

Harmonisation of knowledge management – comparing 160 KM frameworks around the globe

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Abstract

Purpose – The purpose of this paper is to look at how knowledge management (KM) has entered into a new phase where consolidation and harmonisation of concepts is required. Some first standards have been published in Europe and Australia in order to foster a common understanding of terms and concepts. The aim of this study was to analyse KM frameworks from research and practice regarding their model elements and try to discover differences and correspondences.

Design/methodology/approach – A total of 160 KM frameworks from science, practice, associations and standardization bodies have been collected worldwide. These frameworks have been analysed regarding the use and understanding of the term knowledge, the terms used to describe the knowledge process activities and the factors influencing the success of knowledge management. Quantitative and qualitative content analysis methods have been applied.

Findings – The result shows that despite the wide range of terms used in the KM frameworks an underlying consensus was detected regarding the basic categories used to describe the knowledge management activities and the critical success factors of KM. Nevertheless regarding the core term knowledge there is still a need to develop an improved understanding in research and practice.

Originality/value – The first quantitative and qualitative analysis of 160 KM frameworks from different origin worldwide.

Keywords Work study, Knowledge management systems, Critical success factors, Standards

Paper type Research paper

Introduction

Knowledge management (KM) has arrived at a new stage of its life cycle. After the technological euphoria and the KM hype, followed by the disillusion, KM is now on the way to a better understanding of its success factors and KM approaches are more focused to address particular challenges like securing knowledge from leaving experts (Weber *et al.* 2007). Initiatives carried out by standardization bodies in Australia (Standards Australia, 2001, 2003), Britain (BSI, 2001, 2003a, b, c), Germany (DIN, 2006) and on the European Level (CEN, 2004) have tried to achieve a common understanding about KM. One element of a shared understanding within a discipline is a common model or framework, which describes the core elements, concepts and principles of the research object and/or design object. KM research has tried to describe the KM phenomena with frameworks. Organizations have used frameworks to prescribe the essential elements of KM, to communicate coherently about KM and, to design and evaluate KM solutions (Holsapple and Joshi, 1999; Lai and Chu, 2000; Liebowitz and Megbolugbe, 2003; Stankosky, 2005; Wieneke and Phlypo-Price, 2003).

A framework could be understood as an instrument to structure complex problems and a starting point for the generation of alternatives for action (Osterloh and Grand, 1995). Weber *et al.* (2002) understand a:

... *framework* as a holistic and concise description of the major elements, concepts and principles of a domain. It aims to explain a domain and define a standardised schema of its core

content as a reference for future design implementations. A *KM framework* explains the world of KM by naming the major KM elements, their relationships and the principles of how these elements interact. It provides the reference for decisions about the implementation and application of KM.

In the *European Guide to Good Practice in KM* issued by CEN (2004) 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. Typically, a framework is built up into a pictorial representation which serves as an *aide-memoire* for implementing KM within an organization, helping users to position individual KM initiatives with within a wider context” (CWA 14924-5, 2004 (E), 11).

Rubenstein-Montano *et al.* (2001) distinguish three types of KM frameworks:

1. “prescriptive frameworks” provide direction on the types of knowledge management procedures without providing specific details of how those procedures can/should be accomplished. In essence, they prescribe different ways to engage in knowledge management activities (...) As such, the frameworks tend to be task-oriented. (...) In contrast,
2. “descriptive frameworks” characterize or describe knowledge management. These frameworks identify attributes of knowledge management important for their influence on the success or failure of knowledge management initiatives.
3. “Hybrid frameworks” are “a combination of the two”. Weber *et al.* (2002) advocate for a prescriptive KM framework which suggests “how things shall be done” in a practical manner.

A general goal of KM is to improve the systematic handling of knowledge and potential knowledge within the organization. Therefore, it is important to first answer the question, what is the understanding of the term knowledge in the frameworks.

The systematic handling of knowledge at the operational level of an organization is a core element of KM. Handling knowledge is actually nothing new. However, its arrangement and increased orientation towards organization goals demands more systematic handling of knowledge in organizational practice in order to achieve better results. This knowledge handling is described in KM frameworks in the form of activities or processes. Therefore the activities named in KM frameworks will be analysed in detail.

The success of KM depends on certain factors, which are named success factors or context factors. Depending on the specific arrangement, these context factors can both, enable some KM activities and obstruct others, while they can also present a barrier for the successful implementation of KM (e.g. see Bullinger and Prieto, 1998; Skyrme, 1999; Prange, 2002). The KM frameworks will be analysed according the elements they emphasis regarding relevant success or/and context factors for KM.

Purpose

The main aim of this study was to collect KM frameworks worldwide from research and practice, to discover differences and to identify similarities within these KM frameworks. Another aim was to find out, if the results of former studies by Holsapple and Joshi (1999, 2002) could be confirmed on a broader empirical basis.

Method

The Framework study methodology is based on the quantitative and qualitative[1] content analysis of existing KM Frameworks, which are published in the scientific literature, presented at specialized conferences or used in knowledge management initiatives by companies.

For the purpose of data acquisition the scientific publications relevant to the topic “KM” were investigated. Further, conference documentations published at scientific and commercial conferences related to KM in the period of 1998 to 2003 as well as various internet sources were accessed in order to identify KM frameworks. Furthermore a direct e-mail survey was

accomplished among scientists interested in KM and KM professionals and a “call for frameworks” via the Special Interest Group (SIG) on “Standards” on www.knowledgeboard.com was started.

The framework search work took place from April 2003 until August 2003. The e-mail survey was finished in May 2003, while those answers were included that arrived until mid August 2003.

Those represent the basis of the content analysis for the graphically and textually described frameworks for KM. The frameworks originating from science are usually described in more detail than the representations made by the practitioners from companies. The frameworks used in organizational practice often reduce to one or more diagrams and short descriptions in the form of introduction and project presentations, which were made available to the author and/or are publicly accessible.

The evaluation took place in four steps. In the first step the data was extracted as “key words” out from each Framework, if required translated into English, and assigned to the following analysis categories:

- Source: title of the publication, author, year.
- Origin of the frameworks sorted by institution.
- Framework type.
- Statements to respective definitions of knowledge.
- KM activities.
- Critical success factors for KM.

The emphasis on the content analysis is on the last three categories: definitions of knowledge, KM activities and critical success factors for KM.

In the second step, the results in these categories were coded and counted out according to the frequency they were mentioned. On this basic statistic key figures were computed, for, e.g. frequency of KM activities with maximum and minimum values as well as average, median and standard deviation.

In the third step the synonyms were arranged according to content classes. Thus for example in the category of “KM activities”, terms like “Share” (31), “transfer” (23), “distribution” (21), “diffusion” (3) are classified into one group and their frequencies are summed up. The goal of this quantitative-analytical approach was to reduce the heterogeneity and complexity existing in the frameworks by appropriate filtering of the raw data.

