Universität Rostock

Traditio et Innovatio

A Benefit-Oriented Framework for the Decision-Making Process on the Application of KMS in SME

Dissertation
zur
Erlangung des akademischen Grades
Doktor-Ingenieur (Dr.-Ing.)
der Fakultät für Informatik und Elektrotechnik
der Universität Rostock

vorgelegt von

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urn:nbn:de:gbv:28-diss2018-0036-7

Rostock, 31.05.2016

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Date of Submission: 31.05.2016
Date of Defense: 19.10.2016

Ackknowledgements

For the writing of this thesis, as well as for the underlying research a lot of personal effort was necessary, but none of it would have been possible without the help and commitment of a number of individuals and organizations.

This PhD project was realized at the chair of Business Information Systems at the University of Rostock. The chair is lead by Kurt Sandkuhl, to whom, as my main supervisor, belongs special thanks. I have been fortunate to have an advisor who gave me the freedom to explore on my own, and at the same putting me back on track when needed. Furthermore, I appreciate the numerous discussions and feedback on what is necessary for a valuable solution. I also thank Professor Clemens Cap for the collaboration on Tweedback and the willingness to be reviewer for this thesis. This also applies for Professor Marite Kirikova for reviewing this work.

Since the result of this work depended on practical evaluation, I thank the numerous students, who worked with me and the individual organizations participating. It certainly may not have been easy with me as the supervisor of your work, but I hope you also learned from what we did. At the chair of Business Information Systems I was supported by my colleagues, where special thanks goes to my 'office-mate' Matthias Wissotzki for sharing every-day concerns and the incentive to proceed with this work. Furthermore, Christina Köpp helped me to revise this work by finding the countless small mistakes in the texts and figures. Thank you especially for staying in touch during my second maternity leave.

A PhD thesis needs manifold engagement and support from the private environment, which was provided by time, discussions and the time to listen to my concerns during the process. The later especially belongs to my husband, who patiently endured the process and provided the patience I do not own. To my friends, you know who you are.

I would also like to thank my parents for supporting me in my education up till this very last step, and for always being there when needed. Finally, I want to thank my grandmother, who by her permanent interest kept me wanting to finish this work.

Abstract

Knowledge is regarded as the fourth production factor by now, however, knowledge management (KM) is mainly systematically addressed by larger organizations only. For the usage in small and medium sized enterprises (SMEs), thus special demands must be met by KM, as well as knowledge management systems (KMS). Especially, the long-termed nature of KM and the lack of measures to determine the value remains a problem for SMEs.

Though approaches to integrate KM in SMEs have been created, they hardly address the value or benefits gained by the implementation of a KMS. Nevertheless, this is of interest for SMEs to justify the use of their sparse resources available. In addition, KM is often strongly associated with technological support, which can be manifold and has to be carefully integrated to provide the desired success. Providing a means for decision making on and implementation of systemic support for KM in SMEs while considering the benefits, hence is the topic of the present PhD thesis.

The result of the presented PhD project consequently is an artifact providing the SME practitioner with the KinS conceptual framework with embedded method support. For the framework known concepts from KM and KMS are newly combined and validated applying the perceived benefit approach of the KMS Success Model. The perceived benefits support the desired benefit-orientation for a KMS implementation. The KinS framework hence uses the demand for support as the starting point for the perceived benefit and analyzes it with regard to the support opportunities by knowledge services. The knowledge services serve as the classification for technical support, as the decision recommendation is provided on an abstract level, supporting individual preferences of the SME with regard to vendors or budgets available.

With the help of the developed framework consequently, the identified gap in the knowledge base could be addressed and benefit-orientation in the decision on the support with KMS can be provided. The process for the creation of the framework is done according to the guidelines of Design Science Research and is documented with this thesis.

Zusammenfassung

Wissen wird heute als der vierte Produktionsfaktor bezeichnet, dennoch wird Wissensmanagement (WM) hauptsächlich durch große Organisationen systematisch umgesetzt. Für kleine und mittlere Unternehmungen (KMUs) mit ihren geringeren Ressourcen, braucht das WM, genau wie Wissensmanagementsysteme (WMS), spezielle Anpassungen. Besonders die langfristige Orientierung des WM und das Fehlen von Möglichkeiten zur Nutzenbestimmung des Einsatzes, bereitet KMUs Probleme.

Obwohl Ansätze zur Integration von WM in KMUs existieren, thematisieren sie kaum den Nutzen, der durch die Implementation eines WMS gestiftet wird. Genau dies ist aber im Interesse der KMU um die Nutzung ihrer Ressourcen rechtfertigen zu können. Des Weiteren ist WM häufig stark mit dem Einsatz technischer Unterstützung assoziiert, die vielfältig ausfallen kann und für den gewünschten Erfolg sorgfältig integriert werden muss. Die Be-reitstellung einer Möglichkeit zur nutzenorientierten Entscheidungsfindung für die technische Unterstützung von WM in KMUs ist entsprechend das Ziel der vorliegenden Dissertation.

Das Ergebnis der vorliegenden Dissertation ist entsprechend ein Artifakt, dass dem Anwender im KMU das konzeptionelle KinS Rahmenwerk mit eingebetteter Methodeunterstützung zur Verfügung stellt. Für das Rahmenwerk werden bestehende Konzepte unter dem Fokus des wahrgenommenen Nutzen neu zusammengefügt und validiert, u.a. das KMS Success Model. Der wahrgenommene Nutzen soll dabei die Nutzenorientierung der Entscheidungsfindung ermöglichen. Das KinS Rahmenwerk mit dem Wissensbedarf als zentrale Komponente für die WMS Unterstützung analysiert diesen in Hinsicht auf die Unterstützung mit Hilfe der Wissensservices. Diese Ergebnisse dienen zur Klassifizierung der technischen Unterstützung, da die Entscheidungsunterstützung auf einem abstrakten Level stattfindet um Raum für individuelle Präferenzen seitens des KMU zu zulassen.

Das erstellte Rahmenwerk bedient somit den Bedarf an Nutzenorientierung von KMUs bei der Entscheidung für eine WMS Unterstützung. Der Prozess zur Erstellung des Rahmenwerkes mit seinem Methodenhandbuch folgt den Grundsätzen des Design Science Research (DSR) und ist mit der vorliegenden Arbeit dokumentiert.

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List of Abbreviations

CBT computer based training

CEO chief executive officer

CRS classroom response system

CSCW computer supported collaborated work

DSR Design Science Research

EA enterprise architecture

e.g. for example

ICT information and communication technology

IT information technology

IS information system

KM knowledge management

KMS knowledge management system

SECI socialization externalization combination internalization

OMIS organizational memory information system

SME small and medium enterprise

SNS Social Network Services

TOI technology organization individual

Chapter 1

The Concerns

1.1. Background and Motivation

Knowledge over the last decades has evolved from a mere business driver to a fully accepted fourth production factor [vdOH03, KMP01, Jas08] in addition to the generally known factors labor, capital and land. In 2001 the overall net value added by the resource of knowledge was at 60% [AP01], which also led to the description of working within a knowledge society. Consequently, effective and efficient management of this resource knowledge is important to support the continuing increase in value [YWA04]. Management thus affects information, knowledge and the intellectual potential of employees, which have become the most relevant factors in competition in the 21st century [Leh10, HR07, Mig09a].

Nevertheless, demographic progression also threatens this resource [CP03, Har12, BM10], as the baby boomers retiring poses a threat to the organizational knowledge base [Cal08, Ste10]. The upcoming massive retirement will cause a lack of professionals and at the same time the need for knowledge transfer for backup. At this point technology can be used to keep and transfer the knowledge. Hence the application of knowledge management systems in organizations has become a relevant research interest [Leh10]. In 2000 Lehner published one of the first compendiums on "Organisational Memory" presenting knowledge management as an integrative multidisciplinary approach to address the organizational knowledge base including technology support [Leh00]. As early as 1998 Bullinger et al. set up their technology organization individual (TOI) model [BWP98] showing that knowledge management (KM) includes the three dimensions of technology, organization and individual. From there on knowledge management as an holistic approach was applied in all kinds of organizations, combining organizational management with technology support. This holds for all types of organizations since the method of handling knowledge determines the organizations' position in competition [YWA05].

Knowledge management systems are information and communication platforms for knowledge transfer, which support knowledge management in all aspects [MH11]. How-

ever, in 2003 Wegner [Weg03] showed that SMEs (small and medium enterprises) lacked monetary and time resources for knowledge management and corresponding systems and, as a consequence, estimated the cost involved in the usage of such system support to be higher than the benefits and values that could be gained. Knop [Kno09] adds that SMEs, having a low amount of employees and restricted resources in all fields, are consequently restricted in growth. Currently the resources for knowledge management activities are sparse. This prevents SMEs from experiencing the benefits of knowledge management [FLM+07] the improvement of information handling, reduction of search time or the transfer and the preservation of practical knowledge. Moreover, McAdam and Reid [MR01] discovered that in many SMEs the colloquial use of the terms knowledge and information is common, thus using the terms synonymously.

Indeed, even if an organization does not actively commit to knowledge management, many processes regarding organization management can be considered knowledge-intensive and occur in every organization [AH03, vL09]. The resulting support processes such as human resource management often lead to the involvement with knowledge management. For a long time SMEs have tried to solve these problems in a traditional way [AH03] by using informal processes to gain the necessary knowledge [YWA05, DRE12]. Yet, with the demographic changes and growing flexibility [PRR06, BM10] some SMEs are in need to find solutions for their knowledge management. Knowledge management approaches, together with Knowledge Management Systems offer support for the respective tasks [FLM+07, Mey05, MS09]. Since the research discipline of knowledge management has been strongly influenced by information and IT management [Nor16], nowadays manifold IT solutions and complex management systems exist. Consequently, a large variety of software products is available [CES15] on the market, many of them offering similar functionalities and claiming easy implementation. However, the implementation of such systemic support does not automatically include a successful application for knowledge management in SMEs [SL08]. In addition, often formal knowledge management approaches apply technology which is expensive and designed for larger organizations, hence the overall approach is estimated as too expensive by SMEs [HQ08, CES15].

Consequently, the decision on where to spend the sparse resources to actually create benefits worth the costs is essential for SMEs. In the field of knowledge management this connects to the issue that measuring knowledge and knowledge management activities remains difficult [vL09, AL01, GT07, GJRR15, MHBD16], hence it is difficult to visualize what can be gained from engagement in knowledge management and respective systems. This includes the fact that science up to now has not offered generally approved and valid instruments [GT07] and methods for the measurement of knowledge or knowledge management. Furthermore, a general base for comparison of the respective results of an implementation is not available [Dal13]. Moreover, it is measured what *can* be measured instead of what *should* be measured, resulting in organizations knowing their educational expenditures but rarely taking into consideration the education quality [NK14]. Being

unable to measure the intangible asset at hand the success of its management cannot be evaluated and the effects of it can hardly be visualized. This indicates that up to now research can hardly provide SME's with methods for resolving these problems to allow for a value integration in the decision making in the field of knowledge management system support. This thesis further addresses the stakeholders, seeking direct contact to SMEs to provide feasible results for the application of KMS in SMEs [ED13, MHBD16].

The focus of this thesis is on the value and benefits to be integrated in the Knowledge Management System decision support in order to support SMEs in the resulting process. However, since SMEs are more than 99% of all organizations [mit02], not all of them can be considered relevant as a target group. As Desouza and Wang argue, systemic support [DA06] is not relevant for most SMEs. The reason lies in the fact that knowledge management is often accomplished informally and furthermore the organizations are not willing to use technology if they do not use systemic support for their core business processes. The focus of this work hence lies on the knowledge-intensive SMEs, which are more involved with such systemic support since their core competencies rely on knowledge [Gro09a]. This perimeter does not indicate that the solution gained would not work for other organizations, it merely reflects that the focus of knowledge-intensive SMEs is drawn towards knowledge management. In addition, the NIW lists [NIW12] name the branches to be considered knowledge-intensive, describing these to be more involved with technology and therefore more likely to consider systemic support. To support the systematic knowledge management and knowledge management system support this thesis presents the construction process of a framework addressing the benefit and value-oriented decision making process for Knowledge Management System support in SMEs. The value and the benefits are the focus of the work to ensure a successful implementation, thus justifying the use of the resources for knowledge management and knowledge management systems. Nevertheless, this work is not dedicated to technical support only but focuses the holistic approach to KM as needed for SMEs [WY16, MHBD16].

1.2. Research Design and Research Questions

After introducing the problems and motivations in the field of knowledge management (KM) and the according Knowledge Management Systems (KMS), this section presents the research design of this thesis, its research approach as well as goals. The PhD project is settled in the field of IS research, addressing the purposeful use of information systems for the accomplishment of organizational goals. Hence, the project uses the research methods available and approved in the field [WH07]. The research work presented in this thesis specifically follows the idea of the Design Science Research (DSR) approach as described in section 2.1, aiming for a problem-oriented solution relevant for the field of information system (IS) research [HC10, EL08]. This work consequently presents its results focusing on qualitative research instead of on quantitative. The reason for this decision can be found

in the research object since SME and their development, which cannot be researched in a quantitative manner, due to the high amount of influences and developments to be taken into consideration for every single research object.

This thesis is based on a research interest in KMS and their application for SME. Yet, to address this field of interest with a result of practical relevance, this interest had to be specified. Consequently, the preliminary research question was used to describe the field of research: How can the successful implementation of KMS for SME be achieved, considering the special requirements of SME?

The question implies that IS and with them KMS should not be regarded based on their technical characteristics, but as a means for the accomplishment of organizational goals. This assumption has been proved in literature suggesting KMS as an addition to organizational management [Nor16, HR07, BWP98, MS09, RD08] is central to this thesis presenting the results of the work of KMS impacts in SME. Based on this question the research process as shown in figure 1.1 was accomplished and is presented within this thesis.

