefore, existing methods and tools should be assessed regarding their potential contribution toward knowledge activities and KM. At the beginning of the 2000, a group of practitioners from industry assessed and classified about 90 tools regarding the their contribution to KM (Armutat et al., 2002) which was later integrated into the CEN 14924 European Guide to Good Practice in Knowledge Management—Part III (CEN, 2004, 22–25).

Alone, the large number of possible methods to use for KM represents a huge challenge for students as well as practitioners. From an evidence-based management perspective, the narrow empirical basis or even lack of proper evidence regarding design, costs, and benefits of KM tools is limiting the uptake of KM in practice. Furthermore, often limitations of KM methods and KM tools are not explicitly discussed. Finally, consultants and vendors mostly "advertise" their favored tools or sometimes promise or worst misguide practitioners. An example of a recent advert in a practitioner's KM magazine claims that it would be possible to "secure critical

business knowledge in a matter of hours." Not sure how this could be done if you take early research about deliberate practice to acquire expert knowledge and performance into account which was summarized with the *10.000 hours* rule (Ericsson et al., 1993).

Given the large number of possible KM methods, we wanted to understand if we could identify a core to KM methods and KM tools, which have been mentioned in the classical KM literature such as textbooks, handbooks, or specialized method books and journal papers. For a content analysis, the following sources were selected: one German-language (Lehner, 2019) and one English-language textbooks (Hislop, 2009), two handbooks (Easterby-Smith & Lyles, 2011; Holsapple, 2003), three classical KM books (Nonaka & Takeuchi, 1994; Probst et al., 2000; Davenport & Prusak, 2000), three method books (Rao, 2005; Mittelmann, 2011, 2019; APO, 2020), and two review articles (Massingham, 2014a, b). The content analysis used the number of occurrence and the coverage of a method within the sources. Furthermore, we clustered KM tools and KM methods which were aiming toward the same purpose such as capturing the lessons learned from an activity or project. The analysis resulted in the following list of KM methods and KM tools considered as essential core of KM.

The wealth of material on the KM methods listed is almost unmanageable. It ranges from brief descriptions to detailed monographs, dissertations, and web resources as well as case studies and, in some cases, implementation guidelines. A challenge, however, is the benefit assessment (qualitative and, if necessary, quantitative) for the respective application scenario of the KM solution, since the introduction is very much dependent on the organization-specific framework conditions and resources (Table 1).

3.4 Knowledge Management Curriculum

The three KM essentials described above such as (1) different perspectives on knowledge, (2) a KM framework guiding analysis and design of a KM solution, and (3) basic knowledge about the most mentioned KM methods should be part of a basic KM curriculum. Nine out of ten KM experts regarded the systematic instruction to KM as "highly important" and "important." Therefore, KM should be taught primarily at Master level but also undergraduate level at universities (Heisig, 2015). KM is a highly interdisciplinary and multidisciplinary field with its roots in psychology, sociology, organizational sciences, management sciences and computer sciences (Maier, 2004; Jasimuddin, 2006), and the key dimensions of KM with many interdependences between these dimensions (Helm et al., 2007; Heisig, 2009). Therefore, knowledge managers and those taking the responsibility for KM initiatives in organizations should have successfully completed a Master course with basic and applied modules including a practical project, preferably in organizational practice.

Table 1 KM method portfolio

KM method name (dominant)	Alternative terms and/or labels
Communities of practice	Knowledge communities
Knowledge maps	Expert directory (expert finder)
Yellow pages	
Lessons learned	After-action review, debriefing, expert debriefing, post-project review, postmortem, learn before-during-after
Organizational memory	Wiki, Blog
Knowledge transfer	Best practice transfer, learning day, shadowing, mentoring, peer assist, gray advisory boards
Storytelling	Learning histories
Intellectual capital reports	Skandia Navigator, Intellectual Capital Monitor, Wissensbilanz – made in Germany – etc.
Knowledge sharing	Experience-sharing meetings, BarCamp, World Café, Open Space, online discussion forum, FAQ, urgent request

4 Outlook for KM Research and KM Practice

The state, progress, and research needs of the KM discipline were researched within a global Delphi study in 2002 (Scholl et al., 2004) and with a large panel of 222 KM experts with an average KM experience of 12.3 years from 38 countries (Heisig, 2015). The results have been published elsewhere (Heisig, 2015; Heisig et al., 2016; Dayan et al., 2017; Sarka et al., 2019). The following suggestions are based on the personal reflection informed by own research, the literature, exchanges with other academics and practitioners, as well as practical experiences advising different organizations on KM matters.