Study findings

KM frameworks: origin and type

After completing the gathering of literature and other materials, altogether 160 frameworks were selected for further analysis (see Appendix 1). The publication period of the frameworks extends from 1995 to 2003. Approximately half of the collected publications originate from 2001 onwards. Furthermore the selection covers different “development stages” of KM as described by Firestone and McElroy (2003). Table I shows the distribution of the KM Frameworks according to the origin by region and type of organisation.

Table I Origin of KM frameworks according to region and institution

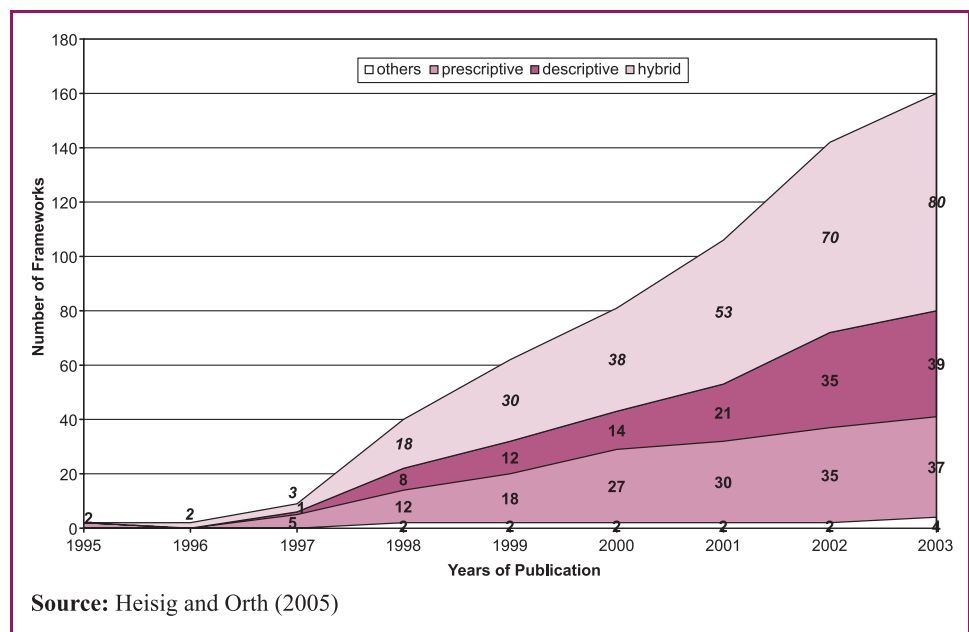
Institution	Region				Sum
	Europe	USA	Asia and Australia	Others	
Science	56	13	1	1	71
Professional consulting	34	11	2	1	48
Companies	26	4	0	0	30
Associations and Standardisation bodies	8	1	1	1	11
Sum	124	29	4	3	160

Classified according to the three KM framework types proposed by Rubenstein-Montano *et al.* (2001) half of the 160 KM-Frameworks exhibit a hybrid character. While the descriptive (39) and prescriptive (37) categories have each been allotted a scarce quarter. A longitudinal analysis of the KM frameworks shows a continuous increase in the number of hybrid frameworks (Figure 1). This framework type dominates the contribution from science and practitioners since 1999. While comparing the development of the different framework, the prescriptive types stagnate since 2000, while the number of purely descriptive frameworks grows in 2002 again by two-thirds. However, since then this type has stagnated.

This development can be interpreted as a proof that KM is not only limited to the organization of knowledge-related activities. The holistic nature of KM requires additional consideration of a variety of context factors, which considerably affect the knowledge management activities of the organization. Vogel (1999) pointed out the limits of the eight knowledge processing activities proposed by Probst *et al.* (1998) which has become a quasi-standard in the German language area. Vogel suggests a change of perspectives from the knowledge processing activities during the starting or analysing phases of KM initiative towards the consideration of context factors like technology, human resources, company culture, etc. during the design and implementation of a KM solution.

Knowledge in KM frameworks

The quantitative analysis shows that a quarter of the examined frameworks (26 per cent/41 of 160) only implicitly – through the description of KM activities – shows an understanding that

Figure 1 Year of publication and type of framework

knowledge is managed here. While three-quarter of the KM frameworks (74 per cent/119 of 160) present explicit statements regarding the term “knowledge”, a closer view of these statements shows that different dimensions of knowledge are mentioned in the KM frameworks.

Knowledge dichotomies are most frequently (52 per cent/62 denominations in 119 frameworks) used for the description of the kind of knowledge, like, e.g. “explicit versus implicit” or “internal versus external”. The second rank applies to knowledge from a strategic perspective, e.g. as “Knowledge assets and resources” or “Intellectual capital” (29 per cent/34 in 119). The distinction of data-information-knowledge is used in one out of five frameworks (20 per cent/24 in 119). Finally in some KM frameworks, the term “organisational knowledge base”(16 per cent/19 in 119) in connection with an explanation of knowledge on the organisational level has been used.

The dichotomies used in the 62 KM frameworks are displayed in Table II. The number of dichotomies per framework varies between one and eight. Table II shows which dichotomies are considered as most relevant in the frameworks.

Knowledge management activities in KM frameworks

The analysis of 160 KM frameworks regarding the description of knowledge handling shows that in 73 per cent ($n = 117$) KM framework activities are explicitly designated to handle knowledge. The range is from two to nine KM activities per framework. Both, average value and median, account for five KM activities, while the standard deviation is 1.7 (Table III).

The analysis of the examined population concerning the KM-activities specified in the frameworks results in the following frequency table (Table IV).

<i>Dichotomy</i>	<i>Count</i>
1 Implicit/tacit – explicit knowledge	42
2 Individual – organisational/collective knowledge	12
3 Internal – external knowledge	6
4 Knowledge as process – Knowledge as product	5
5 Undocumented – documented knowledge	3
6 Structured/ordered – unstructured knowledge	2
7 Used – unused knowledge	2
8 Relevant – irrelevant knowledge	2
9 Objective – subjective knowledge	2
10 Knowledge from experiences – knowledge from rationality	1
11 Public – proprietary knowledge	1
12 Actual – future knowledge	1
13 Public – scientific knowledge	1
14 Industry specific – firm specific knowledge	1
15 Complex – simple knowledge	1
16 Hidden – visible knowledge	1
17 (Electronically) inaccessible – (electronically) accessible knowledge	1
18 Unsecured – secured knowledge	1
19 Informal, unapproved – formal, institutionalised, approved knowledge	1
Specific, particular, contextualized – abstract, general,	
20 de-contextualized knowledge	1
21 Codified – un-codified knowledge	1
22 Abstract – concrete knowledge	1
23 Un-diffused – diffused knowledge	1
24 Declarable – non-declarable knowledge	1
25 Observable – non-observable knowledge	1
26 Autonomous – systematic knowledge	1
27 Positive – negative knowledge	1
28 Low-value – high-value knowledge	1
29 Historical – potential knowledge	1
Note: $n = 62$ of 119	

Table III KM-activities statistical characteristics

	<i>Average</i>	<i>Median</i>	<i>Standard deviation</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Range</i>
KM-activities	5.1	5	1.7	2	9	7
Note: $n = 117$						

Table IV Frequency table for KM activities

x_i	2	3	4	5	6	7	8	9
Number of KM activities per framework								
n_i (absolute frequency)	7	12	23	33	19	5	16	2
n_i (relative frequency)	0.06	0.1	0.2	0.28	0.16	0.04	0.14	0.02
n								

Within these 117 KM-Frameworks 166 different terms for the KM activities has been identified (see Appendix 2). Some terms are more frequently used than others like “use” within 41 frameworks, “identify” in 37 and “create” in 36, to name the three most mentioned activities.