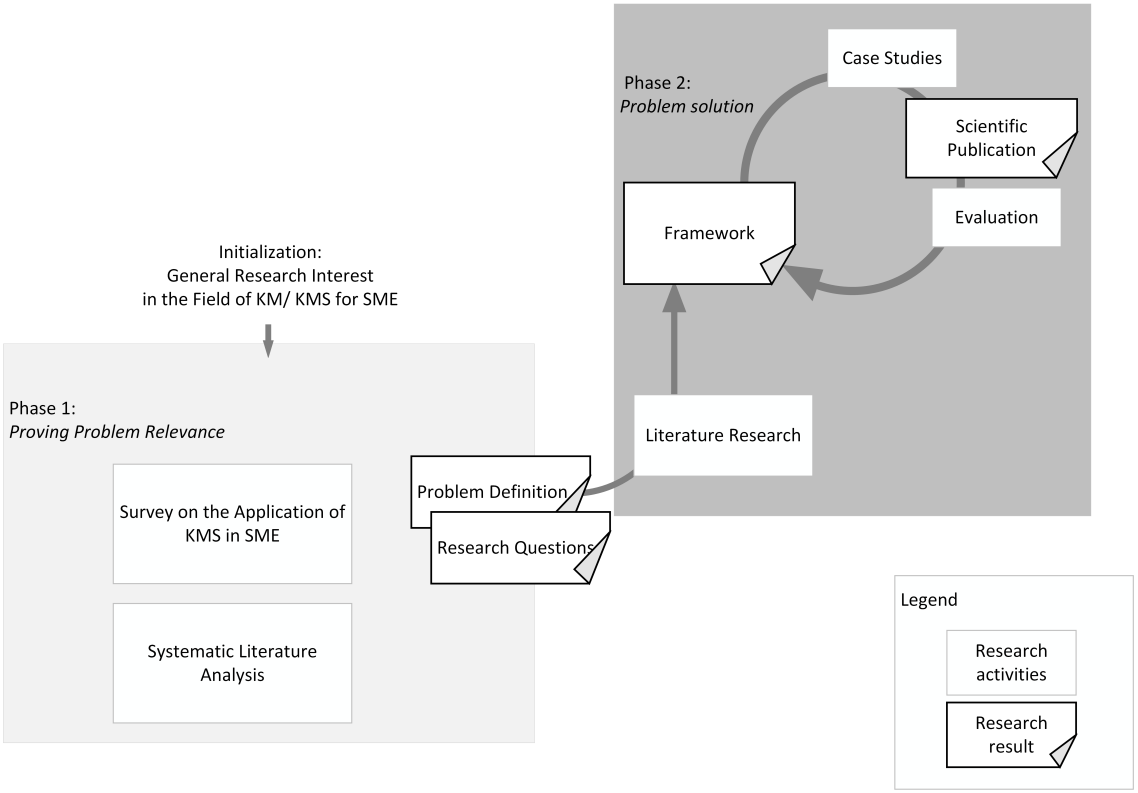


Figure 1.1.: General research structure

The preliminary question describing research interest was specified by the identification of relevant problems for the perception and application of KMS in SME practice. This step was addressed, conducting a survey among relevant SME [Gra10, Wil11] on the one hand

and by comparing it against the available literature within the field on the other hand. The results of the surveys consequently indicated uncertainties in handling the terms of KM and the strong orientation towards business activities among SME. The results revealed the demand for a stronger orientation towards value and benefits for the KM(S) support as well as the allowance for consequent systematic integration in the respective organizations. Further details on the surveys and initial data are presented in section 4.1 and 4.3. Concluding from these surveys, support for a straightforward, well-structured and benefit-oriented approach to access KMS for efficient use of KMS solutions in SME is needed. This demand forms the initial problem definition to be addressed by this thesis. For the surveys, the type of organizations have already been constrained to knowledge-intensive SMEs to be able to focus on the possibility of KMS application. As these SMEs are more likely to use technology support in their business processes than traditional crafts enterprises. This is especially relevant and the central research question was thus refined to:

RQ: How can knowledge-intensive SMEs be appropriately supported in their decision and implementation of KMS/ KM application support?

This central question demands further definition and involves several steps along the problem's solution to gain sufficiently precise answers to the central research question. The refining research questions cover different aspects of the field of interest and are to be included in the answers provided by the research work presented.

- RQ1: What are the specific demands of SMEs towards KMS?
  This question should deliver the aspects of importance as perceived by the SME, which were to be addressed within this thesis. It delivers the connection to the practical application as demanded by design science, showing the actual relevance of this research work for the IS community. This question addresses the appropriateness of a solution, assuming it is based on the demands of a SME.

- RQ2: How can the value and the benefits of a possible KMS in an SME be determined?
  While researching it became evident that the question for the value and benefits to be expected from a certain information technology (IT) based solution should be answered to find a KMS being worth the integration effort, since it is beneficial for the enterprise. However, due to the immaterial character of knowledge being difficult to be ascertainable in monetary terms. Other approaches had to be found. This question addresses the "appropriate" support decision.

- RQ3: Which parts are needed for a framework to address the issue of the holistic approach of KM/KMS for SMEs?
  To design an artifact useful in practical application in SMEs it had to contain all

relevant concepts with regard to KM, KMS and the decision making process. In addition, cover the holistic approach instead of focusing on minor parts of the process only. Within the framework all concepts of importance the support decision making for KMS in SMEs are to be collected and interconnected. Consequently, the influencing concepts from the field of KM and KMS are to be determined and assembled. To support the decision making, the environment of SME should be familiar with the concepts of relevance and their dependencies, for otherwise the general understanding for the decision making process is not provided.

- RQ4: How can a framework be operationalized to support practical application? Although a framework can provide an understanding on the affecting concepts, a concrete application needs more support in the form of artifacts or a method to be followed in order to transfer the ideas of the framework into action. Accordingly, this question addresses the transfer of the framework into practical application showing the concrete work with the concepts introduced in the framework, producing an artifact valuable for the Information System community and practitioners.

To answer these questions and provide a consequent outcome of this thesis, the research design follows the DSR approach. Starting point was the inspection of the existing knowledge base in the form of literature. This analysis revealed that implementation structures and methods as such were covered in several works [MS09, AHI+04, LF06], which were found to be little known by the target audience of SME. In addition, the methods or approaches for implementation do not provide support for the decision on the KMS support, they do not provide the respective criteria for the KMS choice. Consequently a recommendation on this part foregoing the actual implementation should be included in the outcome of this thesis. The approach made focused on SMEs due to their share of all enterprises and their organizational specifics to be addressed. With such decision making process on a KMS solution, especially the benefits integration is to be achieved the support, which is still missing.
To provide this support, the artifact to be developed was created as a framework, which was constructed based on the combination of well known concepts in the field of KM found in the literature. The design of the framework was based on the analysis of the existing work available in the field, however extending the used concepts towards the use in the environment of knowledge-intensive SME. Consequently, the achievement of this PhD project lies beyond the mere combination of known concepts, but shows their combination and extension for the solution of the identified practical problem. It therewith provides the transfer of the concepts to practical application, showing their application in a specifics environments, which has not been done before. In general the framework was composed as follows. Starting point for the design of the artifact is the idealistic view of a centralized KMS architecture as provided by Maier [Mai07]. The realization of a complete implementation of such architecture is also shown within Maier's publication

[Mai07, p.337], however, it has to be kept in mind that a central architecture comes at a rather high cost with regard to maintenance costs and time [Leh10]. Moreover, Maier considers his architecture generic and thus merely an orientation for actual implementations. Consequently, a complete realization would stress the sparse resources of the SME [Mai07], yet the central knowledge services addressing the core functionalities of knowledge management can be used for categorization and single implementation. Using the services independently for implementation also resembles Ackerman's idea of "memory in the small" [AM99]. The concept of knowledge services has also been used by other researchers [HR07, Rie12, BFL13], and Maier himself stated that [MH11] the knowledge services as such are not complete and can be enhanced. When using these services for categorization however, an approach has to be found to connect them to the intended benefit-orientation in this work. This categorization had to be combined with the desired benefit-orientation, which is provided for KMS by the application of the KMS Success model [JSC09]. Yet, to ensure the alignment of the chosen support to the benefits to be expected, the demand has to be included as well. During this part of the research process the general structure of the framework was settled into a first draft of the framework using the different concepts involved influencing the use of KMS in an organization. This first draft then was validated and evaluated to consequently be refined. Partial ideas of concepts found have been refined, adapted and evaluated by the use on practical problems through the conduction of case studies [Yin09]. By using case studies, it was possible to refer the theoretical work in framework construction to the layer of practical relevance and consequently validate the conceptual framework. The results gained during these case studies where also published for evaluation and verification by the research community. With the combination of accepted concepts and their extension using a known research approach, a solution on a known problem can be provided for practical application represented by the framework which resulted from this work. The detailed research process is further described in chapter 2.1

It is the goal of this work to enable SME in their decision upon KMS support to allow them a benefit-oriented systematic choice. To achieve this an artifact is provided which supplies knowledge-intensive SMEs with the general background knowledge and guidelines on the topic. Nevertheless, due to the nature of IT and KM requiring manifold background information and the general focus of SME on their field of business, this is not a stand-alone solution but rather a guided process described with the help of the developed process.

1.3. Contributions and Related Own Publications

This section provides an overview on the outcome of the research process and as such summarizes the contributions the PhD thesis created. The initial intention of the artifact to be created was to address the existing problem of "How to decide for a suiting KMS

support as an SME". Consequently, the artifact had to contain all parts of interest and relevance for the decision making process to combine them into a practical solution. This solution, which was designed as a framework including a method for application, is the main contribution of this research work. It newly combines most well-known concepts to build the underlying theoretical foundation for the method operationalizing the decision making process. Especially the method manual therewith represents the practical contribution of this research work.

For the creation of the framework it was furthermore necessary to delve into some of the concepts and extend the available knowledge. Within this thesis this is especially of importance for the concepts of knowledge demand and knowledge services. In addition the framework had to address the question on value and benefit of KMS and had to combine these with the knowledge services of knowledge management systems. Moreover, this work shows the operationalization of the KMS Success model, first for the model to be applied and second for the permanent integration in the decision making process. The subsequent integration was accomplished using the interrelation of the demand to the experienced value/benefits, which generates benefits perceived by the individual. However, though being developed in the environment of KMS and IS, the framework clearly relates to the holistic approach of KM, integrating technology, organization and individuals. The extensions and interrelations established for known concepts can thus be considered the scientific contribution of this work. As required by the DSR approach, the insights gained have been published to add to the knowledge base available on the topic as is shown with the related work provided below. This related work also includes the systematic preparation of the knowledge base with regard tom KM/KMS in SME. The concrete listing of the achieved contributions relevant is shown in table 1.1.

Scientific contributions	Practical contributions
• Creation of the KinS framework, composing the concepts on knowledge services, knowledge demand and KMS success to a decision support for SMEs • value/ benefit discussion on KMS • Discussion and specification of the concept of knowledge demand for the application in KMS • Focus the integration of the organizational culture and the employees with KMS in the organization by the focus provided in the framework • Systematic overview on the state of the of KMS in SMEs	• KinS framework including a method to support decisions on KMS implementation • Practical application of KMS Success model in SMEs

Table 1.1.: Contributions

The contribution gained through this PhD project are summarized as a monolithic work, however parts of the results have been published on conferences before. The following is a list of the publications under consideration, which are also referenced at the according point in this thesis.

1. Borchardt, Ulrike, and Franziska Grap. “E-learning Application Support for SME.” In Perspectives in Business Informatics Research, pp. 62-72. Springer Berlin Heidelberg, 2010

2. Borchardt, Ulrike. “Towards a Value-oriented KMS Recommendation for SME.” In KMIS, pp. 347-350. 2011

3. Borchardt, Ulrike. “Towards Value-Driven Alignment of KMS for SME.” In Business Information Systems Workshops. Springer Berlin Heidelberg, 2011

4. Borchardt, Ulrike.”KMS Application and Perception in SME? In Perspectives in Business Informatics Research, 10th International Conference, BIR2011, Associated Workshops and Doctoral Consortium, Riga, Latvia, Local Proceedings

5. Borchardt, Ulrike. “Selecting KMS for SME - A Need for Value-Orientation.” In Workshops on Business Informatics Research, pp. 26-37. Springer Berlin Heidelberg, 2011

6. Borchardt, Ulrike. “Using Social Media for Knowledge Management in SME.” In KMIS, pp. 31-39. 2012

7. Borchardt, Ulrike. “Towards Value-Oriented Use of Social Media for Knowledge Management in SME.” In Knowledge Discovery, Knowledge Engineering and Knowledge Management, pp. 323-336. Springer Berlin Heidelberg, 2012

8. Borchardt, Ulrike. “Knowledge Management Systems in SME - State of the Art.” In ILOG@BIR Workshop, 2012

9. Borchardt, Ulrike, and Karsten Weidauer. “The Value of E-Learning to the Lecturer.” In Perspectives in Business Informatics Research, pp. 214-226. Springer Berlin Heidelberg, 2013

10. Borchardt, Ulrike; Kwast, Thomas and Weigel, Tino. “Integrating the IS Success Model for Value-Oriented KMS Decision Support.” In Business Information Systems Workshops, pp. 168-178. Springer International Publishing, 2014

11. Borchardt, Ulrike; Reck, Jörn; Lantow, Birger. “Determining and Evaluating the Benefits of KM Tool Support for SME.” In KMIS, pp. 203-211, 2014

12. Borchardt, Ulrike; Hengl, Christoph; Melinat, Peter. “Wissensbewahrung in der öffent-lichen Verwaltung.” In WIWITA 2014. 9. Wismarer Wirtschaftsinformatiktage. 12./13. Juni 2014. Proceedings

13. Borchardt, Ulrike. “Wertorientierte Empfehlung von Wissensmanagementsystemen für KMU.” In WIWITA 2014. 9. Wismarer Wirtschaftsinformatiktage. 12./13. Juni 2014. Proceedings

14. Borchardt, Ulrike; Vetterick, Jonas; Cap, Clemens. “Determing the Benefits of Social Media Support in Lecturing.” In IMCL2014 - 2014 International Conference on Interactive Mobile Communication Technologies and Learning, IEEE

15. Borchardt, Ulrike. “Knowledge Demand Specification for KMS Decision Support.” In ILOG@BIR, pp. 61-73. 2014

1.4. Thesis Outline

To sufficiently answer the research questions as explained before, several steps in research have been accomplished. To guide the reader through the research process conducted for the development of the framework, which was created and evaluated according to the

guidelines of the DSR, the upcoming work presents the following contents.

The structure of this thesis is oriented towards the DSR approach with its cycles of relevance, rigor and design. The thesis consequently begins with the general presentation of the knowledge base. On the one hand, this relates to the research methodology and on the other hand this covers the topics of KM, KMS and KMS for SME. Chapter 2 explains the research background of this thesis, as there is a certain methodology, DSR, utilized to achieve the results presented here. It therefore provides descriptions on the approach of DSR, on the general scientific investigation tools in use, and finally on the concrete research plan for this PhD project approaching DSR. This research outline depicts the concrete adaptation of the DSR approach to design the artifact presented by the framework and the KinS method manual.

Following the DSR approach chapter 3, presents the relevant theoretical concepts extracted from the knowledge base available for the topic of KMS in SME. Consequently, it provides an insight into the general theoretical scientific foundation on the field of KM. To accomplish this, it describes the general understandings of the terms relevant for this work, as there are knowledge, KM and knowledge-intensive work. In addition general remarks on the field of SME and KM in SME are provided. Furthermore, the technical support for KM is explained with an overview on KMS and the accompanying architectures. And finally, the essentials of value and benefit models for the evaluation of the success of such application implementation are described.

Chapter 4 summarizes in various sections the data collected to support the framework introduced here, showing the practical evidence of the problem in forms of surveys, systematic literature research and case studies conducted. It provides the data gained for the initial research justification, proving relevancy of the research conducted. The data collection mostly describes excerpts from larger works, since many data collection activities were accomplished in collaboration with student theses. The chapter consequently shows the requirements to be found in the target group, which are to be addressed by the artifact to be constructed.

In chapter 5 the initial framework as the centerpiece of this thesis and the first part of the design cycle is shown. It introduces the different components of the framework their interdependencies and the results to be gained by its employment. The chapter concludes with the presentation of the initial application of the created framework as the artifact, making the framework available for the first validation. Subsequently, chapter 6 describes the different case studies conducted for the first rigor cycle. For the general application see section 6.2 and 6.3, for the validation of individual parts of the framework see section 6.4 and 6.5. Based on this, conclusions on the requirements to be addressed with the second design cycle are defined. Consequently, chapter 7 presents the measures taken to address the found shortcomings revealed by the validation. It describes a further cycle for the design of the artifact. Thus, the chapter chapter 7.3 provides the discussion

of the knowledge demand as central concept of this thesis. In addition, it describes the integration of the knowledge demand. The creation of the method manual complementing the framework as the artifact of the conducted research are described as well. The created KinS method manual supports the concrete operationalization of the framework, providing a more systematic documented application of the framework.