4.1 Critical Discourse in Knowledge Management: Knowledge as Critical Resource

In the KM literature, the *functionalist discourse* dominates, where knowledge is understood as a resource or asset, as the analysis of the literature by Schultze and Stabell (2004) revealed. The authors observed only a very small number of studies that used a *critical discourse* related to KM. I believe that this is a deficit within the published research in KM journals in particular. Scientific progress develops from an argumentative debate contrasting different views, the test of different hypothesis, the objection to established "world views" or "taken-for-granted" facts, and the dispute with different researchers and practitioners. Here, the young KM discipline certainly has some catching up to do.

However, practitioners are also challenged to use knowledge as a critical resource (Kaplan, 2017). The recently published research on oil companies' early knowledge of the consequences of burning fossil fuels from the mid-1950s (Franta, 2018) and

the concerted disinformation by their lobby associations (Franta, 2021) clearly shows the difference between knowledge, decisions, and actions. In this context, it might be very useful to revisit earlier research and discussions about wisdom in KM and in management in general (Rowley, 2006; Nonaka et al., 2018; Jakubik & Müürsepp, 2022).

One related avenue for future research employing a critical approach should look at the unintended consequences of KM which have been scarcely addressed, except some research on the "dark side" of KM (Chua, 2009; Aras, 2021).

4.2 Ethics in Knowledge Management

The use of knowledge as illustrated by the example of the oil industry above which represents just one example of among others points us to a broader issue regarding the handling and particularly the use of knowledge. Given that the impact and consequences of such (mis-)use of knowledge lay beyond the organizational boundaries of KM, also the responsibilities of those involved in KM must be regarded from a broader perspective too (Land et al., 2007).

I believe that this leads us to the question of the ethical dimensions in KM, which has hardly been addressed in the scholarly literature and relates to the "underlying motives for the introduction of KM systems, the way they are actually used and the impact of their use on individuals, the organization, and society" (Land et al., 2007, p. 1). Land et al. (2007:3) raised several questions which have also a very practical dimension such as "accountability built into all aspects of KM" or "how do we ensure transparency and uncover the hidden agendas?"

Another important stream of enquiry relates to indigenous knowledge "that is held and used by a people who identify themselves as indigenous of a place based on a 'combination of cultural distinctiveness and priori territorial occupancy relative to a more recently arrived population with its own distinct and subsequently dominant culture'" (Mugabe, 1999 ref. in Orozco & Poonamallee, 2014, p. 276). Surprisingly, indigenous knowledge was neither addressed in leading management outlets nor within the new intellectual capital taxonomy (Orozco & Poonamallee, 2014). The ethical questions arise from the commercialization of products elaborated from indigenous knowledge and the appropriation of the proceeds from these commercial activities.

Koulikov (2011, p. 237) discusses three new "ethics of 'informal' and unauthorized" transfer of knowledge as formal approaches to knowledge sharing often fail. The three new ethics are the "hacker ethic," the "participatory culture ethic," and the "proselytization commons ethic." The important issues arise from the basic questions about what motivates people to share knowledge and how an organization could or should support those new ethics. Still, research is fragmented and therefore presents an opportunity even it might be quite difficult research from the methodological point of view.

4.3 Interrelationships Between KM Enablers

KM as a sociotechnical system influenced by different dimensions as highlighted in many KM frameworks requires more interdisciplinary and multidisciplinary research as described by Heisig (2015) based on a panel of 222 KM experts. Besides these research avenues, further research should be undertaken regarding the following dimensions:

- Leadership and KM Activities
- The importance of leadership as support by top management and role modeling by middle managers is well known as enabler for KM. Recently, Pellegrini et al. (2020) reviewed 488 papers on leadership and its relationship with KM, indicating four research areas such as "human and relational aspects, systematic and performance aspects, contextual and contingent aspects and cultural and learning aspects" providing several potential research questions for future studies. Furthermore, despite the emphasis given by Nonaka and Takeuchi (1994) to the role of the middle managers, we can hardly find any further research on the role middle manager in KM (Carty & Walsh, 2007).
- Governance and Roles and Responsibilities
- Right in the early days of KM, Wiig (1997) already pointed out the relevance of the governance function in KM, still little research has been undertaken, mainly using a case study methodology (Zyngier & Burstein, 2012; Jørgensen et al., 2019). Similarly, the related dimension regarding the roles and responsibilities in KM, research is somehow none existent (Burstein et al., 2010).
- Culture and KM
- Research regarding the culture dimension and its relation to KM and KM processes is abundant and very dispersed. We are lacking more systematic review papers such as Mueller (2012) who identified three perspectives such as corporate culture as (1) a knowledge resource, (2) knowledge culture and its characteristics, and (3) KM which changes the corporate culture, which helps us to systematize the wealth of research and provide more detailed advice to KM practice.
- Skills and Motivation for KM
- One standard question always arises in exchanges with practitioners: "How to motive my employees to engage in KM?" while "Has your staff the right skills to efficiently engage in KM?" is hardly ever mentioned. Skills are either taken for granted or regarded as the responsibility of the individual employee. There is a huge research gap addressing skills and competencies in KM for employees and managers (TFPL, 1999; Heisig & Finke, 2003; Michel & Heisig, 2020), while the large amount of research addressing motivational aspects and incentivization would profit from more systematic reviews.

4.4 Tacit Knowledge, Human Experiences, and Artificial Intelligence?

The current developments in technology, labeled as a new phase in KM, reminds me of research projects undertaken over 30 years ago which were related to the introduction of CNC-machine tools replacing the manual-controlled machines and its impact on the empirical (tacit) knowledge of shop floor workers and staff in technical offices (Böhle & Milkau, 1988; Mertins et al., 1993; Böhle, 1994). The current developments are characterized by increased computing capabilities, more sophisticated algorithms, new software applications, and large repositories (Big Data, digital documents, digital video, and audio files); feeding those applications are accompanied by technology venders suggesting that recording our online project meetings including real-time transcription of the conversations which are immediately indexed for documentation and fast retrieval is regarded as a new solution for an effortless capturing of "knowledge." Well, I just hope that KM practitioners are not that naïve to believe that such codification approach would really solve the issue about proven and reliable knowledge worth to capture and share for further (re-)use, echoing warnings made by Liebowitz (2001) long ago.

Reflecting on the discussion about technology replacing human work activities as the introduction of CNC-machine tools about three decades ago shows – the question which arises with today's use of technical apps helping us to navigate from A to B, or executing tasks or take decisions in the private and the professional life is – how those applications will affect the experience base or tacit knowledge of users today and in the future. To put it simple: Are users of navigation apps still be capable to get from A to B with paper-based maps as well? Are they able to orient themselves and relate the map to the real environment and make the right decisions and take the correct turns? How will our knowledge and experience develop in the future in those areas of action which are increasingly assisted or even replaced by technical devices and applications? One stream of enquiry addresses "metahuman systems" which are defined as the combination of "machines that learn a parts of wider systems where *both* human *and* machines *learn jointly*" (Lyytinen et al., 2020:1) and already in operational use in industries like finance, electronics, as well as travel and tourism. While the authors identify four areas of future research, none of those four addresses the link between human knowledge development related to the use and rollout of metahuman systems. Jarrahi et al. (2023) also discussed the relationship between AI and KM using the four KM activities (see 3.2) as a partnership. Linked to this combination of humans and machines focusing on learning is the discussion about the integration of collaborative robots or Co-bots in workplaces (Peshkin & Colgate, 1999; Kwanya, 2023). Three models of interaction between humans and robots have been identified: (1) co-existence, (2) cooperation, and (3) collaboration. Haesevoest et al. (2021) find support for a collaborative relationship in managerial decision-making. While ethical issues arise from the use of Co-bots, the impact on human experiences and learning needs still to be investigated. KM researchers have a huge opportunity to explore the relationship of human-machine work environments and its impact on knowledge of humans.

4.5 Save Resources with Knowledge!

In order to conclude this chapter, I would like to address a global issue which again shows us on all three levels of analysis and reflection—from the individual level, the organizational level to the societal level—the huge gap between knowledge and action or the knowing-doing gap (Pfeffer & Sutton, 2000). In the face of the worsening climate crisis, we have the obligation to save our natural resources with knowledge or in short "Let's save resources with our knowledge!" I highly recommend reading the original Meadows et al., 1972 report by Meadows et al. The clarity of the presentation and the balanced discussion of solution options and pathways given the data and modeling expertise of the time are striking. It is therefore extremely disappointing that decision-makers, but also most citizens, have so far failed to take this knowledge into account in an appropriate manner and act accordingly. While there are numerous initiatives in the development field to use knowledge (Ferguson et al., 2010) for the benefit of people in less developed countries, we disregard knowledge in the field of climate change which will affect all of us. Therefore, I would like to end this section with a call of action to all those involved in knowledge management to put this knowledge to work.