The classification of the different terms resulted into six broad categories of knowledge management activities which could be regarded in KM research and KM practice as general accepted basic KM activities. These basic KM activities could help to overcome subtle conceptual differences between different KM Frameworks and serve as common basic understanding.

Table V represents the quantitative results of the content analysis of the 117 KM frameworks regarding the most frequently used terms for the description of the KM activities. Synonymous and similar meaning terms were combined within a category. The categories have been named according to the most frequently mentioned single activity in that particular category. On the one hand the table represents data on term level, i.e. how often a certain term was called altogether within all frameworks and on the other hand about the

Table V Six most frequently discussed groups of KM-activities

<i>No.</i>	<i>KM activities^a</i>	<i>Total count in frameworks</i>	<i>Number of frameworks</i>	<i>Per cent of frameworks (n= 117)</i>
1.	Share (31), transfer (23), distribution (23), knowledge communication (6), collaborate (4), diffusion (4), knowledge dissemination (4), allocation (1), network and cooperate (1).	97	96	82
2.	Create (36), generate (22), development (17), innovate (5), build/sustain (2), further development (2), production (1), and experimenting (1), and evolve (1).	87	87	74
3.	Use (41), application, apply (22), act (3), leverage (4), re-use (3), enable, enable use (2), exploit (1), deriving value (1), capitalisation (1), deploy (1).	79	76	65
4.	Store (24), retention (10), capture (9), codification (9), package (2), secure (2), archiving (2), documentation (2), maintain (2), preserve (2), protect (1), accumulate (1).	66	61	52
5.	Identify (37), organize and classify (12), structure (2), analyse (3) determining (2), review (1), inventory (1), locate (1), investigate (1), discover (1), screening (1), survey and categorize (1), mapping (1), find (1).	65	60	51
6.	Acquire (33), collect (4), import (2), provide (2), get (1), sourcing (1), gathering (1).	44	43	37

Note: ^a Numbers in parentheses correspond to the number of entire denominations in the 117 examined KM frameworks mentioning KM activities

framework level, i.e. in how many frameworks one or more terms of a term class were mentioned. On the term level, possible double counting of a category has been avoided.

In 82 per cent – (96 of 117) – of the KM frameworks terms from the category of “share” are discussed, it is followed by the terms from the category of “create” with 74 per cent of the frameworks, third are terms from the category of “use” with 65 per cent, followed by terms from the category “store” with 52 per cent and terms from the category “identify” with 51 per cent. The next category by frequencies is the category of “acquire” with 37 per cent of the frameworks does not cover the majority of the KM frameworks.

It is interesting to note, that considering the nominations each by itself would change the order of activities, however no other activities would be added to the six most frequent entries. Accordingly, the new ranking would be as follows:

1. Use (41).
2. Identify (37).
3. Create (36).
4. Acquire (33).
5. Share (31).
6. Store (24).

Based on the analysis and classification of the activities mentioned in the analyzed KM-Frameworks, a relatively broad consensus about the core activities behind the semantic heterogeneity of the terms to describe the individual KM activities by each KM framework has been discovered. Therefore KM activities can be described with the five central activities of sharing, creating, using, storing and identifying. The activity acquiring knowledge was excluded because it did not reach the majority (min. 50 per cent) of the analysed KM frameworks.

The further analysis of the most frequent combinations of KM activities, leads in the first place to the two categories “Share” and “Create”, which together contributing 63.2 per cent to the framework and thus representing the most frequently discussed “two-term” combination. “Share” and “Use” as well as “Create” and “Use” follow with 51.3 per cent. The most frequently discussed “Three-term” combination is “Share”, “Create”, and “Use” with 43.6 per cent of the frameworks, followed by “Share”, “Create”, and “Store” with 32.5 per cent. The most frequent “Four-term” combination is “Share”, “Create”, “Use”, and “Identify”, which is in 24.8 per cent of the framework mentioned. Also, here it is necessary to recognize that the conceptual variety covers a relatively broad consent over the central KM activities. If one counts out the combinations with the all permutations, many smaller numbers result.

Furthermore, it can be noted that the institutional origin does not have influence on the denomination of KM activities. In the cross tables no corresponding observation results, and also Chi²-Tests show no linkage between the institutional origin of the frameworks and the denomination of certain KM activities.

Critical success factors in KM frameworks

The analysis of the 160 KM frameworks regarding the description of the success factors shows that in 74 per cent ($n=119$) of the KM frameworks success-critical context factors are explicitly mentioned. Within this group the range of the success factors is from two to twelve. Average is 4.9 and median are four success factors per framework, the standard deviation amounts to 2.1 (Table VI).

After reviewing the population regarding the number of success factors mentioned per framework, the following frequency table (Table VII) results.

The existing heterogeneity in the field of KM becomes clearer regarding the success-critical context factors. Altogether 170 different terms has been extracted from the 119 KM

Table VI Critical success factors of the KM – statistical data

	<i>Average</i>	<i>Median</i>	<i>Standard deviation</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Range</i>
Context factors	4.9	4	2.1	2	12	10
Note: $n = 119$						

Table VII Frequency table for critical success factors of the KM

x_i	2	3	4	5	6	7	8	9	10	11	12
Number of critical success factors mentioned per framework											
n_i (absolute frequency)	5	23	45	10	11	12	4	4	2	2	1
n_i (relative frequency)	0.04	0.19	0.38	0.08	0.09	0.1	0.03	0.03	0.02	0.02	0.01
n											

frameworks used to name context or/and success factors (see Appendix 3). Within these 170 terms, many terms can be found, which are similar and synonymously used. Table VIII represents the quantitative result of the content analysis of the 119 KM frameworks regarding the most frequently used terms for the description of the critical success or context factors. The classification of synonyms and related terms led to four main categories with 11 sub-categories (see Table VIII).

The largest portion is allotted to the dimension of the human-oriented factors which count for 149 terms mentioned in 100 frameworks. This dimension includes the categories “culture – people – leadership”. “Culture” is the most frequently called factor (in 51.3 per cent of the frameworks); closely followed by the factor “people” (46.2 per cent) while after that is the factor “leadership” (18.5 per cent).