Based on the completed artifact of an existing framework with a concrete method, chapter 8 provides the description of the detailed evaluation cycle for the method manual describing the details of the structured validation process. With the completion of this validation the results were transferred into adaption on the method manual, which can be found in this form in appendix A. With the method manual, the main contribution of practical relevance is presented guiding through the decision process for a KMS support. Besides the evaluation of the artifact, the threats of validity for the overall research project are also described. Finally, chapter 9 closes the thesis providing critical remarks and a summary of the work done, as well as an overview of further research to be obtained on the artifact as well as the field of research.

Chapter 2

Methodology

This chapter is designated to explaining the general research methodology applied to provide the results for this thesis. To illustrate the research process, it describes the means of DSR. In addition, it presents the general methodological background of this work by describing methods from socio-empirical and qualitative research applied, as well as the general research approach applied to create the result of this PhD project. It furthermore provides details on the actual research design with an overview on the accomplished work and the systematic scheme of the research conducted. Finally, the research plan depicts an outline of the research activities we conducted for this thesis as well as interrelate them to the gained and published results.

2.1. Design Science - a Problem-oriented Approach on IS Research

The objective of the DSR is to achieve progress by "ideas, practices, technical capabilities, and products" [HMPR04] taking effect in the "analysis, design, implementation, and use of information systems" [HMPR04] efficiently as well as effectively. The intention of DSR is to improve the environment by the introduction of new and innovative artifacts [Sim96] within the field of information systems. Contrary to behavioral science approaches the approach focuses on the technology part of the IS usually resulting in so called IT-artifacts. These artifacts cover constructs as well as models, methods and instantiations, being concrete to support the successful implementation of IS in organizations [HMPR04]. In general the artifact can be "any designed object with an embedded solution to an understood problem" [PTRC07], hence DSR focuses the problem-oriented approach to create valuable solutions. Regarding IS in design science does not lead to the development of concrete IT applications, but rather meta-artifacts, which themselves are to support the development of concrete implementations [HC10]. In the certainly first article on the field of design science for IS, Walls et al. [WWES92] describe the categories for these artifacts

as meta-artifacts for the IT-product and meta-artifacts for the system development process.

Being created as IT artifacts, results of the DSR approach [HMPR04, PRTV12] demand evaluation for their application in respective organizations using empirical and qualitative methods known from behavioral science. Consequently, their application may reveal manifold interactions in the system of people, organization and the respective technology including the regarded IT artifact. This artifact can be the center of further behavioral science research, and provides the design science researcher with a deeper understanding of the problem to be solved, enabling him or her to more profound insights on the feasibility of his or her solution to a problem.

Starting from the origin of the word "design" it has to be noted that it names "the purposeful organization of resources to accomplish a goal" [HMPR04]. Furthermore, it denotes a product (as a noun) as well as a process with a set of activities (as a verb). The switch between these two perspectives is immanent in the concept of design science and reflected in including the creation of an artifact as well as its evaluation in the process. Walls et al. [WWES92] explain that the "purposeful goal" is the difference between design science and other sciences, since it strongly determines the direction of research to be taken, where it is otherwise non-existent.

In IS research to combine the problem-oriented design research and its counterpart the theory oriented behavioral science in the field Hevner et al. [HMPR04] suggest a framework for the approaches of IS research with the DSR approach. This widely accepted framework, displayed in figure 2.1, shows all parts essential for the conduction of IS research. It displays their linkage to the outside environment (left side) as well as to the internal research knowledge base (right side). Both research approaches are to be combined to address IS reality, by either developing theories to be applied in business contexts or artifacts solving known business problems. The center of this is formed by the build and justify activities needed to verify that the created artifact is a valuable solution. Consequently, design science can be described as iteration over two activities, namely designing an artifact, that transports improvements and empirically investigating the corresponding performance of the artifact in application context [Wie14].

DSR with the intention of problem orientation should begin by identifying and representing opportunities and problems in an actual application environment [HMPR04, p.17]. This part represented on the left side of the figure 2.1 is forming the relevance cycle. The relevance cycle with its direct linkage to practical application also is supposed to deliver the acceptance criteria for the artifact to be designed, and consequently supports and demands a systematic evaluation. Especially with the help of field testing it can be determined whether additional iterations in the design cycle are necessary. The right side displays the rigor cycle, which is to guarantee the grounding of the research work

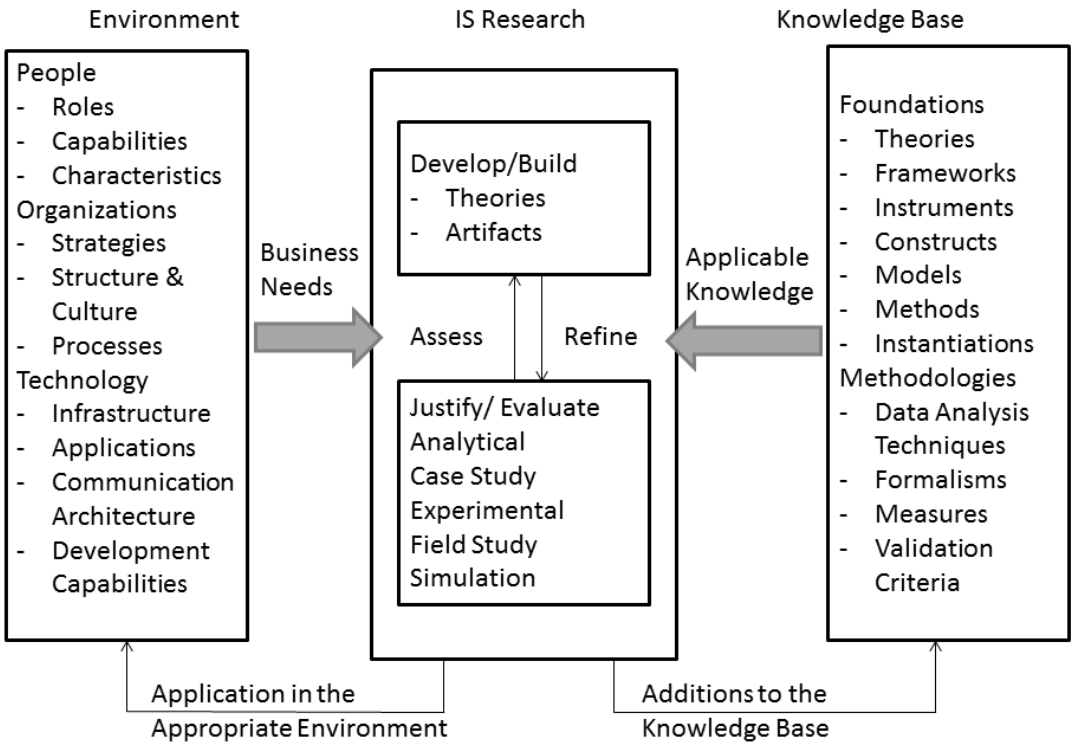


Figure 2.1.: A Framework for IS research [HMPR04]

conducted with regard to scientific theories and methods available.

For further guidance in the research on IS and its purposed outcome, Hevner et.al. [HMPR04] also provide 7 guidelines to be followed during the conducted research:

1. Design as an artifact: the outcome of design science research is expected to be a viable artifact.

2. Problem relevance: the technology- based artifact is supposed to address a relevant business problem.

3. Design evaluation: by the establishment of a rigorous evaluation the artifact has to be proven with regard to quality, utility and efficacy. According to [HC10], evaluation "is the systematic determination of the merit, worth and significance" of an item, independent from whether it is an information resource or a certain political program. Consequently this also should hold for the evaluation of IT artifacts.

4. Research contributions: the outcome of the research process must be clear and verifiable.

5. Research rigor: for the creation of the artifact stringent methods are to be used in design as well as in the evaluation of it.

6. Design as a search process: the actual design of the expected artifact should be done using means available to fulfill the plan as well as the demands put forward by the environment.

7. Communication of research: the produced results, especially the artifacts, are to be presented to all shareholders of the problem solved, managers as well as technologist, in an appropriate effective manner.

Though these guidelines provide a general idea on what to expect from the DSR approach and what to consider relevant within research, the research community also demanded further refinements to structure the research process which resulted in the DSR checklist as shown below [HMPR04, p. 20]:

1. What is the research question (design requirements)?

2. What is the artifact?/ How is the artifact represented?

3. What design processes (search heuristics) will be used to build the artifact?

4. How are the artifact and the design processes grounded by the knowledge base? What, if any, theories support the artifact design and the design process?

5. What evaluations are performed during the internal design cycles? What design improvements are identified during each design cycle?

6. How is the artifact introduced into the application environment and how is it field tested? What metrics are used to demonstrate artifact utility and improvement over previous artifacts?

7. What new knowledge is added to the knowledge base and in what form?

8. Has the research question been satisfactorily addressed?

Even by this extension to these guidelines by the questions, the process of the research still remains vague. In general no common sense on what to use is available though several suggestions can be summarized [Win08], e.g. “build, evaluate, theorize, justify” [MS95], “develop/build, justify/evaluate” [HMPR04] or “design and development, demonstration, evaluation, communication” [PTRC07]. The most detailed described process in design science research as explained in [PTG$^+$06, PTRC07] is shown in figure 2.2.

Design science by now is a well accepted research approach within the IS research community showing its variety in several projects as e.g. [PHPH12], and being under constant discussion in the conference series DESRIST [PRJ12]. It is therefore the method of choice for the conducted research presented in this work. With regard to the precise term definition it should be noted that DSR comprises the two fields design research and design science. Whereas the first actually addresses the artifact creation as a process, the latter is about the verification of the research process reflecting it with regard to the rigour

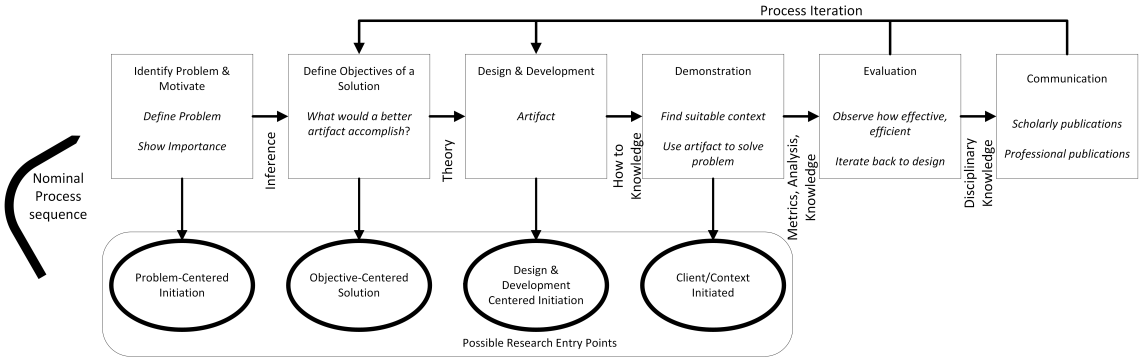


Figure 2.2.: Design Science research process model from [PTRC07, p.10]

[Win08]. Moreover, it can be argued, that DSR is focused on the IT centric part of IS research an thus should be enhanced [CHHK11, Win08] to provide stronger development in the management parts. Consequently, this work settled in the management of knowledge management system (KMS) is usually refers to its work according to the DSR approach and adjusts the process according to the needs of the problems. It also presents the conducted research emphasizing the design research aspect.

2.2. Scientific Research Methods

Proving relevance of the developed artifact of this thesis, several approaches known from behavioral sciences are to be used, which are shortly introduced here. The methods for collection mentioned by [Yin09] are experiment, survey, archival analytics, history and case study. Case studies are mostly concerned with answering how or why research questions, while focusing on contemporary events and require no control of behavioral events. In contrast surveys are used to answer all kinds of questions including who, what, where, how many,and how much. They do not provide control of behavioral events. This is achieved by experiments. For the course of this thesis however only case studies and surveys are of relevance since behavioral control in the field cannot be accomplished and the focus on the contemporary event is given. Therefore the methodology described here focuses on these methods.

2.2.1. Case Studies

Since the artifact in the design process was to be applied in practical work life, it demands practical application at some point. To achieve this and at the same time establish a return flow to the design process case studies are offering a possible frame for practical application. Case studies however, can be used in multiple ways [RH09].

The term itself is used similar to the terms field study or observational study [ZW98] and is interpreted differently in different research disciplines. Consequently, the usage of the term can be misleading especially with regard to pedagogics, where it is used to actually

describe storytelling, anecdotes or business cases [Kle99]. Case studies in general are a method within the qualitative branch of social empirical research. It aims at the study of phenomena, which hardly can be researched in isolation. As such "case studies are different from analytical and controlled empirical studies" [RH09]. However, since the subject of interest is studied in its context, distinguishing between context and research object is sometimes difficult. For the actual data collection on the phenomenon according to [Yin09] six different data sources are available for the use in case studies, namely documents, archive entries, interviews, direct or participatory observation and artifacts. The methods actually in use for data collection should be determined by contact with the field since not all of them are equally suitable for the different purposes to be fulfilled with such a study. The methods available according to [BG07] and their categorization are depicted in fig.2.3. This matches with [Yin09] who mentions 6 sources of evidence: documents, interviews, direct observation, participant observation, physical artifacts, archival records.

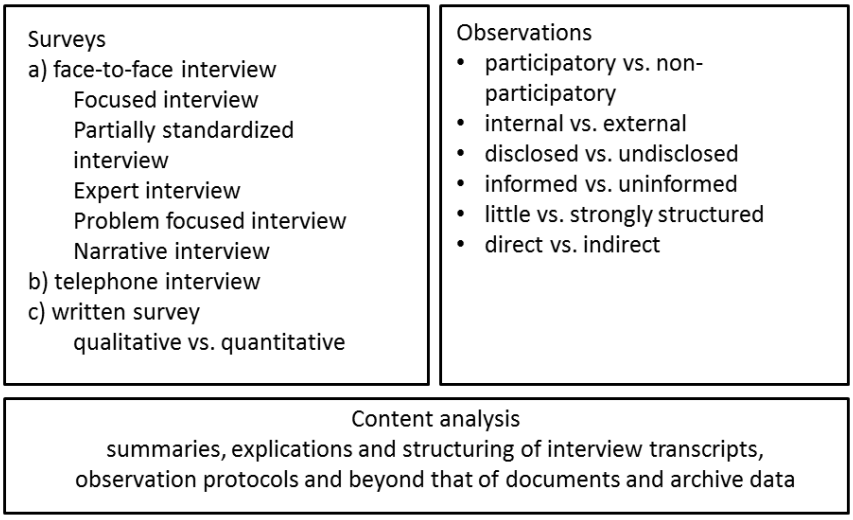


Figure 2.3.: Methods to be used for data collection within case studies (translated from [BG07])

Subsequently, a case study contains methods or elements known separately, e.g. surveys or literature research [RH09]. Planning these, different data collection should be done with the set up of the initial case study plan [Yin09]. The plan resembles the objective of the case study and is itself subject to several publications [Yin09, RH09, Kle99]. Nevertheless, it should be kept in mind, that case studies also differ with the research perspective [Kle99]. Whereas a positivist study aims at finding evidence for a proposition or to test existing hypotheses, critical case studies instead focus on social critique and are searching for social, cultural or political issues influencing the phenomenon under research. Thirdly, there are interpretive case studies, which focus on the participants' interpreta-

tion of their environment to understand the studied phenomena. Another distinction was provided by [RM16], who names the categories exploratory, descriptive, explanatory and improving. Whereas case studies initially were used mainly as exploratory studies to find new insights, ideas and hypotheses, descriptive case studies aim at gathering details on a phenomenon. Furthermore, case studies can be either explanatory or improving with regard to the phenomenon under research. For all kind of case studies it holds true that research on real world issues in comparison to controlled experiments demands a trade off between control and realism [RH09]. Moreover, due to this characteristic and case studies being of qualitative nature, they are unlikely to provide statistically significant results, thus they provide rich and detailed descriptions of the phenomenon under research [RM16]. According to Borchardt and Göthlich [BG07] case studies are designed as theory tests or for further development of theories. They also, by including observations of the context, provide results in areas where only a limited number of results are available.