5 Summary

I would like to conclude with the following statements. *Knowledge management* is a very interesting discipline and organizational function which enters a new phase with opportunities and challenges requiring further collaborative, applied research between academia and KM practice. *KM essentials* are composed of three main elements: first, different perspectives of knowledge to assess limitations of KM solutions; second, a wholistic KM framework based on a sociotechnical systems view to guide analysis and solution design; and third, a basic understanding of the most frequently mentioned KM methods to understand benefits and limitations—should be taught at master level at academic institutions. Finally, *KM research* and *KM practice* require more research using a critical discourse, addressing ethical issues, and investigating the impact of new technological applications on knowledge in organizations and use our knowledge to safe resources and our joint planet.

References

APO (2020). Knowledge Management. Tools and techniques manual, Asian Productivity Organization, Tokyo, January 2020.

Aras, M. (2021). Problems of knowledge management: Seeing the dark side! In I. Öztürk (Ed.), *Dark side of digital organization*. Peter Lang Verlag der Wissenschaften.

Armutat, S., Krause, H., Linde, F., Rump, J., & Striening, W. (2002). Wissensmanagement erfolgreich einführen. In R. Weidmann (Ed.), *Strategien – Instrumente – Praxisbeispiele*. Deutsche Gesellschaft für Personalführung e.V.

Arthur Andersen and American Productivity and Quality Center. (1996). *The knowledge management assessment tool*.

Austin, J. (2003). Transactive memory in organizational groups: The effects of content, consensus, specialization, and accuracy in group performance. *Journal of Applied Psychology, 88*(5), 866–878.

Blackler, F. (1995). Knowledge, knowledge work and organizations: An overview and interpretation. *Organization Studies, 16*(6), 1021–1046.

Böhle, F. (1994). Relevance of experience-based work in modern processes. *AI & Society, 8*(3), 207–215.

Böhle, F., & Milkau, B. (1988). Computerised manufacturing and empirical knowledge. *AI & Society, 2*(3), 235–243.

BSI. (2001). *Knowledge management: A guide to good practice*. British Standards Institution.

Burstein, F., Sohal, S., Zyngier, S., & Sohal, A. S. (2010). Understanding of knowledge management roles and responsibilities: A study in the Australian context. *Knowledge Management Research & Practice, 8*(1), 76–88.

Carty, R., & Walsh, S. (2007). The role of middle managers in knowledge transfer. *Journal of Information & Knowledge Management, 6*(4), 297–302.

CEN. (2004). *European guide to good practice in knowledge management*. CWA 14924, Part 1–5, European Committee for Standardization, Brussels.

Chua, A. Y. K. (2009). The dark side of successful knowledge management initiatives. *Journal of Knowledge Management, 13*(4), 32–40.

Dalkir, K. (2005). *Knowledge management in theory and practice* (1st ed.). MIT Press.

Davenport, T. H., & Prusak, L. (2000). *Working knowledge. How organizations manage what they know* (2nd ed.). Harvard Business School Press.

Dayan, R., Matos, F., & Heisig, P. (2017). Knowledge management as a factor for the building and implementation of organization strategy. *Journal of Knowledge Management, 21*(2), 308–329.

de Solla Price, D. J. (1963). *Big science*. Little Science.

DIN. (2012). *SPEC 91281 Implementation of process-oriented knowledge management in small and medium-sized enterprises*. Deutsches Institut für Normung e.V.

Dixon, N. (2010). *The three eras of knowledge management – summary*. Accessed February 12, 2023, from https://www.nancydixonblog.com/2010/08/the-three-eras-of-knowledge-managementsummary.html

Easterby-Smith, M., & Lyles, M. A. (2011). *Handbook of organizational learning and knowledge management*. Wiley.

El Sawy, O., & Josefek, R. A. (2003). Business process as nexus of knowledge. In C. Holsapple (Ed.), *Handbook of knowledge management. Knowledge matters* (Vol. 1, pp. 425–438). Springer.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*(3), 363–406.

Ferguson, J., Huysman, M., & Soekijad, M. (2010). Knowledge management in practice: Pitfalls and potentials for development. *World Development, 38*, 1797–1810.