Table VIII Critical success factors of the KM

<i>Number</i>	<i>Critical success factors^a</i>	<i>Count</i>	<i>Frameworks</i>
1.	Human-oriented factors: Culture – People – Leadership <i>Culture</i> , corporate culture, knowledge culture, knowledge oriented culture, knowledge sharing culture, culture and power, culture of learning, cultural and social factors (58); value system, values and norms, values (4) <i>People</i> (23); employees, (organisational) personnel (10); skills, employees' skills, employees' knowledge and experience, personal characteristics, personal knowledge, personal knowledge capabilities (13); human (8), human resources (3); motivation and qualification (4) <i>Leadership</i> , knowledge leadership, leadership and support (18); top management support, senior management support (5), knowledge oriented management, management (3)	149	100
2.	Organization: processes and structures <i>Organization</i> (35) <i>Processes</i> , organizational processes, process organization (40), business processes (2) <i>Structures</i> , organizational structures, organizational design, organizational infrastructure (22)	99	83
3.	Technology: infrastructure and applications <i>Technology</i> (39), information and communication technology (23), technological infrastructure (14) <i>Applications and tools</i> (12), technological systems (5), KM technologies (3)	96	94
4.	Management-process: strategy, goals and measurement <i>Strategy</i> (33), goals, organizational goals, concrete and measurable goals (9), vision (8), knowledge-based strategy (3), strategic behaviour (2), mission (2), long term vision and medium and short strategies (1), policy (1), planning (1) <i>Measurement</i> (12), knowledge controlling (3), knowledge controlling and learning (1), metrics (1), measurement criteria (1), KM-performance measurement (1), performance indicators (1)	80	61

Note: ^a Numbers in parentheses correspond to the number of the entire denominations in the 119 examined frameworks

The terms of the dimension “organization” have been named 99 times in 83 frameworks. This dimension is comprised of the categories “organizational processes” (35.3 per cent) and “organizational structures” (18.5 per cent).

The third dimension names technology-oriented aspects of the KM with altogether 96 denominations in 94 frameworks. The subcategories within the group of technology are “infrastructure” and “applications”.

The fourth dimension called management-process (80 times in 61 frameworks) includes the categories “goals, strategies and measurement” which covers the remaining spectrum of critical success factors. “Strategy” and “goals” are described as critical success factors in 39.5 per cent of the frameworks. Aspects of the “measurement” and/or “evaluation” are brought up for discussion in 14.3 per cent of the frameworks. It is interesting to mark that these aspects are in some KM frameworks understood as KM activities. This means that, in the long run, far more attention is attached to this group of topics than it appears at first sight with the exclusive view of the critical success factors: 18 of 117 frameworks (15.4 per cent) call (knowledge) goal setting an important KM activity. Aspects related to the evaluation are discussed in 23 out of 117 frameworks (19.7 per cent).

When grouping terms that are frequently mentioned together as success factors within the frameworks, the following results are obtained: “human-oriented” and “technology” is discussed in 66.7 per cent of the frameworks and is followed by the combination, of “human-oriented” and “organization” with 62.5 per cent. The combination “human-oriented”, “organization” and “technology” is highest among the three factor combinations with 43.3 per cent, which is followed by the combination “human-oriented”, “organization”, and “management process” with 35 per cent. The combination “human-oriented”, “organization”, “technology”, and “management process” as the only possible four group combination nevertheless still occurs in 29.2 per cent of the frameworks.

Therefore in more than 50 per cent of the frameworks both human factors and technology are called critical success factors. Nevertheless, still in more than 40 per cent “organization” is additionally labelled a critical success factor for KM.

Here, the institutional origin of the frameworks also do not plays any role for the denomination of the critical success factors. In the crosstables no remarkable observations result, and also the Chi²-tests resulted that no connection exists between the denomination of certain critical success factors and the institution. The chronological analysis of the frameworks shows that in the newer initiatives (since 2002/2003) human factors are represented in more than 90 per cent of the efforts. There is thus a broad consent over the fact that human factors are central for the success of KM.

In the above results the following four categories were constructed for considering context factors which are critical for the success of KM:

1. Human-oriented factors: culture – people – leadership.
2. Organisation: process and structure.
3. Technology: infrastructure and applications.
4. Management process: strategy, goals and measurement.

In the literature broad consent prevails over the fact that the one-sided emphasis on one of the factors does not correspond to what is generally considered to constitute a holistic KM effort. The task of KM is to manage these factors as a whole in such a manner that the knowledge-referred activities and/or process can be fulfilled as optimally as possible.

Summary and discussion

Today, the increasing importance of knowledge for organizational success is hardly questionable. Therefore significant attention is directed towards the understanding and design of the management of knowledge. However, this development led to a still

“A goal of this study was to work out similarities and differences between different frameworks on the basis of a quantitative and qualitative content analysis and thus to make a contribution towards the harmonization of KM.”

unresolved conceptual variety and to a lack of unanimity in the field of KM. A clear differentiation and definition of the conceptual base is still needed. In addition to the CEN project “European guide to good practice in KM” a comprehensive analysis of 160 KM frameworks was accomplished. A goal of the study was to work out similarities and differences between different frameworks on the basis of a quantitative and qualitative content analysis and thus to make a contribution towards the harmonization of KM. The emphasis of the content analysis of the KM frameworks was on three categories:

1. Understanding of “knowledge”;
2. KM activities; and
3. Critical success factors of KM.

The KM frameworks were divided into three classes, based on the typology by Rubenstein-Montano *et al.* (2001). These three classes were prescriptive, descriptive and hybrid frameworks. It can be noted that half of the frameworks exhibit a hybrid character. Furthermore, it was proven that this framework type in particular dominates the reports originating from research and practice since 1999.

Holsapple and Joshi (1999) concluded their comparative analysis of ten KM frameworks as follows:

First, the dimension of knowledge resources has received comparatively little attention. Second, there is not a common or standard way of characterizing knowledge manipulation activities. Third, there is not a common or standard way of characterizing influences on the conduct of knowledge management. Fourth, no individual KM framework subsumes the others.

Understanding of knowledge

The analysis showed that the conclusions made by Holsapple and Joshi (1999) are still valid. Different understandings of knowledge on the organisational level have been identified; a uniform understanding of term knowledge does not exist in KM frameworks. Dichotomies are most frequently used to describe the elements of knowledge, especially the distinction between implicit and explicit knowledge and between individual and collective knowledge.

Knowledge management activities

Handling knowledge actually presents nothing new. However, it is important to ensure systematic knowledge handling. Therefore, it was necessary to examine the activities required for the systematic handling of knowledge resources in the frameworks. The result of the analysis shows that there are five most frequently mentioned broad categories of KM activities: share, create, apply, store and identify knowledge. The KM activity acquire knowledge does not reach a minimum level of 50 per cent of all framework. Therefore this activity will be excluded. Beyond that, it is stressed in the frameworks that these activities mutually complement each other and therefore require co-ordination. While in 1999 it was concluded that there is no standard way of describing knowledge processes, there is still a great variety of terms, but the majority could be grouped into the five major activities mentioned above.

The result of the analysis regarding the KM activities is supported by the empirical data of a Europe wide enterprise survey (Heisig, 1999). According to the evaluation of KM activities by

“Isolated efforts for the improvement of knowledge handling which only address one KM activity like ‘sharing knowledge’ and only one critical success factor like ‘information technology’ are considered insufficient.”

KM practitioners, “apply knowledge” was rated as “essential” and “very important” by a total of 96 per cent respondents. “Distribute knowledge” received 91 per cent, in third place “create knowledge” with 84 per cent, followed by “store knowledge” with 78 per cent and “identify knowledge” with 65 per cent.