Two types of case studies are distinguished in literature: the single case design and the multiple case design. The single case design concentrates on critical representative cases or such involving observation over a longer time period. The multiple case design however heads for comparison, where differences and similarities are critically reviewed. Due to this fact the results of the latter generally seems more convincing and robust. However to retrieve these results a reasonable amount of similar cases and the resources to observe must be available. An average multi-case study includes 4 to 10 cases [Yin09]. In this context Yin [Yin09] distinguishes between holistic and embedded case studies. In a holistic case the individual case is approached as a standalone unit of analysis. In contrast in an embedded case study multiple cases at once form the unit of analysis. Case studies, though originating from social studies have been adopted to several fields of research, e.g. software engineering [RH09], technical engineering [Wie14] or IS research [Kle99]. Already in 1993 Sauer [Sau93] argued that case studies are the most appropriate method to prove phenomena connected to IS.

Nevertheless besides planning and conducting data collection the gained data has to be analyzed at some point. For this [Yin09] provides 3 general principles. First cases studies are supposed to have multiple sources of evidence, so that triangulation is also given by the sources. Second, a case study database should be built to keep the data for exchange for other researchers and by this support the analysis with the raw data. And finally a chain of evidence should be given to the reader to provide him with a proper argumentation.

To sum up the remarks on case studies the threats to validity [Yin09] are to be explained. By checking these it is supposed to secure the overall validity of the case study to provide the desired results. The 4 points to be considered are: construct validity, internal validity, external validity and reliability. The construct validity aims at identifying the correct operational measures for the research objects. The second, internal validity is directed at showing the causal relationships ruling out influences which might go unrecognized. The

	telephone	face-to-face	written
Costs	middle	high	low
Sample	partially restricted	not restricted	restricted, needs addresspool
Sample size	high	middle	very high
Procedure control	very high	middle	none
Data Rigour	high	middle	middle till low
Anonymity	middle till high	middle till low	high
Questionnaire complexity	low	high	low
Duration	medium till long	long	short to medium

Table 2.1.: Data collection with surveys [Häd15]

external validity in contrast secures the domain of the study findings to ensure findings can be generalized. And finally, reliability is supposed to provide documentation and planning allowing another execution of the case study. Hence, this aims at excluding biases and errors.

2.2.2. Data Collection Method: Surveys

Surveys are common methods for data collection, within case studies as well as independently, as indicated in figure 2.3. These can be further categorized into interviews (either face-to-face or telephone) or written surveys (online as well as mail) [Häd15, BD13]. In the table below the main types for data collection within surveys are named and compared with regard to their main characteristics relevant for research design. These characteristics mainly influence the decision on their use in the research design [FJ13].

Interviews

When an interview is conducted usually two strangers meet, where the initial contact, the topic of the interview and the procedure are depending on the interviewer. However, some factors influencing the results can be identified, as there are gender, age, educational degree, appearance and language [Att03]. These factors constitute a certain impression of the interview partner which induces certain adoptions on both sides. Hence the interview procedure should be as neutral as possible to avoid the bias of results. This partially can be supported by the creation of a well formed interview guideline. In addition unwanted influences on the results, as there are articulation abilities of the questioned as well as the purposeful holding back of information, can occur which should be prevented by a profound choice of the interviewers, a good interview training and thorough interview instructions. Moreover certain rules of conduct as letting the interview partner finish speaking, taking down the information without adjustments and omitting interpretation

	standardized	partially standardized	non standardized
question formulation	predefined	partially predefined - partially free	free
question order	established	basically established	free
prior knowledge	high	middle	low
terminology	consistent	mostly consistent	inconsistent
interviewer skills (required)	minor	middle - high	high

Table 2.2.: Interview types [Fan01]

of the uttered should be applied [BD13]. Though survey methods generally are designated to deliver quantitative results, especially interviews can support qualitative aspects in research [Lam10].

Face-to-face interviews have certain advantages as e.g. the registration of non-verbal expressions or fatigue as well as a lack of concentration. To avoid detachment and distrust of the interview partners, insight into the interview notes taken down is helpful. As for the environment it should also be taken care of conditions caused by other than the interview partners, e.g. uninvolved persons, unwanted interactions. The length of an interview depends on the topic, the interests of the interviewee, the interview guideline, payment and the overall interview situation, e.g. lack of time is restricting the interview time[BEE09]. The according categories to be found among interviews can be found in table 2.2.

Written Survey - Questionnaires

Besides the oral interviews, written surveys support the data collection in DSR. These can be conducted as questionnaires holding closed questions using scales or open questions allowing, but also demanding, text production. However, for the according questionnaire design a high degree of structuring must be given for the field of interest [BD13], since regulating interventions cannot be made [FJ13]. Written surveys are the most used instrument for the conduction of social empirical research and can be conducted either per mail, or online [Lam10]. Though online questionnaires are a rather young category of surveys in 2012, 35% of all questionnaires were conducted that way [Häd15]. Yet within application and result interpretation two main points of criticism appear. Firstly, written surveys or questionnaires usually ask for subjective points of view or perceptions, which hardly can be observed or even interpreted and verified from the outside. Secondly, this fact can be realized by the answering persons leading adaption or manipulation of answers provided depending on the situational context of the survey to be conducted [Att03]. On the other hand the data provided therewith becomes prone to misinterpretations due to facts men-

tioned above but also based on the interpretation of the questions by the respondents. This demands careful construction of the questions used with regard to understandability and unambiguity. With regard to the special online form of the written survey several advantages can be named as there are the reduction of effort in time and money. These advantages are offered in comparison to the written surveys conducted by mail [Att03]. Furthermore, online surveys do not demand a special time and place and include the data collection in electronic form when using the according programs, which support automatic data analysis. Nevertheless online surveys also have disadvantages as there are the low response rates, which in student groups may reach 50 % but generally are far below this value. Consequently to achieve results with a sufficiently large basic population a large initial sample of contact data is necessary [FJ13]. The problem of the return rate does not only affect the online form, but all written surveys. Certainly reminders and incentives can help to improve the individual response rate, yet also increase the possibility of interference [Att03]. In general the return rate raises with the degree of homogeneity of the target group [Att03].

2.2.3. Observations

Observation as part of the social empirical methods allows for the systematical gathering of facts on a process [BD13, SHE05, Lam10]. The repeated process or actions might differ, however the initial task to be fulfilled remains the same under the series of observations. Observations though due to proximity to "common watching" being an controversial method offer access to fields of research which otherwise can hardly be approached [BD13]. Observations are categorized as means of qualitative research [Töp12].

As for the method of observation, it holds different instruments, which can be categorized as follows: Observations can be conducted structured or unstructured as well as participating or not participating. These four characteristics in two dimension span up a field allowing for classification as non-scientific common observations (non-participating and unstructured), ethnological observation (participating and unstructured) and moreover observations as empirical social studies (structured, non-participating as well as participating).[SHE05, Lam10, Att03] In addition social empirical research included direct and indirect observations, where indirect observations can only review the outcome of the accomplished process, whereas direct observations are done at the time of the event to be observed [SHE05, PWS14]. Though observations are mainly understood as a method for field research laboratory observations are possible, yet at all times the observer remains receptive. In comparison with an experiment this means, that the actual observation object cannot and is not manipulated under observation [Lam10].

To be able to provide answers on the research questions, the means of observation are appropriate when the focus is on the actions within the process while avoiding the problem of written externalization, as e.g. necessary for questionnaires or interviews.

[SHE05]. To be able to gather reliable and valid results observations need an according observation instrument. Therefore character scales, category scales or rating scales can be implemented. Yet in all cases, the observer can only reflect part of the observed process and hence observations are at all times subjective. Consequently, the observer is the main source of failure to the method, as the observation demands high skills in perception, selection and reduction [SHE05].

2.3. Evaluation

In guideline three for DSR by [HMPR04], it is written that design evaluation is essential for the research process. This step is to prove utility, quality and efficiency of an artifact by the application of the according evaluation measures. Hence evaluation is to be done systematically, however there is no agreement on the actual evaluation methods to be used nor the criteria [PRTV12].

In [HMPR04] e.g. the criteria of "functionality, completeness, consistency, accuracy, performance, reliability, usability" are named as interest of the evaluation process. The methods to ensure these criteria can be "case studies, field studies, static analysis, architectural analysis, optimization, dynamic analysis, controlled experiments, simulation, functional testing, structural testing, informed argument, or scenarios". Hence a variety is offered which has to be adapted to the individual artifact to be evaluated. In [PTRC07] evaluation is described to "observe how well the artifact supports a solution of the problem", consequently two issues have to be resolved by evaluation. First, how is the measurement done for proving "well" and second, how can the performance of the artifact be observed. Peffers et al. [PTRC07] therefore suggest field studies, observation of reuse rates, performance testing and client feedback on the usefulness. The methods alignment for evaluation still remains to be resolved according to the artifact. When considering IS research in general, evaluation can be considered either ex-post, meaning that the system is evaluated after implementation, or ex-ante, verifying the choice before implementation [PHBV08]. The ex-ante perspective is often implemented in an economic manner determining the value of an option to base the decision on. Ex-post evaluation in contrast can be achieved collecting data after system implementation aiming for the system performance as well as the user perception of the system. Within the DSR evaluation discussion the notion of artificial and naturalistic evaluation context has arisen. Whereas the artificial evaluation is conducted in situations created for the evaluation purpose only, naturalistic evaluation is aiming for real life application [PHBV08]. Pries et al. [PHBV08, VPHB12] however have suggested a framework based on these dimension using the questions on "what is to be evaluated", "when does the evaluation take place" and "how is the evaluation conducted" to be able to describe the evaluation type. Though these questions support a categorization of the conducted evaluation and extension to the framework was needed to provide, an evaluation strategy selection framework [VPHB12]

as displayed below.

DSR Evaluation Strategy Selection Framework		Ex Ante	Ex Post
		• Formative • Lower build cost • Faster • Evaluate design, partial prototype, or full prototype • Less risk to participants (during evaluation) • Higher risk of false positive	• Summative • Higher build cost • Slower • Evaluate instantiation • Higher risk to participants (during evaluation) • Lower risk of false positive
Naturalistic	• Many diverse stakeholders • Substantial conflict • Socio-technical artifacts • Higher cost • Longer time-slower • Organizational access needed • Artifact effectiveness evaluation • Desired Rigor: "Proof of the Pudding" • Higher risk to participants • Lower risk of false positive-safety critical systems	• Real users, real problem, and somewhat unreal system • Low-medium cost • Medium speed • Low risk tp participants • Higher risk of false positive	• Real users, real problem, and real system • Highest cost • Highest risk to participants • Best evaluation of effectiveness • Identification of side effects • Lowest risk of falsepositive – safety critical systems
Artificial	• Few similar stakeholders • Little or no conflict • Purely technical artifacts • Lower cost • Less time-faster • Desired Rigor: Control of the variables • Artifact efficacy evaluation • Less riskduring evaluation • Higher risk of false positive	• Unreal users, problem, and/or system • Lowest cost • Fastest • Lowest risk to participants • Highest risk of false positive regarding efffectiveness	• Real system, unreal problem and possibly unreal users • Medium-high cost • Medium speed • Low-medium risk to participants

Figure 2.4.: Evaluation strategy selection framework [VPHB12, p.10]

Besides this approach from the DSR community other approaches for qualitative oriented research in general exist. Therefore it has to be considered that evaluation as known from quantitative work by showing internal and external validity, reliability and objectivity can hardly be applied to the field of research presented within this work. For qualitative work as presented within this thesis, the problem of inter-subjectivity as well as the availability of results with regard to the amount arises. This leads to problems in generalization of the results and comparability. Yet, in qualitative research new insights usually are gained by inductive methods since data usually has a verbal character instead of a numerical. Consequently results are found by generalization, which makes them vulnerable for being insecure [BD13].

To ensure the evaluation is conducted in a systematic manner Lincoln and Gubas sug-

gest a validation approach. The authors [LG85] therefore suggest validation in different dimensions, as there are the internal and external validation, as well as the theoretical and practical. These are combined into a matrix as shown in table 2.3. With the theoretical and practical aspect the construct by Lincoln and Guba resembles the artificial and naturalistic dimensions of the framework by [VPHB12]. As a second dimension however internal and external validation are approached.

With their work Lincoln and Guba follow the classic quality criteria for qualitative research, but verify them. The central issue of their work is the generation of trustworthiness under research study. They therefore operate the four terms credibility, transferability, dependability and confirmability, which are to form trustworthiness in the results of qualitative research.
Credibility refers to the conventional internal validity and aims at adding credence to the results of research within research itself, but also for the research subjects. To ensure credibility five techniques are suggested. These are longterm experience with the topic under consideration, longterm field experience and triangulation, allowing for trustworthy results and interpretation of them. Furthermore peer debriefing negative case analysis and referential adequacy improve the chances of credibility. Finally number checking with the participants in research generates trustworthiness support this aspect. In general credibility assurance can be considered similar to the methods of content validation in known quantitative validation.

The second criterion to be ensured by validation is transferability, which itself is not within the scope of the researcher to conduct it. However, he or she should provide the possibility that a potential user of the research result can transfer it to a specific situation or environment. Lincoln and Guba [LG85] argue that this can be seen as equivalent to the external validity known from quantitative evaluation. The external validity aims at the researcher to provide more precise statements on external validity in form of e.g. statistical values, which contrasts the idea of general transferability.
As a third criterion dependability [GL$^+$94] is supposed to replace the reliability used for quantitative evaluation. This means that by two times looking at the same situation the same results should be gained. However in this field of qualitative research the same situation cannot be considered twice, the results cannot be replicated in qualitative research. To avoid this problem Lincoln and Guba demand an independent review using documentation measures, as there are protocols. These are to report the changes in detail to make a reproduction of the results redundant.

Finally confirmability corresponds to the criterion of objectivity, which is supposed to ensure the independence of research from individual abilities and visions. To put this criterion into practice Lincoln and Guba recommend the usage of audits. As a confirmability audit it should be considered how many other researchers confirm the gained research results. Furthermore, triangulation among researchers is to approve the results. These

criteria result into 4 (6) parts of a validation to be considered as shown in table 2.3. As can be seen from the table the external evaluation dimension however can be further distinguished, resembling the mere validation purpose and the real-life application.

	theoretical	practical
internal	Validation against state of research	Prototype implementation, test in lab environment
external validation	Peer-review, comparison to known best practices	Case studies for evaluation purposes
external application	Development of extensions by external actors	Use of the artifacts developed for solutions

Table 2.3.: Types of validation according to Lincoln and Guba

The decision was made in favor of the approach of Lincoln/Guba to reflect, that this thesis considers a problem which is related to the naturalistic approach. The KMS decision support for small and medium enterprise (SME) of course can be discussed theoretically. Nevertheless, to prove the efficiency of the theoretically designed result real life application is inevitable, since this situation can hardly be simulated. Consequently, this approach was preferred to the one of e.g. [WRH+12], aiming at software engineering in general.