Firestone, J. M., & McElroy, M. W. (2003). *Key issues in the new knowledge management*. KMCI Press; Butterworth-Heinemann.

Floridi, L. (2010). *Information. A very short introduction*. Oxford University Press.

Franta, B. (2018). Early oil industry knowledge of CO_2 and global warming. *Nature Climate Change, 8*, 1024–1025.

Franta, B. (2021). Early oil industry disinformation on global warming. *Environmental Politics, 30*(4), 663–668.

Garvin, D. A. (1993). Building a learning organization. *Harvard Business Review, 71*(4), 78–91.

Gherardi, S. (2000). Practice-based theorizing on learning and knowledge in organizations. *Organization, 7*(2), 211–223.

Goesmann, T. (2002). *Ein Ansatz zur Unterstützung wissensintensiver Prozesse durch Workflow-Management-Systeme*. Dissertation, Berlin, Technische Universität.

Gronau, N., Müller, C., & Uslar, M. (2004). *The KDML knowledge management approach: Integrating knowledge conversion and business process modeling*. Lecture notes in Artificial Intelligence, Col. 3336, p. 1–10, 5th International conference PAKM 2004, 2.–3. December 2004.

Haesevoest, T., De Cremer, D., Dierckx, K., & Van Hiel, A. (2021). Human-machine collaboration in managerial decision making. *Computers in Human Behavior, 118*(106730), 11p.

Heisig, P. (1999). Geschäftsprozeßorientiertes Wissensmanagement. In: Bläsing, J. P. (Hrsg.). *Total Business Knowledge Management –Wissensmanagement verändert Unternehmen*, Proceedings 6.–7. Dezember 1999, Ulm, Germany, pp. 27–42.

Heisig, P. (2005). *Integration von Wissensmanagement in Geschäftsprozesse*, eureki, Berlin (PhD, Technical University Berlin).

Heisig, P. (2007). *Improving knowledge handling in business processes – The GPO-WM® Method*, Proceeding of the 8th European Conference on Knowledge Management, Barcelona, Spain, 6–7 September 2007, pp. 456–464.

Heisig, P. (2008). *GPO-WM Analyseleitfaden. Verbessern Sie Ihren Umgang mit Wissen!* Knowledge Capability Assessment Guide.

Heisig, P. (2009). Harmonisation of knowledge management – Comparing 160 KM-Frameworks around the globe. *Journal of Knowledge Management, 13*(4), 4–31.

Heisig, P. (2015). Future research about knowledge and knowledge management – Results from the global knowledge research network study. In E. Bolisani & M. Handzic (Eds.), *Advances in knowledge management – celebrating twenty years of research and practice* (pp. 151–182). Springer.

Heisig, P., & Finke, I. (2003). Wissensmanagement-Kompetenz-Check. [Knowledge Management Skill Test] In: Lutz Rosenstiel und John Erpenbeck (Hrsg.). *Handbuch Kompetenzmessung. Erkennen, verstehen und bewerten von Kompetenzen in der betrieblichen, pädagogischen und psychologischen Praxis*. [Handbook Competence Measurement. Recognise, understand and evaluate competencies in the company, pedagogic and psychological practice] Stuttgart: Schaeffer-Poeschel Verlag 2003, pp 488–504.

Heisig, P., & Mertins, K. (1999). *Knowledge Management in Europe – Results from a European survey. Global Production Management: IFIP WG5.7 International Conference on Advances in Production Management Systems*, September 6–10, 1999, Berlin, Germany, edited by Mertins, K., Krause, O., Schallock, B. Dordrecht: Kluwer 1999, Page 193–200.

Heisig, P., Orth, R. (2007) *Knowledge management frameworks – An international comparative study*. Berlin.

Heisig, P., Suraj, O. A., Kianto, A., Perez-Arrau, G., & Easa, N. (2016). Knowledge management and business performance: Global Experts' views on future research needs. *Journal of Knowledge Management, 20*(6), 1169–1198.

Helm, R., Meckl, R., & Sodeik, N. (2007). Systematisierung der Erfolgsfaktoren von Wissensmanagement auf der Basis der bisherigen empirischen Forschung. *Zeitschrift für Betriebswirtschaft, 77*(2), 211–241.

Henry, N. L. (1974). Knowledge management: A new concern for public administration. *Public Administration Review, 34*(3), 189–196.

Hislop, D. (2009). *Knowledge management in organizations: A critical introduction* (2nd ed.). Oxford University Press.