Critical success factors of knowledge management

The success of KM initiatives is considerably dependent on the basic conditions under which it has to be implemented. Since knowledge partly extracts itself from direct control, it is the task of KM to work toward the management of the organisational context in the way that the accomplishment of the core KM activities are enabled (Willke, 1998; Roehl, 2000). It is necessary to identify the context factors which are classified in the frameworks as particularly critical for the success of KM. The result of the study shows that among the central factors of KM; in particular critical factors are: human factors (culture, people and leadership), organisational aspects (structures and processes), information technology as well as a management processes (strategy and control).

Furthermore, a broad consent prevails over the fact that a one-sided implementation of only one of these factors does not correspond to KM as a holistic effort. The task of KM is to arrange these factors in such a manner that the KM activities can be achieved as smoothly as possible. Despite the fact that there is still not a standard way of characterizing influences on the conduct of KM, in this study, a widely shared understanding of the main categories affecting KM success has been observed.

The result of the analysis regarding the critical success factors of KM is supported by the empirical data, too (Heisig, 1999). The clustering of the responses regarding “the three most important factors for the success of your KM initiative” resulted in the following categories: Human factors were classified as particularly influential for the success of KM with the categories “corporate culture” (47.1 per cent of companies, $n=104$) and “skills and motivation of the employees” (27.9 per cent). The relevance of organizational aspects (“structures and processes”) for the success of KM was stressed by 29.8 per cent. The relevance of the information technology is emphasized by 27.9 per cent of the enterprises. The “support by management” as critical success factor was mentioned by 26.9 per cent of the companies.

Helm *et al.* (2007) have conducted a secondary research of 39 German and international empirical studies about critical success factors of KM. They identified the following main framework dimensions:

1. “Human Resources” with the sub-categories “personnel management/leadership”, “Motivation” and “human resource development”.
2. “Structure” with the sub-categories “Organisation” and “Technology”.
3. “Culture” with the sub-categories “Organisational level” and “Actors”.
4. “Knowledge management activities” with the two sub-categories “Knowledge collection” and “Knowledge application”.

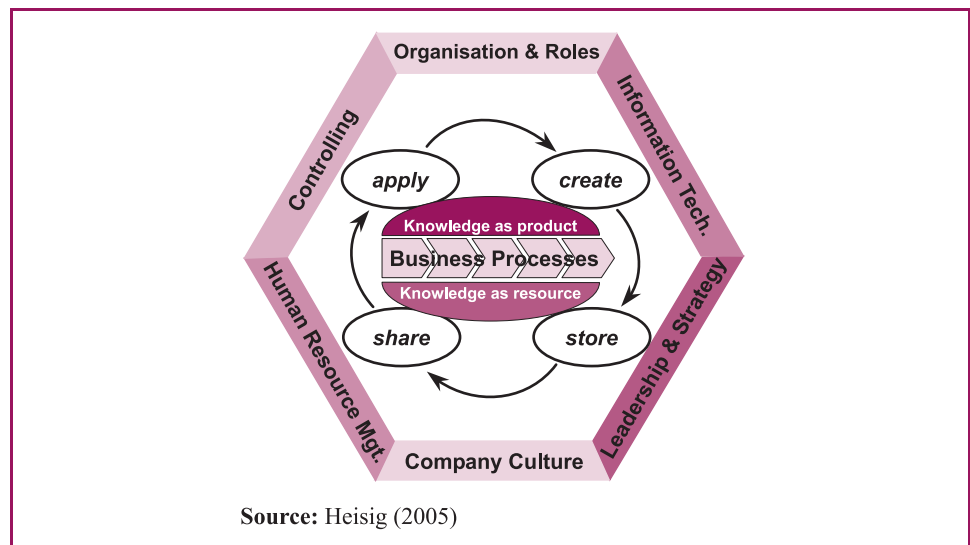
The later dimension and sub-categories re-use seven of eight knowledge management activities proposed by Probst *et al.* (1998).

The analysis of the 160 KM frameworks, the research by Helm *et al.* (2007), the authors empirical data (Heisig, 1999) and previous research (Holsapple and Joshi, 1999; Lai and Chu, 2000; Liebowitz and Megbolugbe, 2003) suggests that a KM framework should be composed of at least five core KM activities such as “identify”, “create”, “store”, “share” and “apply” knowledge. As context factors the four main critical dimensions are “Human Factors” including the categories “culture”, “people” and “leadership”, the dimension “Organisation” with “structures” and “processes”, the dimension “information technology” as well as the dimension “management processes” with “strategy” and “control”. The understanding of knowledge the core object of KM still requires more research and practical experience in order to achieve a widely shared understanding.

Based on the results from this study, other empirical data (Heisig, 1999; Scholl *et al.*, 2004), several KM case studies (Mertins *et al.*, 2003, 2005) and KM projects with industrial companies and public administration, the author has developed and refined a three layered KM Framework. The GPO-WM[®]-Framework differentiates between the following layers (Figure 2):

- **Business focus.** The business process is the context of application and generation of specific domain knowledge (El Sawy and Josefek, 2003) and its tasks are the central object for analysis and design. KM has to demonstrate its benefits for the key processes of an organization not only from the management perspective but also from the perspective of the “knowledge workers” performing theses tasks on a daily basis.
- **Knowledge focus.** The systematic handling of knowledge could be described with (at least) four core activities: “create”, “store”, “share” and “apply”. These KM activities form an interlinked process. They should be merged with existing tasks and integrated into the business process (Heisig, 2005). Knowledge is understood as a resource applied in the business process and a (by-)product generated within the business process. This product could be reused by the same or another business process inside or outside the organization. Knowledge itself could appear in different forms. The organisation has to determine which forms contribute most to their strategic and business objectives.
- **Enabler focus.** Successful and sustainable KM is influenced by the following key enablers: “Culture”, “Organization and roles”, “Strategy and leadership”, “Skills and motivation”, “Controlling and measurement” and “Information technology”. Practical experiences showed that a proper KM assessment related to these six design areas should be carried out at the start of any KM initiative. Successful implementation generally requires adequate measures within each of these areas.

Figure 2 GPO-WM[®]-Framework



“The result of the analysis shows that there are five most frequently mentioned broad categories of KM activities: share, create, apply, store and identify knowledge.”

Outlook

In both research and practice the consent prevails that the future challenges of the knowledge-based business are substantially determined by an organisation's ability to handle valuable knowledge resources. Isolated efforts for the improvement of knowledge handling which only address one KM activity like “sharing knowledge” and only one critical success factor like “information technology” are considered insufficient. Moreover, the goal of KM is to implement a holistic approach towards the management of organisational knowledge while considering the specific boundary conditions of the organization.