2.4. The Research Plan

Using the research methods and DSR approach as described above the actual research questions as explained in section 1.2 are to be answered within the research process. The result hence should be described as an artifact as demanded by DSR. To describe the conducted research process the model as suggested by Peffers et al. [PTRC07] is used. The research plan as presented in this section, is visualizing the creation of the artifact, which embodies the solution to the identified problem. The general resulting research plan in a visualized form can be seen in figure 1.1, however the concrete mapping of the research activities to the individual phases of DSR is provided in figure 2.4. In the model of Peffers et al. constant communication of the results is demanded, hence the figure shows the references to the own publications as listed in section 1.2.

With the identification of the research questions, the first phase of Peffers model [PTRC07], namely the problem identification and motivation, is provided. The research questions hence describe the specified problem. With these research questions the second phase of defining objectives for the aspired solution is accomplished. Consequently the concrete demands of knowledge-intensive SMEs with regard to KMS support needed to be researched. The corresponding surveys were conducted in 2010 among knowledge-intensive SMEs inquiring on their KMS/KM use, implementation approaches and general expecta-

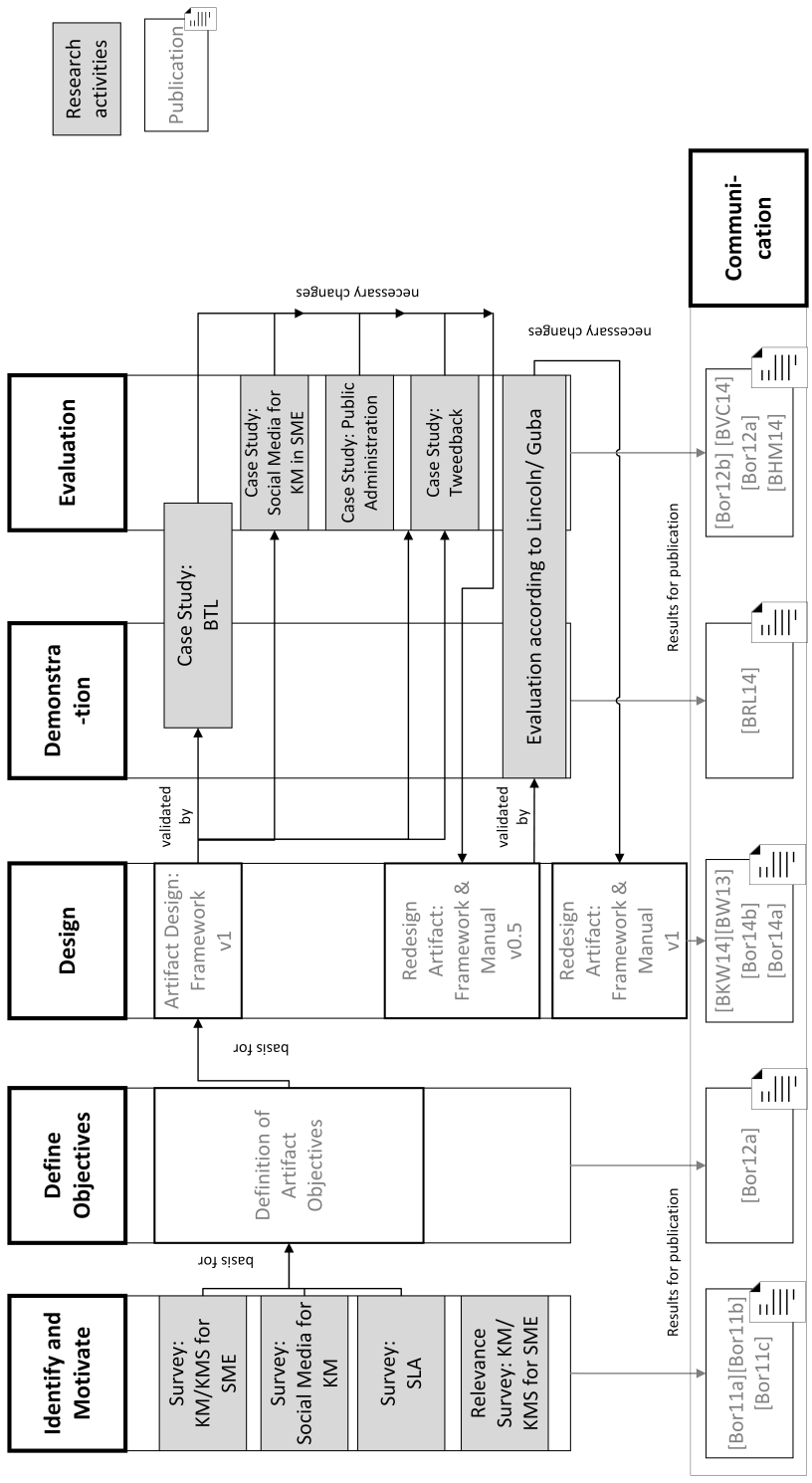


Figure 2.5.: Alignment of the research activities of the PhD project to DSR as shown by [PTRC07]

tions towards the applications of such systems. The respective surveys are presented in section 4.1. However, for objective definition these were completed by a follow-up survey in 2014. With these activities proving the relevance and describing the demands of practical application a counterpart in the knowledge base was necessary to prove the actual existence of the problem. This knowledge gap was demonstrated by the completion of a systematic literature analysis [KPBB+09] on the field, which is presented in section 4.4. With this step the actual demands could be identified as described in section 4.5. Hence the demands are considered the objectives to be achieved under artifact creation.

Addressing these requirements the actual design process was started. Therefore the generally known concepts related to KM, KMS as well as benefits/value of IT (see chapter 3) were analyzed with regard to their possible interrelations and afterwards compiled into the first draft of the desired IS artifact. The initial compilation was to provide a general understanding of the concepts used in the field of knowledge management and knowledge management systems. In the course of research furthermore a decision upon the kind of artifact had to be made. Referring to the missing value orientation criticized by the inquired SMEs, this issue became the focus of this work. This thesis and the according artifact hence are dedicated to making the concept of value-orientation in the surveys accessible under the decision making process for a systemic knowledge management support within SMEs. This decision was made first due to the demand for value orientation, and second because of the low rate of overall implementations found during the initial data collection for problem relevance. Accordingly the artifact should support in the process of decision making for a KMS delivering guidelines and points of orientation for SME facing the problem. As a consequence the idea was to create a framework explaining the concepts and showing the interrelationships among the concepts of KM and KMS with regard to value creation. Found concepts on the support of KM for SME under review turned out to be rather abstract and were not supporting the decision on and implementation of KMS. In addition the demanded value/benefit orientation was not reflected in the found literature.

Besides the alignment of the research activities to the DSR approach, the actual design phase of the artifact can be described as a construction-oriented approach. In the construction-oriented approach the phases of theoretical composition alternate with phases of validation. Consequently, following the DSR or the construction-orientation the first version of the framework, was designated for validation. This was accomplished with the case studies conducted and documented in chapter 6. The main demonstration as demanded by Peffers was accomplished with the case of BTL (see section 6.2). Based on the definition of KMS being information and communication technology (ICT) and delivering knowledge service support [Mai07] different technologies can be included in the scope of KMS application support. Consequently social media applications can be interpreted as a means for collaboration support and a channel for knowledge publication. Case studies focusing on these technologies hence are included as relevant for KMS application support

(see 6.3). However, with the social media cases the scope lay beyond the mere proof of the framework working and consequently these refer to the evaluation phase. This holds as well for the case of Tweedback (Learning service support) and the application of knowledge maps in public administration (as base for knowledge allocation), which are included in this thesis for the evaluation and subsequent improvement of individual aspects included in the framework.

According to the DSR model of Peffers demonstration and evaluation as phases should be separated, yet since the model is a compilation gained from the work of several researchers also sources could be found not distinguishing between the phases and consequently using one of both [PTRC07, p.12]. Facing the long term effort necessary for a case study this work uses the same case study (BTL) for general demonstration but at the same time derives results relevant for actual evaluation, leading to adaptations and enhancements in the artifact design.

Combining these different results changes and additions to the actual artifact had to be made taking the research process back to the design and development phase as presented in chapter 7. Within this phase conceptual additions were to be integrated enhancing the artifact as a framework. The main addition made, was the explication of the framework in form of a method manual to provide a physical form of the artifact to the user group. By this step the publication of the artifact was addressed, and at the same time the access to the artifact and its actual applicability were improved. By the existing method manual, the user group can access the artifact without direct interference with the researcher. Using this method manual the next validation cycle was accomplished, but this time evaluation was conducted referring to [LG85], which interpreted includes the demonstration phase as well as the evaluation phase from the model of Peffers et al.. With the gained comments and requirements to be included in the framework, especially adaptations in the method were made in the final design cycle, leading to the manual version as can be seen in the appendix A.

The artifact to be created for the work of this thesis holds a benefit oriented framework for the recommendation on KMS in SME with the following integrated parts:

- the elaboration on the terminology of the research area, including the concepts' explanation to provide a thorough understanding of the used components,
- a description of the interdependencies and relations of the concepts in use,
- and an operationalization of the framework as a process for the decision making including templates providing methodical essentials for the process components for practical application.

Though further cycles could be added leading to further enhancements the research questions as composed in the beginning could be answered at this point in the course of

research. Consequently the work is concluding at this point with a fully evaluated first version of the framework, embodied in the method manual.

Chapter 3

Theoretical Foundation

This chapter presents the general prerequisites, as there are the general terms in use within this thesis, as well as the background of the scientific field to clarify the understanding of the research field. The goal consequently is to present the applied understanding of the domain knowledge management. The topics described here for further reference are restricted to general views on knowledge, knowledge management and knowledge management systems, as well as the characteristics of small and medium sized enterprises to depict the background and challenges of the field this work is settled in. Furthermore, the fundamentals for frameworks as the background for the artifact are provided.

3.1. On Knowledge

"Knowledge denotes the entirety of cognition and skills by individuals to solve a certain problem. This comprises theoretical insights as well as practical everyday rules and operation procedures. Knowledge is based upon data and information, but contrary to them always bound to a person"(translated from [PRR06])

The definition provided above is one of the most commonly used definitions on knowledge in the KM community. However, it is not the definition agreed upon in the scientific field. The goal of this section is to point out the different views on knowledge relevant, since there is no consensus on the term of knowledge [AH03], but many different disciplines being involved in the area [Leh10, HR07, BFL13].

Knowledge started as a philosophical concept discussed over years and milennia starting with Platon [PL92] (around 400 BC) however, never being finalized in a formal universal definition. Nevertheless, many attempts on the one definition have been made in several research disciplines without providing a final result. Based on this development Grant [Gra96] states, that the definition of knowledge should be done according to the field, the purpose and the research goal, holding for it though not being a universal definition. Applying this understanding to the definition provided above it has to be noted, that a KMS could not exist, since knowledge as such could not be stored outside the individual

heads. To show the disciplines involved for this thesis several definitions from authors within the field of organizational knowledge management were collected and are shown below:

"Knowledge is a competence-like notion, being a potential for generating action. The knowledge cannot so easily be seen only imagined as the result of interpretive processes operating on symbolic expressions." [New82]
The definition provided by Newell represents the understanding of knowledge from the artificial intelligence perspective, emphasizing that it is possible writing knowledge down. When compared to another definition from the field of organizational management however, it can be seen that knowledge as such relies on a process of understanding.

"Knowledge is the result of a process of understanding, accomplished by the classification of information in a certain context based on individual experiences" (translated from [Kle01])
With these three definitions the interpretation aspect of knowledge is visualized, however who has to accomplish this interpretation varies. Moreover, the definitions already show that, this act of interpretation depends on the context. With regard to the consideration of knowledge management systems, further researchers point out, how the knowledge term applies when not only considering individuals as knowledge keepers.

"Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the mind of the knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms."[DP98]
"Knowledge emerges as a strictly contextualized connection of information (which can be considered relevant within a grid of a certain system) with "experiences" of that system, e.g. with appropriate moments of its history, its semantic and cognitive structures and its identity" [Wil01]

Looking at the definitions so far it could be shown that knowledge does not exist on its own, but has to be processes to reach the status of being real knowledge. The authors therefore usually refer to a context which influences this processing and which is settled around the person carrying or creating that knowledge. Furthermore, it has to be noted that only minor differences can be perceived, especially when approaching the topic from the angle of SMEs. With regard to research later researchers often combine the aspects relevant for their work as e.g.:

"Knowledge comprises all cognitive expectancies - observations that have been meaningfully organized, accumulated and embedded in a context through experience, communication, inference - that an individual or organizational actor uses to interpret situations and to generate activities, behavior and solutions no matter whether the expectancies are rational or used intentionally " [Mai07, p.76]

Besides the connection to the context, the presented definitions of knowledge also show the close relation of knowledge to information. This issue was already used by [Ack89] to create an understanding of knowledge by differentiating it from term like information with the knowledge pyramid. This approach to the term of knowledge can be illustrated with the help of the knowledge pyramid [Fri09] or knowledge staircase [Nor16], see figure 3.1. Both concepts show knowledge being settled above information and differentiated from it by the addition of interconnections or context.

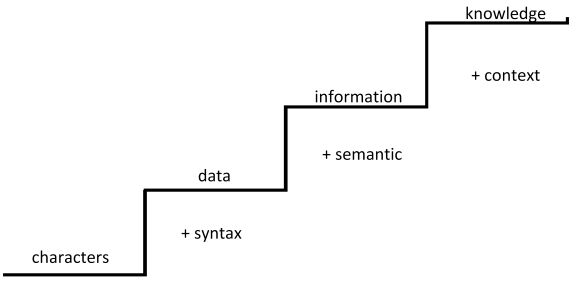


Figure 3.1.: Knowledge staircase according to [Nor16]

Interpreting the concept of the staircase, the complexity of the concepts shown rises from signs to knowledge. However, the aspect of context/ interconnection differentiating information from knowledge is not as clear as the ones of syntax and semantics necessary for data and information. Addressing this problem, Maier [Mai07, p.87] names two types of context relevant for knowledge creation in interconnection with information systems. The first type, the internal context, describes knowledge in the contexts of its creation as there are authors, creation date and circumstances, assumptions influencing the creation as well as the purpose of creation. The second context type, named external context, relates retrieval and application of knowledge by categorizing it, relating it to other knowledge, describing access rights, usage restrictions and circumstances as well as feedback from its re-use. With this listing a more concrete conception of the context is given, however also relating it to Newells notion of knowledge being related to action.

Following this line of thought this work assumes context as the distinctive attribute between knowledge and information, since the context is not necessary for the work with mere information. As a summary [Ste94] knowledge can also be characterized as the ability to act, since it allows the system holding it to make decisions. This is also reflected by the enhanced version of the knowledge staircase [Nor16], naming ability as the next step towards competitive advantages. The possibility to convert knowledge into abilities and consequently into actions is necessary to generate the competitive advantages in the organization [HR07].