Holsapple, C. (Ed.). (2003). *Handbook on knowledge management. Vol. 1: Knowledge matters, Vol. 2: Knowledge directions*. Springer.

Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Sciences, 2*(1), 88–115.

ISO/DIN 30401 (en) Knowledge Management Systems – Requirements. 2018.

Jakubik, M., & Müürsepp, P. (2022). From knowledge to wisdom: Will wisdom management replace knowledge management. *European Journal of Management and Business Economics, 31*(3), 367–389.

Jarrahi, M. H., Askay, D., Eshraghi, A., Smith, P. (2023). Artificial intelligence and knowledge management: A partnership between human and AI Business Horizons 66(1):87-99. https://doi.org/10.1016/j.bushor.2022.03.002

Jashapara, A. (2004). *Knowledge management. An integrated approach*. Prentice Hall.

Jasimuddin, S. M. (2006). Disciplinary roots of knowledge management: A theoretical review. *International Journal of Organizational Analysis, 14*, 171–180.

Jones, W. (2017). Personal information management. *Annual Review of Information Science and Technology*, 453–504.

Jørgensen, R., Scarso, E., Kirchner, K., & Edwards, K. (2019). Exploring the maturity and development of global communities of practice. *Knowledge Process Management, 26*, 321–331.

Kaplan, W. (2017). *Why dissent matters: Because some people see things the rest of us miss*. McGill-Queens University Press.

Koulikov, M. (2011). Emerging problems in knowledge sharing and the three new ethics of knowledge transfer. *Knowledge Management & E-Learning: An International Journal, 3*(2), 237–250.

Kwan, M.-L. M. (1999). *Process-oriented knowledge management*. Dissertation Boston University, School of Management.

Kwanya, T. (2023). Working with Robots as colleagues: Kenyan perspectives of ethical concerns on possible integration of co-bots in workplaces. In D. O. Eke, A. Wakunuma, & S. (Eds.), *Responsible AI in Africa. Challenges and opportunities* (pp. 65–99). Palgrave Macmillan.

Lambe, P. (2011). The unacknowledged parentage of knowledge management. *Journal of Knowledge Management, 15*(2), 175–197.

Land, F., Amjad, U., & Nolas, S.-M. (2007). The ethics of knowledge management. *International Journal of Knowledge Management, 3*(1), 1–9.

Laszlo, C. K., & Laszlo, A. (2002). Evolving knowledge for development: The role of knowledge management in a changing world. *Journal of Knowledge Management, 6*(4), 400–412.

Lehner, F. (2019). *Wissensmanagement. Grundlage, Methoden und technische Unterstützung*. München: Hanser-Verlag, 6. überarb. und erw. Aufl.

Liebowitz, J. (2001). Knowledge management and its link to artificial intelligence. *Expert Systems with Applications, 20*, 1–6.

Lyytinen, K., Nickerson, J. V., & King, J. L. (2020). Metahuman systems = humans + machines that learn. *Journal of Information Technology,* 1–19.

Machlup, F. (1962). *Knowledge: Its creation, distribution, and economic significance* (Vol. 1). Princeton University Press.

Maier, R. (2004). *Knowledge management systems. Information and communication technologies for knowledge management*. Springer.

Massingham, P. (2014a). An evaluation of knowledge management tools: Part 1 – managing knowledge resources. *Journal of Knowledge Management, 18*(6), 1075–1100.

Massingham, P. (2014b). An evaluation of knowledge management tools: Part 2– managing knowledge flows and enablers. *Journal of Knowledge Management, 18*(6), 1101–1126.

May, Kenneth O. (1968) Growth and quality of the mathematical literature author(s), *Isis*, *59*, 4 (Winter), 363–371.

McElroy, M. W. (2000). Integrating complexity theory, knowledge management and organizational learning. *Journal of Knowledge Management, 4*(3), 195–203.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W., III. (1972). *The limits to growth. A report for the club of Rome's project on the predicament of mankind*. Potomac Associates Book.

Mertins, K., Heisig, P., & Vorbeck, J. (2003). *Knowledge management. Best practices in Europe*. Springer.

Mertins, K., Heisig, P., & Vorbeck, J. (2005). *Knowledge management. Concepts and best practices*. Berlin, New York: Springer, 2003, 2nd revised and extended edition.