With regard to planning and implementation, frameworks can provide useful assistance for holistic KM solutions (Weber *et al.*, 2002; Liebowitz and Megbolugbe, 2003; CEN, 2004). They contribute and promote a harmonised basic understanding of relevant aspects and terms, thereby assuring the possibility of interdisciplinary exchange of experience and ideas. Apart from this integrative effect, frameworks offer guidance in order to purposefully and systematically plan KM efforts. The CEN KM Framework as a guiding proposition is a useful first step in order to achieve a more harmonized understanding of KM.

Research and practice in KM remains an exciting field that is driven by the competition and cooperation of different disciplines as well as the combination of theoretical understanding and practical experiences. A core requirement remains to overcome the aforementioned deficits regarding a common understanding of KM and especially the core term “knowledge”.

Note

1. The detailed qualitative analysis results are published in German language in Heisig and Orth (2005), English version (Heisig and Orth, 2007)

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Appendix 1. Source listing of KM frameworks

The following overview categorises the sources of frameworks according to their institutional origin: Science, Enterprise, Management Consultant as well as Association and Standardisation bodies.

1. Science (71):

- Amelingmeyer (2000).
- Andriessen (2003).
- Bach/Vogler/Österle (1999).
- Bhatt (2001).
- Boisot (1998).
- Bose/Sugumaran (2003).
- Bullinger and Prieto (1998).
- Center of Effective Organization (2002).
- CIKM-Project (2002).
- CORMA (2000).
- Cranfield School of Management (2001).
- Davenport/Prusak (1998).
- Despres/Chauvel (1999).
- Dincmen (2003).
- Eck (1997).
- EKMF – European Knowledge Management Forum (2002).
- Eppler *et al.* (2001).
- Forcadell/Guadamillas (2002).
- Franken (2002).
- Gottschalk (1999).
- Grant (2000).
- Grundstein (2000).
- Heck (2002).
- Heisig (2000).
- Herder/Veeneman/Buitenhuis/Schaller (2003).
- Herrmann (1998).

- Hlupic/Pouloudi/Rzevski (2002).
- Holsapple/Singh (2001).
- Jones/Herschel/Moesel (2003).
- Kerkhof/van den Ende/Bogenrieder (2003).
- KM-Centre (2001).
- KM-Networking (2002).
- Krogh/Venzin (1995).
- Krogh/Ichijo/Nonaka (2000).
- Kucza (2001).
- Leonard-Barton (1995).
- Liestmann/Schick/Brumby (2003).
- Lytras/Pouloudi/Poulymenakou (2002).
- Maier (2001).
- Maula (2000).
- McAdam/McCreedy (1999).
- McInerney/Le Fevre (2000).
- Moffet/McAdam/Parkinson (2002).
- Newman/Conrad (1999).
- Nissen/Espino (2000).
- Nonaka/Takeuchi (1995).
- North (1998).
- Ohlhausen (2002).
- Pawlowsky (1998).
- Probst/Raub/Romhardt (1998).
- Reinhardt (2000).
- Reinmann-Rothmeier/Mandl (1999).
- Remus (2002).
- Robotiker (2002).
- Roehl (2002).
- Sarharge (2002).
- Schreiber/Akkermans (2002).
- Schreiber/Höhnel (2002).
- Schüppel *et al.* (1998).
- Seemann *et al.* (2000).
- Stankosky (1999).
- Teece (1998).
- Tormo/Poler (2003).
- Troxler (2001).
- Uit Beijerse (1999).
- Samad/Hannus (2002).
- Warnecke/Gissler/Stammwitz (1998).

- Weggemann (1999).
 - Wiig (1995).
 - Willke (1998).
 - Ziegler (1998).
2. Enterprise (30):
- ABB Schweiz (2003).
 - BASF AG (1998).
 - Bertelsmann Media Systems (2001).
 - BMW AG (1999).
 - BP Amocco (2001).
 - British Telecom (2001).
 - Buckman Laboratories (1998).
 - Compaq (2000).
 - DaimlerChrysler Aerospace (1999).
 - Deutsche Telekom (1999).
 - DVS GmbH (1998).
 - IBM Corp. (2001).
 - Lafarge Group (2003).
 - London Underground (1998).
 - MCC/Smart (1997).
 - Münchner Rückversicherungsgesellschaft (1998).
 - Nokia (1998).
 - Perotsystems (1999).
 - Porsche AG (2002).
 - PWC Deutsche Revision (2001).
 - Royal Mail (1998).
 - SAP AG (1999).
 - Siemens AG (Hofer-Alfeis 1999).
 - Siemens AG (Ehms/Langen 2002).
 - Siemens Nixdorf (1997).
 - Sequent Computer Systems (1997).
 - Swiss Life (1998).
 - Systor AG (2002).
 - T-Systems (2001).
 - Voestalpine AG (2003).
3. Management Consultant (48)
- Accenture (2002).
 - Allee (2003).
 - APQC/Arthur Andersen (1996).
 - Arthur Andersen (2001).
 - Arthur D. Little (2002).

- Bain & Company (2001).
- Binner (2002).
- Booz, Allen & Hamilton (2001).
- Bukowitz/Williams (1999).
- Cap Gemini Ernst & Young (2002).
- Community Intelligence Labs (2002).
- Della Schiava/Rees (1999).
- DGM – Deutsche Gesellschaft für Mittelstandsberatung mbH (2003).
- Diebold Deutschland GmbH (2001).
- ExperTeam GmbH (1998).
- Gundry (200).
- IDS Scheer (Allweyer 1998).
- InfoPlex (2003).
- Kenniscentrum CIBIT (1998).
- Kienbaum Management Consultants (1998).
- Know House (van der Westhuizen 2003).
- Knowledge Management Group (2003).
- KnowNet (2002).
- Knowledge Park (2001).
- KPMG (2002).
- Kurtzke/Popp (1999).
- Lotus Consulting (1998).
- META Group (2001).
- MIT-Beratung (1999).
- Moss (2001).
- Plaut Management Consulting (2000).
- PriceWaterhouseCoopers (1998).
- Rao (2002).
- Rivero (2002).
- Roland Berger & Partner (2000).
- Siemens Business Services (2002).
- Skyrme (1999).
- Softlab (1999).
- SRI Consulting (Syed 1998).
- Sullivan (1998).
- Suresh (2002).
- Sveiby (2001).
- Sydänmaanlakka (2002).
- Syseca GmbH (2001).
- TEG (Miller 1998).
- Tissen/Andriessen/Deprez (1998).

- USU Softwarehouse AG (1999).
 - WMP Team (2002).
4. Associations and Standardisation Bodies (11)
- BSI – British Standards Institute (2001).
 - CEN – Comité Européen de Normalisation (2003).
 - DGFP – Deutsche Gesellschaft für Personalführung (2002).
 - EIRMA – European Industrial Research Management Association (1998).
 - EFQM – European Foundation for Quality Management (1998).
 - KMCI – Knowledge Management Consortium International (Firestone/McElroy 2002).
 - GKEC – Global Knowledge Economics Council (Vaupel 2002).
 - SAI – Standards Australia International (2001).
 - TBS – Technologieberatungsstelle beim DGB NRW e.V. (2001).
 - VBM - Verband der Bayerischen Metall- und Elektro-Industrie e.V. (2000).
 - Wissensmanagement Forum (2000).