Besides the search for a distinction of knowledge the categorization in its description

allows for a more thorough understanding of its concept. For this reason numerous categorizations (e.g. [DJFH96, Mac62, MRR00]) have been created. The one mentioned most often, namely the distinction between tacit and explicit knowledge introduced by Polanyi [Pol66] and further established and refined by Nonaka and Takeuchi [N$^+$95] is considered fundamental for the field of organizational KM. When first being introduced by Polyani, tacit knowledge was considered to be existent in the heads of individuals only, impossible to be externalized. This can easily be illustrated by the example of face recognition or bike riding. Both processes can be somehow described but never sufficiently to fully explain the knowledge and enable another person to learn these abilities by reading a certain document only. Nevertheless, Nonaka and Takeuchi [N$^+$95] used the term "tacit knowledge" for all knowledge in the heads of people however assuming it can be externalized. They do not neglect that some knowledge might not be externalized at all, yet assume that larger parts are and should be for the sake of knowledge creation within an enterprise. In contrast they describe "explicit knowledge" as being easily externalized and most often already available in written form. Explicit knowledge hence can be described using language in contrast to tacit knowledge which, as embodied knowledge, relies upon the possibility to be demonstrated. The distinction in tacit and explicit knowledge is the one most common and most often mentioned in knowledge management showing most clearly where the important and relevant knowledge is located. Knowledge as skills and competencies as such can be transferred best from one person to another through training, socialization and interaction with people and environment [AH03]. Implicit knowledge reveals itself as skills and competencies [AH03]. Explicit knowledge on the other hand by some researchers is considered information [Gro09b, Her08]. This approach justifies using the description that both are independent from a person, easy to be transferred and can be contained in IS. With this comment also the weakness of the DIKW description is shown [Fri09], since most definitions rely upon the clear distinction between knowledge and information, although some researchers see no difference between information and explicit knowledge. Anyhow, [Gro09b] also states that the equality implies appropriate contextualization and linkage. For this work difference between knowledge and information by the help of context is nevertheless assumed, since technological support might mostly provide information, but the combination of it allows for the consequent processing which is not given in case of unlinked information.

Another categorization mentioned often is the one into declarative and procedural knowledge [DJFH96]. Declarative knowledge is described as rather static, easy to store and to operationalize. It covers the intellectual knowledge written down in documents, books and lectures, which is easy to replicate. With this description it partially resembles the explicit knowledge from Nonaka and Takeuchi. In contrast the procedural knowledge can be considered the "knowing how", which usually is hardly tangible or verbalizable knowings on procedures. It is also understood as practical knowledge or "recipe" knowledge including only little need for objective facts or information, which leaves them at

most prerequisites. All categorizations aim for a better understanding of what is to be considered when talking about knowledge management and knowledge as a productive factor. They emphasize that knowledge is an important part to maintain the organizations competitiveness and thus point out where the skills and abilities come from.

With this definition and characteristics provided, knowledge for this thesis is assumed as contextualized information to be processed for internalization by the user. And even if knowledge is available, it has to be brought into application which should be addressed by the means of KM. Furthermore, the concept "knowledge" as such should be registered as needing explanations to be accepted by the target group of this thesis, SMEs.

Knowledge-intensive Work

For several years now, knowledge is discussed to be one of the productive factors necessary for an organization to remain competitive. Besides the classical productive factors [SG38] land, labor and capital stock, knowledge as being part of the intellectual capital [SR98, EM97] is described to have strong influence on the process of production nowadays. However, not every way of production is equally strong influenced by knowledge and hence knowledge-intensive work and processes can be identified.

According to [Hei02, GH11, Geh06], knowledge intensive work can be characterized by a high variability and many exception rules. This description indicates, what [DP98] state, namely that knowledge intensity means a high variability and uncertainty about the income and the outcome, of the knowledge-intensive process. [Rem02] even states that knowledge-intensive processes cannot be optimized by the means of normals business process optimization. Combining these issues and proceeding on the character of knowledge-intensive work, [Gro09a] summarizes knowledge-intensive work as being highly complex in processing, weakly structured, strongly oriented towards communication and having a high employee autonomy with regard to decision making. In the same direction heads [GH00], describing that a wide variety of sources and media, high variance and dynamic development of process organization, many process participants of differing expertise, use of creativity, high degree of innovation and a wide scope for decision-making are typical for knowledge-intensity. According to Eppler [Epp99] knowledge-intensity in processes depends on the contingency, the scope for decision-making, the innovation possibilities by the process worker, the half period of the knowledge, the influence of the process worker and the learning time. Following this line of thought, branches could be identified which typically involve knowledge-intensive processes [NIW12, Sei11] as there were:

- data processing,
- hardware consulting,
- engineering services,
- communication services,
- marketing,

- software development,
- technical consulting,
- technical services,
- enterprise consulting,
- business services
- and advertising.

Organizations operating in these fields are more likely to be confronted with the issues of knowledge management. Yet, this does not indicate, that organizations operating in other business fields do not need knowledge or use knowledge-intensive processes at all, however it is not their core business. This is also due to the fact that one can differentiate between knowledge-based activities, knowledge-intensive activities and knowledge work [HR07]. Whereas knowledge-intensive activities include all conversions of knowledge into performance by a person, knowledge work means less concrete tasks in form of diverse, partially diffuse problems, without a clear definition of the possible result. These complex problems normally cause a cognitive preparation phase including the processing of information, the activation of knowledge, the communication of knowledge and thinking results. This can hardly be automatized and is highly immaterial up to the developed concept. Consequently, true knowledge work includes application-oriented, as well as development-oriented tasks, whereas knowledge-intensive tasks usually focus on one of these. Organizations relying on such activities hence can be described as knowledge-intensive. The development towards a knowledge-intensive working environment was not the result of a sudden revolution but the result of a gradual technical business and social development [Ste94].

Whereas knowledge-intensive work characterizes all activities conducted within an organization, knowledge-intensive processes focus the knowledge-intensity to the business processes. However, the characteristics remain: being unstructured, with tasks arising under execution and a large number of tasks to be included in the process [DCMR12]. As a typical example processes from health-care are named, where the context of the treatment strongly defines the tasks, as does the care scenario. In comparison a knowledge-intensive organization makes use of sophisticated knowledge and offers knowledge-based products [Alv04]. They do not necessarily have to depend upon knowledge-intensive processes. In addition [Alv04] names the amount of academics as an indicator for knowledge-intensive organizations, indicating the amount of employees confronted with complex work tasks. Hence it can be summarized, that knowledge-intensive process can be named one part of the knowledge-intensive organization however it has to be kept in mind, that this is not the main focus of this work.

By the properties provided, the characteristics of the work to be met in the target group of knowledge-intensive SMEs are provided. It can be seen, that working knowledge-intensive hence faces some particular challenges, e.g. the lack of structuredness of the work, which makes it difficult to support.

3.2. Knowledge Management

After having clarified the general term of knowledge this section proceeds with explaining the idea of the discipline of knowledge management. Though many models for organizational management exist (e.g. [All03, FM03]), this chapter includes only two, most commonly known: first the "SECI model" of Nonaka and Takeuchi and afterwards the "Building Blocks of Knowledge Management" by Probst, Raub and Romhardt. Both models are widely known and accepted in the field of knowledge management and influence the basic conception of the ideas this work and many other are build on. Working in the field of information systems and business informatics this discussion is followed by the clarification of the term knowledge management system which is the central point of interest of this thesis.

Similar to the term of knowledge the definition on KM varies. In [Jen05] KM is described as "*the practice of selectively applying knowledge from previous experience of decision making to current and future decision making activities with the express of purpose of improving the organization's effectiveness*". This rather general definition was enhanced by other researcher to a more precise description of what to expect of knowledge management by [PHM09]:

"Knowledge Management is defined as the management function responsible for regular selection, implementation and evaluation of knowledge strategies that aim at creating an environment to support work with knowledge internal and external to the organization in order to improve organizational performance. The implementation of knowledge strategies comprises all person oriented, product-oriented, organizational and technological instruments, suitable to improve the organization-wide level of competencies, education and ability to learn."

Using this definition the manifold aspects to be covered in KM can be identified, as there are the scope, the goal, the activities or the organizational integration. Especially with regard to the tasks to be accomplished by KM several listings exist. The tasks of knowledge management can according to [Leh10] be summarized as follows:

- information distribution
- information selection and rating
- embedding information into a context and providing meaning to it
- construct knowledge from information and develop new knowledge
- relate knowledge items and form knowledge nets
- preserve, structure and update knowledge
- broker, distribute, share knowledge
- apply and implement knowledge
- evaluate knowledge-based actions to gain new knowledge from it

Though these tasks provide an impression of what to expect from knowledge management, the individual adaptation has to differ from organization to organization, since the

demands and the context in which the knowledge is to be applied differ. Consequently, the environment has to be managed as well. Thus the effective and efficient management of knowledge is essential for the continuous enhancement in value of the organization [YWA05, DA06].

Like knowledge itself, knowledge management is confronted with the question on how it is related to the discipline of information management. Riempp [Rie12] states e.g. that knowledge management very much covers the content aspect whereas information management focuses on information and communication technology as the base for information systems. Both disciplines depend on one another and have a holistic, global and organization wide orientation. However, information management is no prerequisite for knowledge management and the interdependence is on time rather than logic or content wise.

3.2.1. Models in Knowledge Management

KM approaches in organizations can be categorized in two ways, the IT approach and the people approach [Sve01]. A similar categorization was also done by [HNT00], who categorized KM initiatives into a social approach and a technology-oriented approach. Whereas the latter one concentrates on knowledge preserved in objects and consequently focuses on systems storing these knowledge objects, the former supports systems facilitating communication among employees in the process of using knowledge. According to the categorizations every model on KM can be put into one of these two categories as can every organization implementing KM. It furthermore can be stated, that the other approach must not be fully neglected, however the focus should be set and documented, for otherwise the orientation is unclear and the efforts cannot be bundled. Both categorizations match the strategies on introducing KM to organizations found by North [Nor16] called implementation paths. He distinguishes 4 strategies: technology-initiated, coordinator-based, benchmarking-driven and strategic. Whereas the first can be associated to the IT approach instantaneously, the others are to be considered social or people-oriented.

Riempp [Rie12], on the other hand, enhances the differentiation to strategy-orientation, process-orientation and system-orientation. This categorization is based upon the starting points for implementation within the organization. When KM is done according to strategy it is usually top down driven, offering incentives to generate more and better knowledge in certain parts of the organization. Attaching KM to the business processes the knowledge generation is supported according to the value chain, in general starting with the knowledge intensive processes first. Consequently, the system orientation focus on information systems for storing, distributing and analyzing data and information to create a system support for knowledge generation.

Though describing general approaches of organizations to apply KM, these general categorizations provide only little incident of how KM works. Consequently, in the following two of the most established models are shortly described, which provide general informa-

tion on the issue and belong to the general knowledge base in the field. The SECI model of Nonaka and Takeuchi [N+95] describes the interrelation of implicit and explicit knowledge, as well as the transformations between the states leading to the creation of new knowledge. The second model of Probst, Raub and Romhardt [PRR06, Pro98] explains with its building blocks of knowledge management, the ideal steps for the implementation of KM in an organization. Besides these two general models on KM the TOI model [BWP98] is presented illustrating the holistic approach necessary for successful KM using a technical support, which is not regarded within the other models. Therefore it introduces the dimensions of KM relevant, which allows for a concrete integration of the barriers and success factors of the field.

For this thesis and the KMS support to be recommended, the provided definitions and tasks for KM show that an holistic approach should be aspired. The systemic support with a KMS consequently needs alignment with the other KM activities and the organizational strategy.

3.2.2. The SECI Model of Nonaka/Takeuchi

Nonaka and Takeuchi [N+95] created their model upon the differentiation of tacit and explicit knowledge as introduced before. Accordingly the initial assumption is that knowledge is existing in either one or the other form in the organization, and transformation between the kinds, as well as according transfer leads to the generation of new knowledge. The general structure of the SECI model consequently is a two dimensional matrix, where one dimension marks the starting point of the knowledge transformation whereas the other marks the goal dimension. Both are holding the characteristics tacit and explicit as displayed in figure 3.2. The transformation processes take place within the organization hence it is assumed that all processes already exist within organizations. Their alignment however supports generating the positive effects leading to knowledge generation.

The starting point of the also called spiral model is the direct transfer from tacit to tacit knowledge. This can for instance be found in a master apprenticeship relationship when knowledge is transferred via imitation which does not require the description in an explicit form, may it be oral or written. Due to the fact that this process needs direct contacts of individuals, it is called socialization. The explication of knowledge into a permanent form is accomplished during the next phase of the spiral where knowledge is made explicit to be stored or to be handed over. Nonaka and Takeuchi emphasize that the externalization is not a trivial process, since knowledge is related to the inner mental model of the individual carrying it. Consequently, the ideas of those mental models have to be explicated as well, which leads to the recommendation of using metaphors and analogies to provide concrete knowledge in explicit form. When this knowledge is stored in knowledge bases, the next step (combination) is to combine this knowledge with other explicit knowledge available as knowledge artifacts within the knowledge base to create new knowledge, which again

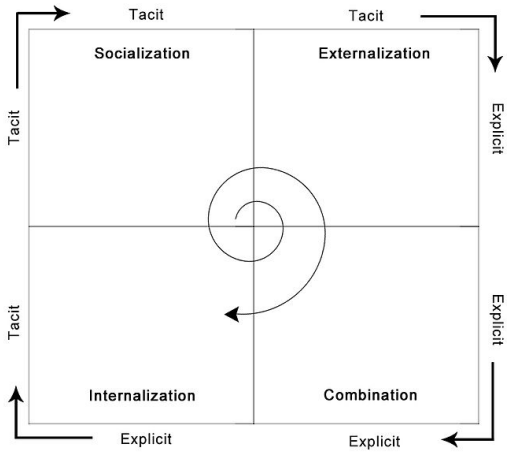


Figure 3.2.: The SECI model [N+95]

can be stored in its explicit form. This is e.g. done when artificial intelligence algorithms are working on databases searching for patterns and possible combinations. However, for being effective in the organization the knowledge newly gained has to be internalized once more to bring it into application, which is the purpose of the last step (internalization), where the objective is that employees integrate the knowledge into their internal "storage".

Since the 4 steps socialization, externalization, combination and internalization (SECI) are passed through repeatedly the model is also known as the spiral model. By the repeated uptake of new knowledge into the individuals the individual knowledge is growing. The individual hence is said to have the ability to generate new knowledge, yet only the transfer to the organizational level ensure knowledge growth. The models shows very well the processes needed to transfer knowledge between individuals, however it does not address the technical support of it, or the organizational implementation. In addition, the plain spiral model is restricted to the epistemological dimension and does not show the effects within an organization with its ontological dimension. With their further work Nonaka and Takeuchi also describe the different processes in combination with the ontological units of individuals, groups, organizations and inter organizational entities. This model extension can be seen in figure 3.3. Here it can be seen that within an organization the knowledge growth especially occurs with regard to the organizational units. Consequently, socialization and combination are accomplished between the organizational units, whereas the internalization and externalization is done with regard to the whole organization or at the individual level.