Mertins, K., Schallock, B., Carbon, M., & Heisig, P. (1993). Erfahrungswissen bei der kurzfristigen Auftragssteuerung. [The role of tacit knowledge and experiences within short term scheduling]. *Zeitschrift für wirtschaftlichen Fabrikbetrieb, 88*(2), 78–80.

Mertins, K., & Seidel, H. (2009). *Wissensmanagement im Mittelstand. Grundlagen – Lösungen – Praxisbeispiele*. Springer.

Michel, A., & Heisig, P. (2020). *21st century skills for knowledge managers, Lecture Notes in Informatics (LNI)*, Proceedings – Series of the Gesellschaft fur Informatik (GI), P-303, pp. 76–90.

Mittelmann, A. (2011). *Werkzeugkasten Wissensmanagement*. Norderstedt, Books on Demand.

Mittelmann, A. (2019). *Wissensmanagement wird digital*. Books on Demand.
Mohrman, S. A., Lawler III, E. E., & Associates (2011). *Useful Research. Advancing theory and practice*. San Francisco, Berret-Koehler.
Mokyr, J. (2002). *The gifts of Athena: Historical origins of the knowledge economy*. Princeton University Press.
Mueller, J. (2012). The interactive relationship of corporate culture and knowledge management: A review. *Review of Managerial Science, 6*(2), 183–201.
Mugabe, J. (1999). *Intellectual property protection and traditional knowledge: An exploration in international policy discourse*.
Mumford, E. (2000). A socio-technical approach to systems design. *Requirements Engineering, 5*, 125–133.
Nonaka, I., Chia, R., Holt, R., & Peltokorpi, V. (2018). Wisdom, management and organization. *Management Learning, 45*(4), 365–376.
Nonaka, I., & Takeuchi, H. (1994). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford University Press.
Nonaka, I., & von Krogh, G. (2009). Tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory. *Organization Science, 20*(3), 635–652.
North, K., Maier, R., & Haas, O. (2018). Value creation in the digitally enabled knowledge economy. In K. North, R. Maier, & O. Haas (Eds.), *Knowledge management in digital change. New findings and practical cases* (pp. 1–29). Springer.
Orlikowski, W. (2002). Knowing in practice: Enacting a collective capability in distributed organizing. *Organization Science, 13*(3), 249–273.
Orozco, D., & Poonamallee, L. (2014). The role of ethics in the commercialization of indigenous knowledge. *Journal of Business Ethics, 119*, 275–286.
Örtenblad, A. (2001). On differences between organizational learning and learning organization. *The Learning Organization, 8*(3), 125–133.
Pawlowsky, P. (2019). *Wissensmanagement*. De Gruyter Oldenbourg.
Pellegrini, M. P., Ciampi, F., Marzi, G., & Orlando, B. (2020). The relationship between knowledge management and leadership: Mapping the field and providing future research avenues. *Journal of Knowledge Management, 24*(6), 1445–1492.
Peshkin, M., & Colgate, J. E. (1999). Cobots. *Industrial Robot: An international Journal, 26*(5), 335–341.
Pfeffer, J., & Sutton, R. I. (2000). *The knowing-doing gap. How smart companies turn knowledge into action*. Harvard Business School Press.
Polanyi, M. (1966). *The tacit dimension*. Doubleday & Company.
Probst, G., Raub, S., & Romhard, K. (2000). *Managing knowledge. Building blocks for success*. Wiley.
Rao, M. (Ed.). (2005). *Knowledge management tools and techniques. Practitioners and experts evaluate KM solutions*. Elsevier Butterworth-Heinemann (Part I & II).
Reinmann, G., & Eppler, M. J. (2008). *Wissenswege. Methoden für das persönliche Wissensmanagement*. Verlag Hans Huber.
Remus, U. (2002). *Prozessorientiertes Wissensmanagement. Konzepte und Modellierung*. Dissertation, Universität Regensburg.
Ribeiro, R., & Collins, H. (2007). The bread-making machine: Tacit knowledge and two types of action. *Organization Studies, 28*(9), 1417–1433.
Rowley, J. (2006). Where is the wisdom that we have lost in knowledge? *Journal of Documentation, 62*(2), 251–270.
Rubenstein-Montano, B., Liebowitz, J., Buchwalter, J., McCaw, D., Newman, B., Rebeck, K., & The Knowledge Management Methodology Team. (2001). A systems thinking framework for knowledge management. *Decision Support Systems, 31*, 5–16.
Sarka, P., Heisig, P., Caldwell, N. H. M., Maier, A. M., & Ipsen, C. (2019). Future research on information technology in knowledge management. *Knowledge and Process Management, 26*, 277–296.