Appendix 2. Knowledge management activities in KM frameworks

The following list contains all the knowledge management activities, which are referred in 117 out of 160 frameworks and forms the basis for content wise evaluation. For this different KM-activities are gathered and arranged according to the frequency of their use. For, e.g. in 41 frameworks term “use” has been used.

1. Use, using, knowledge usage, use of enterprises intangible assets, use and multiplication, utilization (41).
2. Identification, identify, knowledge identification, identification of needs for knowledge, knowledge identification and transparency (37).
3. Create knowledge, knowledge creation, creation, create new knowledge, create and produce knowledge (36).
4. Acquire, acquisition, knowledge acquisition acquiring and accessing external knowledge (33).
5. Share knowledge, knowledge sharing (31).
6. Store, storing, knowledge collection and storage, store and retrieve (24).
7. Knowledge transfer, transfer, transfer of knowledge between individuals, groups and organizations (23).
8. Knowledge distribution, distribute (23).
9. Knowledge generation, generate, generate new knowledge (22).
10. Application, applying knowledge, apply (22).
11. Knowledge development, development, develop (17).
12. Knowledge goal setting, knowledge goals (13).
13. Organize, knowledge organization, organize and classify, organize and focus knowledge (12).
14. Knowledge retention, retain (10).
15. Evaluation, evaluating knowledge, knowledge evaluation (10).
16. Assess, assessment, knowledge assessment (9).
17. Capture (9).
18. Knowledge integration, integrate: connecting knowledge (8).

19. Codification, codify (7).
20. Knowledge communication, communication, communication (i.e. distribute), communication/disseminating (6).
21. Combine, combine and connect, refining/ combining, connect (5).
22. Edit (5).
23. Innovate; innovate: creating new knowledge, Innovation and re-use of knowledge (5).
24. Learn, learning, learn: building knowledge (5).
25. Plan (5).
26. Collaborating, collaborate, collaborate: sharing knowledge (4).
27. Collect (4).
28. Knowledge diffusion (4).
29. Knowledge dissemination (4).
30. Knowledge leveraging, leveraging, lever: using knowledge to create value (4).
31. Reflect, reflections (4).
32. Act (3).
33. Knowledge processing (3).
34. Measurement, knowledge measurement (3).
35. Re-use (3).
36. Knowledge externalization (2).
37. Explain (2).
38. Knowledge presentation, knowledge representation (2).
39. Documentation, document (2).
40. Knowledge archiving, archive (2).
41. Package (2).
42. Formalize (2).
43. Structure, structuring (2).
44. Secure, knowledge securing (2).
45. Build and sustain (2).
46. Knowledge refinement, refine (2).
47. Further development (2).
48. Modification of knowledge (2).
49. Enhance (2).
50. Manage (1).
51. Handling (1).
52. Elicit, codify and organize knowledge (1).
53. Dispose (1).
54. Discover (1).
55. Perceive (1).
56. Get (1).

57. Synthesizing (1).
58. Locate (1).
59. Allocation (1).
60. Representation (1).
61. Consolidate (1).
62. Conceptualise (1).
63. Classification (1).
64. Mapping (1).
65. Generalize (1).
66. Knowledge codification and coordination (1).
67. Knowledge codification and storage (1).
68. Preserve (1).
69. Knowledge preservation (1).
70. Maintain (1).
71. Protect (1).
72. Maintain, control quality (1).
73. Knowledge quality control (1).
74. Knowledge controlling (1).
75. Leverage, distribute and automate knowledge (1).
76. Migrate (1).
77. Knowledge embodiment (1).
78. Publish (1).
79. Support (1).
80. Informing (1).
81. Information (1).
82. Mentoring (1).
83. Network and cooperate (1).
84. Synthesize knowledge-related activities (1).
85. Appraise and evaluate value of knowledge an knowledge-related actions (1).
86. Control (1).
87. Revision (1).
88. Review knowledge (1).
89. Transform (1).
90. Adapt (1).
91. Divest (1).
92. Purge (1).
93. Knowledge removal (1).
94. Knowledge update (1).
95. Actualize (1).

96. Improving (1).
97. Evolve (1).
98. Knowledge production (1).
99. Knowledge construction (1).
100. Implementing and integrating (1).
101. Knowledge connect and exploit (1).
102. Deploy knowledge (1).
103. Enter (1).
104. Access (2).
105. Convert (1).
106. Knowledge conversion (1).
107. Capitalisation (1).
108. Activate (1).
109. Enable use (1).
110. Enable (1).
111. Absorption (1).
112. Exploitation (1).
113. Foster use (1).
114. Perform (1).
115. Relate/value (1).
116. Deriving value from knowledge (1).
117. Realize knowledge value (1).
118. Handle, use and control knowledge (1).
119. Speculation (1).
120. Test (1).
121. Knowledge utilization and feedback (1).
122. Feedback (1).
123. Sense and response (1).
124. Intention (1).
125. Search (1).
126. Find (1).
127. Knowledge selection (1).
128. Screening (1).
129. Collect and analyse data (1).
130. Analyze (1).
131. Analyse knowledge (1).
132. Investigate knowledge (1).
133. Knowledge trading and analyse (1).
134. Survey and categorize knowledge (1).

135. Determining necessary knowledge (1).
136. Making inventory of available knowledge (1).
137. Determine knowledge needs (1).
138. Determining knowledge gap (1).
139. Problem solving (1).
140. Provide (1).
141. Knowledge provision (external and internal) (1).
142. Importing knowledge (2).
143. Sourcing (1).
144. Gathering (1).
145. Accumulating (1).
146. Contribute (1).
147. Participation (1)
148. Knowledge internalisation (1).
149. Institutionalisation of individual and collective knowledge (1).
150. Socialisation (1).
151. Tradition (1).
152. Innovation management (1).
153. Experimenting (to build capabilities for the future) (1).
154. Competencies building (1).
155. Qualification and training (1).
156. Learning by doing (1).
157. Instinctual learning (data) (1).
158. Single-loop learning (procedural) (1).
159. Double loop learning (functional) (1).
160. Communal learning (managing) (1).
161. Deutero learning (integrating) (1).
162. Generative learning (renewing) (1).
163. Questions (1).
164. Ideas (1).
165. Prepare (1).

Appendix 3. Critical success factors in KM frameworks

The following list contains all the critical success factors of the knowledge management, which are referred in 119 out of 160 frameworks and forms the basis for content wise evaluation. For this different KM-related factors are gathered and arranged according to the frequency of their use. For, e.g. in 58 frameworks cultural factors are considered success critical for knowledge management.

1. Culture, corporate culture, knowledge culture, knowledge oriented culture, knowledge sharing culture, culture and power, culture of learning, cultural and social factors (58).
2. Processes, organizational processes, process organization (40).