Furthermore, to illustrate how the process of the SECI model can work in practice Nonaka and Takeuchi name 5 essentials needed at the workspace to foster knowledge creation. These should be provided by the organizational management to support the process and intensify the knowledge creation. The 5 essentials accordingly are:

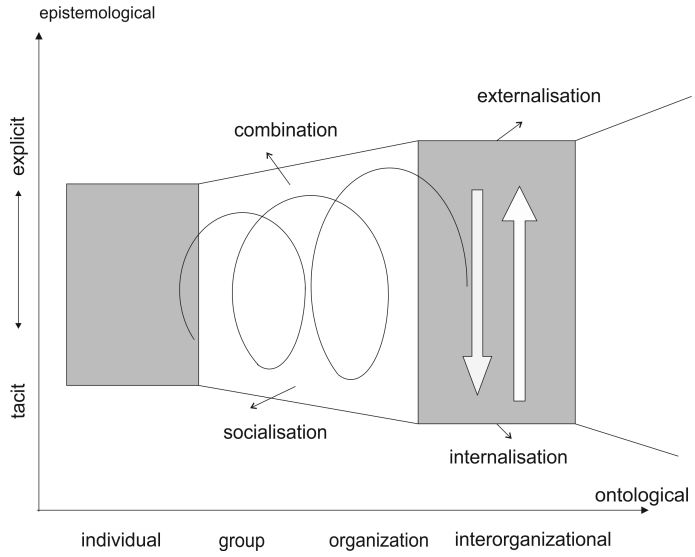


Figure 3.3.: The extended SECI model [N+95]

1) intention: Communicating a clear intention as an organization means sharing objectives and visions among the employees and determine concrete steps to be taken. Being confronted with these, the employees know in which direction to work and to develop new knowledge, they are able to channel their efforts.

2) autonomy: the individual employees should have a certain amount of autonomy to decide themselves where to develop. This includes being responsible for processes and tasks, since responsibility supports the identification with the working task. Autonomy accordingly is supposed to increase engagement and motivation.

3) fluctuation and creative chaos: by allowing fluctuation into the enterprise, the market's crises are allowed to enter and confront the employees. This on the one hand is frightening, yet on the other hand provides a strong motivation to leave old behavioral pattern to head for something new, fit to the market. The state is called "creative chaos" showing, that it might seem out of order but is providing new solutions. Even if the markets of the organizations are stable, the artificially induced fluctuation can be used to provoke such state supporting the creation of new knowledge.

4) redundancy: though being usually regarded as negative, redundancy as the existence of more information and knowledge than necessary can help the fostering of new knowledge. It provides employees with insight into other fields of interest, supporting the linkage between them. Consequently, new insights can be gained. Redundancy can be induced artificially with the help of e.g. job rotation.

5) required variety: indicates that to be able to adjust to new environmental conditions the organization needs a certain flexibility. This flexibility indicates the existence of many different information or employees holding knowledge to allow for new combinations

instead of being stuck with a limited set as e.g. available with homogeneous staff. This prerequisite also includes avoiding strong hierarchies and a change in organizational culture.

With the SECI model a general idea on the processes relevant for knowledge creation within the enterprise is provided and an emphasis on the organizational support is given. However, an discussion of technical support is not provided but the focus remains on the individual. Hence, the model can be considered elementary for further approaches to KM in an organization regardless of the technical use. For SMEs it furthermore shows and explains that knowledge can be transferred, though being mostly tacit.

3.2.3. The Building Blocks of Knowledge Management

The building blocks of knowledge management is a KM model widely accepted in the German speaking research community. It describes the phases to be accomplished or meassures to be taken for KM application within an organization. The work leading to this model by Probst, Raub and Romhardt [PRR06] therefore analyzed multiple case studies. The focus of the model lies completely on the organizational layer, omitting the process between individual employees. The building blocks described in this model concentrate on the externalized knowledge and hence on the overall knowledge available in the organization. As displayed in figure 3.4, the building blocks are 8 parts of the model to be passed through usually starting with the block in the upper left corner: knowledge goals.

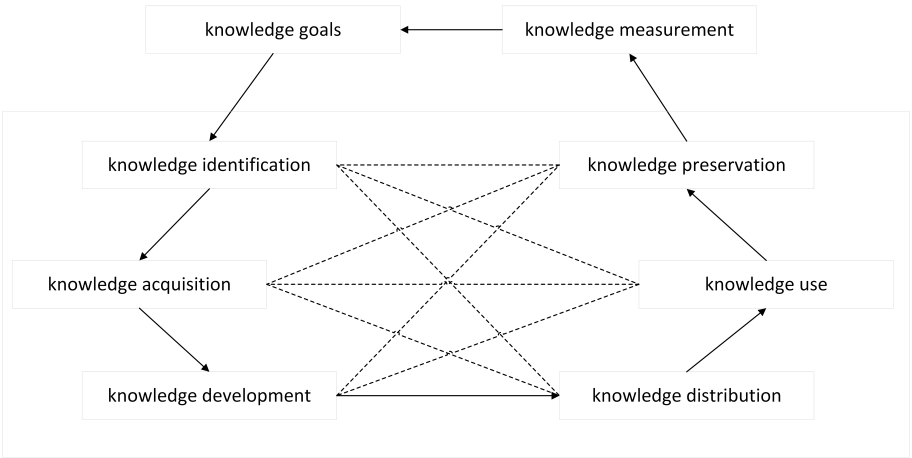


Figure 3.4.: The building blocks of KM

These knowledge goals are supposed to be derived from the organizational goals. The step is part of the strategic cycle of the building blocks model, whereas the operational cycle begins only with the next building block of knowledge identification. Having set goals, the organization moves on to knowledge identification, which covers the knowledge

already in the organization, as well as the identification of knowledge outside the organization. This results in the identification of knowledge gaps which are to be filled by the help of KM. At the end of this block the decision on whether to make or to buy new knowledge has to be made, since it determines whether to enter the block of knowledge development and/or knowledge acquisition.

In the block of knowledge development the organization tries to gain new knowledge by its own research and development without buying it as it is done in knowledge acquisition. The decision however, should not merely be based on the costs but has to take into account strategic issues as well. These are e.g. whether the organization wants to communicate, that it is lacking certain knowledge or if the knowledge needed is considered part of the core competencies. In case these issues are relevant, the own knowledge development should be done despite the higher costs of it. When considering knowledge acquisition different choices can be taken: namely whether to hire people permanently or for a restricted period of time, buy products or documentations or let someone else do the research necessary. Consequently, a mixture between development and acquisition is possible, namely in the various stages of contract research.

By passing through these block, new knowledge is entering the organization. Yet, once it is there, it has to be distributed to the right people, which is the issue of the building block knowledge distribution. The next block is covering the practical application of the new knowledge since only because it is available, it is not guaranteed that it is used by the employees due to a number of barriers involved. These have to be addressed, e.g. the fears of the employees of new ideas, or the "not invented here syndrome". In the operational part of the cycle described by the building blocks of KM the knowledge preservation follows at last. Here the decision has to be made what knowledge needs to be preserved in which way (documentation, mentoring) and also what knowledge is obsolete and should be forgotten (cleaning knowledge bases). The consequences of a badly maintained knowledge base can be illustrated as shown in figure 3.5. There it can be seen that the condition of the knowledge base influences the trust in the available knowledge and information, which influences the use and consequently further investments to be made. Remaining the operational cycle of the model only this building block should be followed again by the knowledge identification.

In the strategic cycle knowledge measurement has to follow, which means evaluating whether the knowledge goals set at the very beginning were fulfilled or not. Moreover, this building block also closes the cycle leading back to the knowledge goals which eventually are to be adjusted or asking for new goals in a new cycle.

Though offering a good systematic overview and being intuitive the model of the building blocks for KM does not include statements on the technical support of the individual blocks. Certainly it is possible to reflect system support upon the individual blocks yet it is hardly possible to do this without repetitions in the systems, as most systems are able

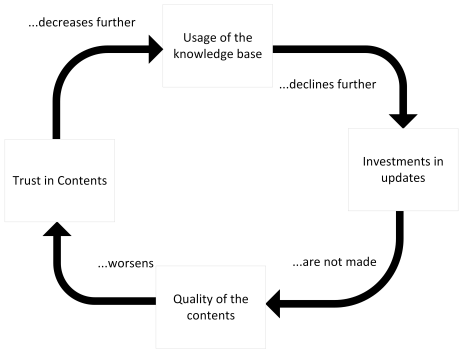


Figure 3.5.: The vicious cycle of an electronic data base [MA96]

to support more than one block of the model, e.g. wikis might help for knowledge identification, as well as distribution, knowledge usage and knowledge preservation [vdOH03]. Moreover, it lacks approaches for practical implementation [Nor16]. Further success factors for KM as provided e.g. by [YW05, CC06, LW11, DDLB98, MMMC12] consequently can be assigned to the individual dimensions.

Though being used often, this model does not specifically address SMEs, nevertheless, the building blocks of knowledge management provide an overview on the necessary tasks to be accomplished.

Though neither the SECI model nor the building blocks of knowledge management directly address the support with IT, they very well illustrate the KM processes working within the organization seeking KMS support. Hence, to be aware of these mechanisms is necessary in order to align the IT activities to the organization. Moreover, these models are widely spread so most people concerned with KM have come across them. The alignment nevertheless, has to consider different aspects, which can be summarized with the TOI model. This is described in the next section.

3.2.4. TOI Model

Besides the mere IT related activities being the centre of attention for this PhD thesis, the field of KM demands to cover more than the introduction of new soft- or hardware. Though this might be one way to introduce KM and consequently a KMS to an organization [Nor16, HNT00] according to e.g. [BWP98, HR07, BFL13], the whole organization and all personnel has to be involved as well to ensure a balanced, well established KM within the organization. Consequently, the dimensions which the TOI model [BWP98, RD08] holds, are “technology”, “organization” and “individual” as the three dimensions influencing the success of a KM initiative including technological support.

The three dimensions span a triangle as shown in figure 3.6. The “technology” dimension includes every issue connected to IT, however, technology should not be applied arbitrarily, but be adjusted to the organizational demands. These support possibilities demand an

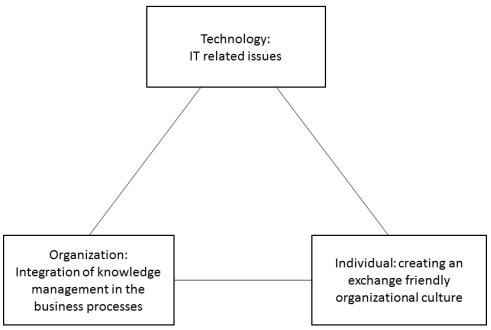


Figure 3.6.: The TOI model as suggested by [BWP98]

integration into the logic and architecture of the already running organizational systems. As a consequence, this dimension also covers the issues of data management, data security and data integrity. One possibility to address this concern, is e.g. introduced by using an appropriate architecture for a KMS or more generally to focus on user-friendly systems and prevent the status of "yet another system".

The next dimension of "organization" is to support the knowledge acquisition, storage and transfer in the organization. This includes all measures to be taken for integrating knowledge management in the organizational structures and the existing process organization [RD08]. For example this dimension addresses the management support to be provided for a successful integration as there are "leading by example" or the provision of incentive systems. However, it has to be considered, that rewards, appreciation and trust a the driving forces in organizational culture [vL09].

Finally, the last dimension focuses on the "individual", the employee, the human being working with the knowledge within the organization. These individuals form the culture of the organization, which itself is the factor influencing the knowledge flow within. Only with an adequate design of the measures for the organizational culture, the participation and willingness of the employees to perform and engage in KM is ensured and facilitated [RD08, BWP98]. The model stresses the fact, though being rather minimalistic, that KM has to be regarded an approach that integrates all three dimensions [GBV+09, SL08]. The model also emphasizes that KM is not be regarded as a sequential process but for a successful implementation the interdependencies of the dimensions have to be taken into consideration [MR01].

3.3. Knowledge Management Systems

As with all terms in the field of KM, knowledge management systems are not clearly defined. However, being part of the technical dimension of KM, KMS refer to the class of

information systems. As such [AL01] define them as follows. "*Knowledge management systems (KMS) refer to a class of information systems applied to managing organizational knowledge. That is, they are IT-based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer and application.*"

Another definition on the term extending the one above is delivered by [Mai07]: "*A knowledge management system is an ICT system in the sense of an application system or an ICT platform that combines and integrates functions for the contextualized handling of both explicit and tacit knowledge, throughout the organization or that part of the organization, that is targeted by a KM initiative. A KMS offers integrated services to deploy KM instruments for networks of participants, i.e. active knowledge workers, in knowledge-intensive business processes along the entire knowledge life cycle. Ultimate aim of KMS is to support the dynamics of organizational learning and organizational effectiveness.*"

In both definitions it can be seen, that the term is closely related to information systems, which are to be applied for the means of knowledge management on the organizational knowledge base. The difference lies within the embedding of the systems: Maier puts them in a direct context with an overall KM initiative, whereas Alavi and Leidner simply name the tasks to be accomplished with the system. This might be due to the times of publication as the awareness for the holistic concept of KM and KMS rose during the early 2000's and is nowadays resembled in models as e.g. the TOI model [BWP98, RD08] or success factors [YW05, MMMC12] or KMS architectures as described by Riempp [Rie12].

As with the definition on KM, also for KMS the viewpoint of the tasks to be fulfilled or the functionalities to be offered can be taken. When summing up definitions and architectures of possible KMS, Lehner [Leh10] presents the following functionalities to be fulfilled by such a system. These lists can be enhanced or hold items differently described by other authors, however it provides an insight on what is expected from a KMS.

- identification of knowledge
- knowledge acquisition
- knowledge development
- knowledge distribution
- search and reproduction of knowledge
- storage and preservation of knowledge
- administration of knowledge
- disposal of knowledge
- logistics and knowledge evaluation

Since this work is concentrating on the general perspective of the IS support within KM activities, the system support in general had to be covered as well. Due to the manifold applications available claiming to be support for KM [Leh10, BFL13] categorization of the support was needed. Due to this and following Riempp's statement that a KMS architecture can provide a description on the KMS functionalities or an orientation for structure,

analysis and comparison [Rie12] this work proceeds with the introduction of a KMS architecture for further orientation on KMS. The general objective of KMS architectures according to [Leh10, p.277] is to provide an abstract model defining all prerequisites or components in need to be able to introduce a KMS in any organization. Consequently, the generic KMS architecture model as introduced by Maier [Mai07] is described here since it presents functions to deal with explicit knowledge as well as with tacit knowledge [GBV+09]. Nevertheless, KMS are often implemented to work as an enabler of KM [Nor16, Ste11], yet they should always be considered in combination with the people-oriented measures to be taken.

KMS Architecture according to Maier

Though several architectures [GBV+09, Leh10, HR07, AM98] in a wide variety exist for building KMS, not one of them is accepted as a general standardized version. In general it is more like the architectures are extracted after the establishment of a certain system. Nonetheless, several architectures provide an entry point for the design of a new KMS. Consequently, after the process of review within this work, the one provided by Maier [Mai07, MR07] as a general architecture to describe the idealistic central KMS, depicted in figure 3.7, is used. It is compared to [HR07, Rie12, AM98] the one mostly concerned with the mere technical implementation of such a system. [Rie12] in contrast depicts the organizational framework in which such a system can be embedded, whereas [HR07, AM98] leave out the degree of detail as offered by Maier. An overview on two further architectures is provided in figure 3.8.

The architecture presented holds 6 layers which are to be addressed by individual applications or within an overall IS. Maier presents his approach as service-oriented, based upon a process-oriented view of KM. [PHM09] The central layers of the architecture with regard to KM, are situated in layer 3; the knowledge services and layer 4; knowledge integration services. The other services are not specific to KM but can be found in manifold architectures, resembling especially the general portal architecture [Leh10, BFL13, San05].