Scholl, W., König, C., Meyer, B., & Heisig, P. (2004). The future of knowledge management. An international Delphi study. *Journal of Knowledge Management, 8*(2), 19–35.
Schön, D. A. (1983). *The reflective practitioner*. Basic Books.
Schreyögg, G., & Geiger, D. (2007). The significance of distinctiveness: A proposal for rethinking organizational knowledge. *Organization, 14*(1), 77–100.
Schultze, U., & Stabell, C. (2004). Knowing what you don't know? Discourses and contradictions in knowledge management research. *Journal of Management Studies, 41*(4), 549–573.
Snowden, D. (1998). A framework for creating a sustainable knowledge management program. In: Cortada, J. W., & Woods, J. A. (Eds.), *The knowledge management yearbook 1999–2000*. Boston.
Snowden, D. (2002). Complex acts of knowing: Paradox and descriptive selfawareness. *Journal of Knowledge Management, 6*(2), 100–111.
Stuhlhofer, F. (1983). Unser Wissen verdoppelt sich alle 100 Jahre. Grundlegung einer "Wissensmessung". *Berichte zur Wissenschaftsgeschichte, 6*, 169–193.
TFPL Ltd. (1999). *Skills for knowledge management: Building a knowledge economy*. A report by TFPL Ltd. London.
Thiesse, F. (2001). *Prozessorientiertes Wissensmanagement: Konzepte, Methode, Fallbeispiele*. Difo-Druck, Bamberg.
Vanini, S. (1999). *Halbwertzeit von technologischem Wissen: Meßkonzepte und Implikationen für die Technologieplanung*. Verlag Dr. Kovac.
VDI-Guideline 5610 Part 1 "Knowledge Management for Engineering – Fundamentals, concepts and approaches" VDI Competence Area Information Technology, Committee 1.4.1, Düsseldorf March 2009.
Vogel, E. (1999). *Wissensmanagement bei den Helvetia Patria Versicherungen – Ein Vorgehen zur Bewertung des Ist-Stands und zur Entwicklung eines Grobkonzepts*. 21. Online-Tagung der DGI: Aufbruch ins Wissensmanagement; Frankfurt am Main, 18.–20. Mai 1999, Proceedings/ Schmidt, R. (Eds.) – Frankfurt/M.: DGI, 1999, S. 117–128.
Weltz, F., Bollinger, H., & Lullies, V. (1990). *Konfliktfeld Informationstechnik*. Frankfurt/M.: Campus.
Weltz, F., Julich, H., & Jacobi, U. (1986). *Arbeitsgestaltung in der öffentlichen Verwaltung*. Frankfurt/M.: Campus.
Wiig, K. M. (1993). *Knowledge management foundations: Thinking about thinking – How people and organizations create, represent and use knowledge* (Vol. 1). Arlington Press.
Wiig, K. M. (1997). Knowledge management: Where did it come from and where will it go? *Expert Systems with Applications, 13*(1), 1–14.
Zyngier, S. M., & Burstein, F. (2012). Knowledge management governance: The road to continuous benefits realization. *Journal of Information Technology, 27*(2), 140–155.

Peter Heisig is Professor for Information and Knowledge Management and Vice-President for Research and Transfer at the University of Applied Sciences Potsdam. He studied Social Sciences at the University Göttingen, University of Economics Vienna, and University Deusto Bilbao and earned his PhD in Engineering at the Technical University Berlin. He founded the Competence Center Knowledge Management (CCWM) at Fraunhofer Institute IPK (Berlin) in 1996 undertaking research projects from tacit knowledge toward corporate-wide KM projects. After some years in consulting, he joined the Engineering Design Center (EDC) at the University of Cambridge (UK) in 2006 and the Leeds University Business School (UK) in 2010. In 2011, he created a Global Research Network on Knowledge Management with partners in 30+ countries undertaking a joint worldwide study on KM with more than 220 KM researchers and KM practitioners. He is also a founding member of the International Association of Knowledge Management (IAKM) and an active member of the Gesellschaft für Wissensmanagement e.V. in Austria and Germany. He contributed to the development of several standards (DIN, CEN, ISO, VDI) and has supported numerous well-known Fortune 500 companies on KM projects for more than 25 years. He ranks among the Top 20 Authors of the Journal of Knowledge Management.