3. Technology, technologies (39).
4. Organization (35).
5. Strategy (33).
6. People (23).
7. Information technology, information and communication technologies (23).
8. Structures, organizational structures, organizational infrastructure, organizational design (22).
9. Leadership, knowledge leadership, leadership and support (18).
10. Infrastructure, infrastructure view, technical infrastructure, supporting technological infrastructure (14).
11. Measurement (12).
12. Skills, employees skills, employees knowledge and experience, personal characteristics, personal knowledge, personal knowledge capabilities (11).
13. Employees, (organisational) personnel (10).
14. Tools and applications (11).
15. Content (9).
16. Human (8).
17. Vision, direction (8).
18. Goals, organizational goals, KM-goals and related business goals (7).
19. Top management support, senior management support, top management leadership (5).
20. Human resource management (5).
21. Incentives, incentive system (5).
22. Methods, methodology (5).
23. Systems (5).
24. Technological systems (5).
25. Value system, values and norms, values (4).
26. Roles, knowledge management roles, new roles (4).
27. Communities, communities of practice (4).
28. Context (4).
29. Knowledge base (4).
30. Knowledge-based strategy (3).
31. Management, knowledge-oriented management (3).
32. Management system, managerial systems (3).
33. Knowledge form and structure, some level of knowledge structure (3).
34. Knowledge controlling (3).
35. Knowledge management technologies (3).
36. Human resources (3).
37. Knowledge content (2).
38. Knowledge coordination (2).

39. Concepts (e.g. shared language) (2).
40. Behaviour (2).
41. Strategic behaviour (2).
42. Clarity of vision and language (2).
43. Concrete and measurable goals (qualitative and quantitative) (2).
44. Organizational learning, learning (2).
45. Motivation (2).
46. Implementation (2).
47. Business processes (2).
48. External relations, external relationships (2).
49. External structure (1).
50. Company environment partnerships (1).
51. Environment (1).
52. Macro-environment (1).
53. Market (1).
54. Commerce (1).
55. Business value (1).
56. Link to economic or industry value (1).
57. Price/performance characteristics of the product (1).
58. Inherent replicability of the product (1).
59. Intellectual property protection afforded the product (1).
60. Fundament (1).
61. Resources (1).
62. Capital (1).
63. Potentials (1).
64. Capacity (1).
65. Qualification (1).
66. Motivation and qualification (1).
67. Individual competence (e.g. competence of the professional, technical, managerial staff, experts, R&D, sales and marketing) (1).
68. Individual capabilities (1).
69. Collective capabilities (1).
70. Core capability (1).
71. Competencies/training (1).
72. Decision-making tools (1).
73. Basic (operational) competences of the firm (1).
74. Complementary assets and technologies (1).
75. Communication (1).
76. Conversations (1).

77. Connectivity (1).
78. Cooperation (1).
79. Cooperation and coordination (1).
80. Information (1).
81. Knowledge (1).
82. Knowledge assets (1).
83. Knowledge sources (1).
84. Organisational knowledge capabilities (1).
85. Process-oriented knowledge (1).
86. Knowledge-quality assurance (1).
87. Knowledge protection (1).
88. Knowledge entrepreneurship (1).
89. Business- & psychological drivers (1).
90. Adaptability (1).
91. Innovation capabilities (1).
92. Innovation (1).
93. Innovation process (1).
94. Change circle (1).
95. Learning context (1).
96. Change management (1).
97. Corporate change programs (1).
98. Development and change (1).
99. Policy (1).
100. Mission (2).
101. Long term vision and medium and short strategies (1).
102. Business research and analysis (1).
103. Analysis (goals and processes) (1).
104. Metrics (1).
105. Measurement criteria (1).
106. KM-performance measurement (1).
107. Performance indicators (1).
108. Knowledge controlling and learning (1).
109. Nontrivial motivational aids (1).
110. Comprehension of the employees (1).
111. Human and social knowledge management-issues (1).
112. Internal structure (e.g. patents, concepts, models, internal networks, culture, HR, IT etc.) (1).
113. Content structures (1).
114. Content and context (1).

- 115. General context (1).
- 116. Governance, process and organization (1).
- 117. Integration of knowledge-processes into business-processes (1).
- 118. Modicum of process orientation (1).
- 119. Models (1).
- 120. Instruments (1).
- 121. Operations (1).
- 122. Panning (1).
- 123. Task (1).
- 124. Work (1).
- 125. Services (1).
- 126. Identity (1).
- 127. Type (1).
- 128. Level (1).
- 129. Style (1).
- 130. Branding (1).
- 131. Action (1).
- 132. Practices (1).
- 133. Time (1).
- 134. Timing (1).
- 135. Space (1).
- 136. Bottom line (1).
- 137. Basic conditions (1).
- 138. Fostering conditions (1).
- 139. Barriers (1).
- 140. Rules (1).
- 141. Standards (1).
- 142. Repositories (1).
- 143. Influencing knowledge management factors (1).
- 144. Knowledge management dimensions (1).
- 145. Knowledge management level (1).
- 146. Knowledge management services (1).
- 147. Knowledge property rights (1).
- 148. Knowledge users (1).
- 149. Knowledge providers (1).
- 150. Documentation and data level (1).
- 151. Organisational knowledge level (1).
- 152. Application- and knowledge level (1).

153. Knowledge and systems (1).
154. Sustaining systems (1).
155. Integrating systems (1).
156. Integrative approach (1).
157. Definition of the necessary processes (1).
158. Create the right context (1).
159. Managing knowledge as a corporate asset (1).
160. Knowledge management-business cases and implementation (1).
161. Globalize local knowledge (1).
162. Multiple channels for knowledge transfer (1).
163. Active knowledge transfer (1).
164. Human oriented KM tools (1).
165. Manage conversations (1).
166. Mobilize activists (1).
167. Meaning (1).
168. Orientation (1).
169. Language register (1).
170. Co-production (1).

About the author

Peter Heisig is Senior Research Associate at the Engineering Design Centre, Department of Engineering, University of Cambridge (UK) and researches knowledge management throughout the product life cycle. He holds a Diplom in Social Sciences from the University Göttingen (Germany) and earned his PhD in Engineering from the Technical University Berlin (Germany) about "Integration of knowledge management into business processes" (GPO-WM). His GPO-WM method has been adopted by small and large companies to improve their knowledge handling in daily business processes. He is working in the field of knowledge management since 1988 and has founded the Competence Center Knowledge Management at the Fraunhofer IPK (Berlin) which he directed until 2004. In 2005 he started his consulting network eureka. In 2002 he was appointed by the CEN and the DG Information Society to serve as KM Subject Matter Expert with other seven european colleagues to work on the *European Guide to Good Practice in Knowledge Management* (CWA, 14924), which was published in English and German in 2004. He is a member of the VDI expert group for the VDI Guideline 5610 *Knowledge Management in Engineering* (Berlin, 2008). He conducted several Benchmarking studies about KM, was responsible for several KM projects for clients from manufacturing and service industry as well as public administration and research organizations. He is a funding member of the German "Arbeitskreis Wissensbilanz" (Working Group Intellectual Capital Statement), who implemented IC-Statements in over 60 small and medium-sized companies in Germany. From 2000 to 2004 he served as Chairman to the Global Benchmarking Network (GBN). Peter Heisig can be contacted at: ph350@cam.ac.uk

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