The knowledge integration services are as such meant to provide the integration of diverse knowledge resources to be found attached to the system, by the sixth layer. This integration is especially addressing the content-wise integration on a semantic base. This includes the application of ontologies and taxonomies to create semantic interrelations between the documents at hand. Even more important for the actual knowledge management is the layer of the knowledge services, where Maier names 4 services to be addressed by a KMS which represent the 4 core knowledge functionalities “discovery”, “publication”, “collaboration” and “learning” [Mai07, p.320]. He does not state this composition as complete nor does he not allow for addition upon them. Anyhow, he considers publication, discovery, collaboration and learning as central for the establishment of a KMS in an organization. For each of the services he redefined several tasks to be fulfilled, which are introduced in the following paragraphs.

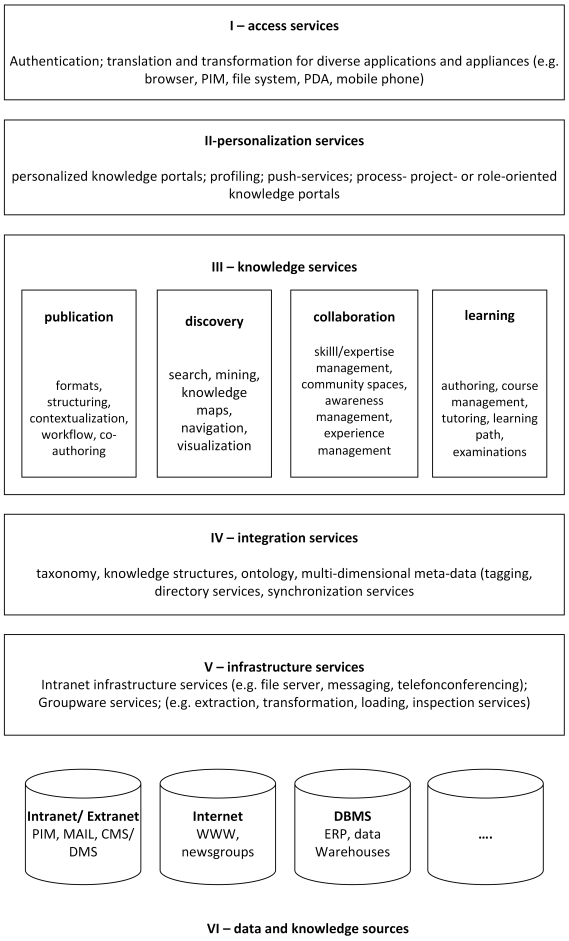


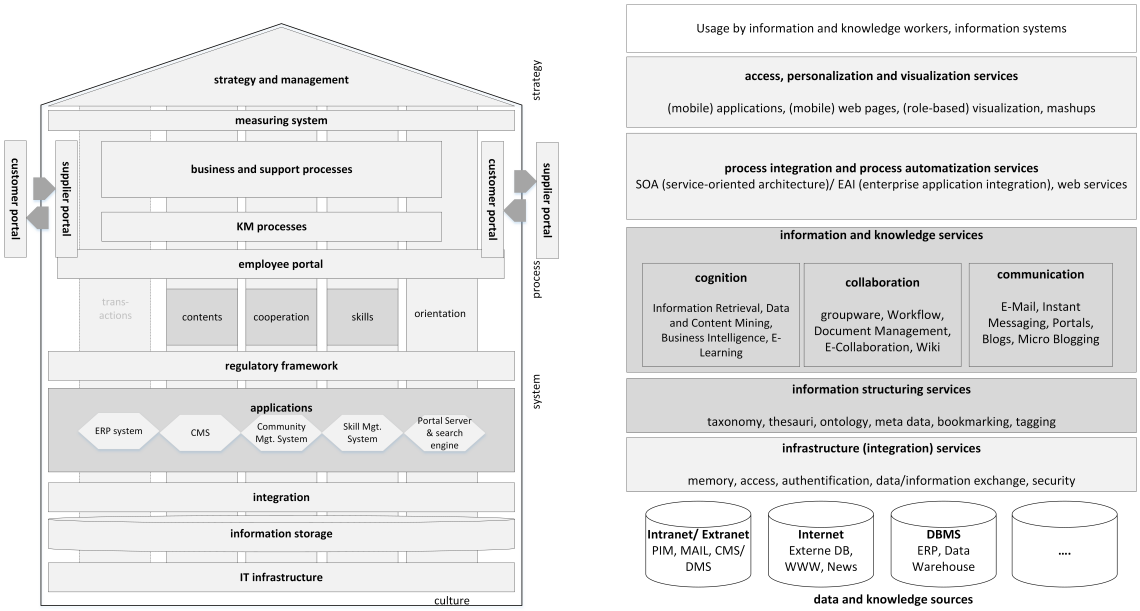
Figure 3.7.: Ideal architecture of a KMS according to [Mai07]

Publication

This knowledge service suggested resembles the input-orientated part of the system. Considering this the service of publication consequently is implementing two main functionalities; on the one hand that is the mere knowledge publication in means of e.g. writing or filming, providing formats and formatting, and pushing the created object somewhere to be found. And on the other hand this service covers the structure behind publication, namely knowledge organization. This includes e.g. the file structures, the attachment of correct and sufficient meta data, the rights organization and the versioning.

Discovery

As a complement to the publication service discovery focuses on the output-oriented part of the KMS. The mechanisms in use can be divided into pull and push, pull indicating that each information is retrieved by the users initiative, whereas push services are activated once and keep on delivering contents until the user stops them. Within this service concentrating on search, retrieval and the presentation of the according elements 5 main



(a) KMS Architecture according to [Rie12]

(b) KMS Architecture according to [HR07]

Figure 3.8.: Different architectures containing knowledge services

functionality groups have to be covered. First, there are the primary search functions, covering the actual retrieval and keyword search as offered to the user. These are complemented by search support functions, easing the search for knowledge elements, as there are thesauri, presentation/indication of new elements, search assistance and statistics on the elements. The next functionalities center around the presentation of the knowledge elements before and after the actual search. With representation before and after search the means of previews, grouping and ranking is covered. Finally, the whole complex of discovery asks for reporting.

Collaboration

Keeping in mind that knowledge and its transfer are strongly interconnected with the interaction of people for the means of transfer as described in the SECI model (see section 3.2.2, communication and cooperation are of central interest in a KMS. Both should be supported within to facilitate the personal exchange between the users. This service is hence strongly connected to the field of CSCW (computer supported cooperated work). As a consequence, two fields of interest are covered in this service, namely asynchronous and synchronous communication and cooperation.

Learning

This service orients towards the internalization of the existing explicit knowledge into the employees minds to put the knowledge into work. Accordingly, it is responsible for

the integration of CBT (computer based training) and e-learning within the KMS. As collaboration before this service has a synchronous and an asynchronous set of functionalities. This covers for the support of the whole learning process including the authoring of contents up to the control questions.

Though a complete idealistic architecture as provided by Maier, is not designated for the implementation in SMEs with their sparse resources, the knowledge services should be noted as the core tasks for systemic support of an KM initiative. They consequently provide a means to name the support in need within the organization.

3.4. Benefits and Success of KMS

Like every organizational management discipline, knowledge management has to answer on the value or the benefits that are added to the organization by the application of certain management measures and solutions. The answer on the utility is actually needed for the measurement of the results, as e.g. suggested within the building blocks of KM in the last block of the knowledge measurement. The objectives in the measurement are however manifold as there are "*securing funding for KM implementation, providing targets and feedback on implementation, assessing implementation success and deriving lessons for future implementation*" [KT04]. Yet, before dwelling on the possible solutions for the measurement in the context of KMS this section is to provide the general discussion on benefits and value as the outcome of activities. Afterwards the models of relevance for application on IS and KMS evaluation and success prediction are presented.

3.4.1. Value and Benefits

According to the Webster's Dictionary [weba] value can be discussed from the angle of three different disciplines: accounting, economics and marketing. Following the accounting perspective value describes the "*the monetary worth of an asset, business entity, good sold or service rendered*". Consequently, this discipline describes with monetary terms the outcome to be expected or achieved by the usage of an asset, which in case of this work would be a KMS in the context of KM. Though this monetary term to be generated appeals as e.g. the return-on-investment such value is difficult to be created for knowledge in general and KMS in specific as they are considered intangible assets [Sve97, GT07, NPR98]. Nevertheless, attempts have been made to address this issue especially since the factors for success of a KM/KMS activity should be known and considered in advance. The field of KM evaluation consequently contains two perspectives [FS04]. The first one focuses on the idea of Intellectual Capital (IC), concentrating on the non-physical so called intangible assets of organizations. The approaches to be mentioned here are according to [RD08] e.g. the Skandia Navigator, Balanced Scorecard [KN96], Tobin's Q or the Intangible Assests monitor. The intellectual capital measurements are focusing on the intangible assets and the monetary value of knowledge to the organization by estimating the human capital,

customer capital or structure capital [AH03] in which the knowledge is embodied.

The second perspective for KM evaluation, that has emerged, focuses on systems managing knowledge and accordingly measures contributions of according systems or initiatives to a organization's success. The integration of these became necessary since even knowledge systems are supposed to regard "success factors, effectiveness metrics, and key performance indicators to assess the systems' success and usefulness" [JC12, p.1]. These knowledge management measurements have a wider focus than the mere accounting perspective presented above. They therewith go beyond the intellectual capital measurement and contain performance issues, knowledge sharing and gap assessment [AH03]. Though this perspective strongly focuses on technical support, the definition of the term success should however not be restricted to the technical effectiveness, in addition success usually holds for the terms success and effectiveness [JSC09]. Within this category the approaches of the IS and KMS success can be located as perceived value approaches [WS04].

Coming back to the theoretical definitions of value, two more viewpoints dealing with value have to be considered. On the one hand there is the economic value discussion, stating that value "*is the worth of all benefits and rights arising from ownerships*" [weba] of a good or service. The value origin can furthermore be described as one of two types. First, there is the utility of a good or service and second, the power of a good or service to command other goods. Since this work focuses on KMS as a supporting aspect in organizational KM only the first origin of value, namely the utility can be of interest here. Nevertheless, the economic perspective as well relates to the term worth which commonly is associated with monetary terms. On the other hand value is provided by the marketing discipline. There it says that "*value is the extend to which a good or service is perceived by its customer to meet his or her needs or wants*". Consequently, this perspective can also be described as perceived value. For mere marketing issues the value however is associated with the amount of money a customer is willing to spent on the good or service [SFIB07].

The value though being hardly thoroughly defined [SFIB07] is usually named to justify an investment decision, as is the benefit to be expected. Both terms express the interest in the success of the investment. In the context of KM however, the question arises by which degree certain aspects as e.g. conversation necessary for the knowledge transfer can be expressed in numbers. Subsequently, already the titling of benefits to be expected can be considered an expression towards the value of KM initiatives. For value to be created with a system furthermore holds, that benefit [Gil05] is when some perceived value is actually produced by a defined system. In addition, Gilb [Gil05] also states that value is relative to the stakeholder. Since KMS are also systems this value conception can apply and following characteristics of value are relevant, namely the value being relative to the stakeholders and hence connected to the individual perceptions. Consequently, the actual value sums up the benefits perceived by the stakeholders based on its utility. This research work is related to the business value of IT, which has been manifold discussed and allows for different categorizations. According to [WS04] there are process-oriented approaches,

perceived value approaches, the information economics approach and further performance indicators.

Since this thesis is settled in the field of IS, we concentrate on the definition of value as given in the context of system engineering, investigating the possibilities to determine an KMS' success. With the scenario in the SME and the value as discussed above this thesis focus on the perceived value approaches. Consequently, the value is approach as a perceived value. To avoid the confusion with the monetary related term unit, in the following the term "perceived benefit" is used, related to the following characteristics:

- related to the individual perception
- relative to the stakeholder
- independent from monetary measurement
- produced by the system under discussion, context-dependent

Applying these characteristics within this PhD project means, that benefit-oriented focuses the perceptions of the user and hence can in combination with their demand show potentials in application of a system. The demand in this case is indicating what the employee needs or wants, and hence the fulfillment of these demands is creating benefits perceived by the employee.

Using perceived benefits approaches as a matter to describe the success of a system, special models on the success of Information Systems (IS), KMS in particular can be found. Assuming that KMS are based on Information Systems as e.g. indicated by the definition of the term KMS provided by Maier (see p.86), the IS Success model [Del03] and its KMS adoptions [JO06, Mai07] offer a promising approach to evaluate KMS success. The models introduced in the following sections avoid the length of organizational controlling, asking for a measurement in monetary units. This measurement usually is difficult due to the intangible character of the good knowledge and the manifold effects to be expected from the implementation of such a system and its integration, which prevents a direct assignment of made investments [RD08]. The value gained from the use of a system consequently hardly can be named in monetary terms, but creates immaterial values [KRF06]. Subsequently, effects of such implementation can be perceived by the system user, and with this consideration focuses on the actor in the system, since a system independently cannot be successful. Those effects resulting in positively perceived benefits are necessary to grant the system success and keep it running on a high quality level [JO06].

3.4.2. IS Success

In 1992 Delone and McLean first published their work on IS Success and the according model, revealing the categories relevant for the establishment of an information system. The work was widely accepted, critically as well as applied to real cases. The amount of feedback on their initial model introduced Delone and McLean to an update on their work. The first version of the IS success model can be seen in figure 3.9. In figure 3.10 the updated version of Delone and McLean's IS Success model from 1992 is displayed showing

the refinements done after that very review of their own model in 2003 [Del03].

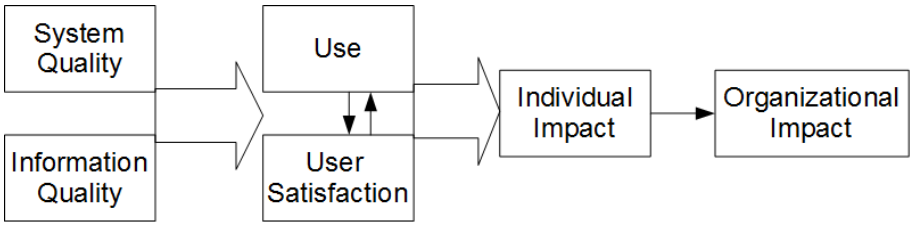


Figure 3.9.: Initial IS Success model according to [Del03]

The IS success model is a generalized framework providing different dimensions of success to be adapted by researchers for specific contexts. The model in general can be distinguished into three levels. The most general level of "system and service" includes information, system and service quality, categories for the development of an IS. Upon this level the level of "use" follows holding the intention to use, the use itself and the user satisfaction showing the categories interesting for deploying such a system. Finally, the third level displays the impact resulting in the "net benefits", being the delivery level. Consequently, the second layer includes and visualizes the perceived benefits. The assumption hence is, that if a user is satisfied with a system he is willing to use the respective system for further actions. The actual intention to use the system also arises from the system and the support it can offer to the user and in which quality it is offered. The distinction between "intentions to use" and actual "use" was made to reflect that a system may not be in permanent use however is perceived useful. Both aspects "use" and "user satisfaction" are measured on the individual level, but can be summed up to the net benefits perceived in the organization or organizational unit. These added benefits can be positive as well as negative and reflect back on the individual user satisfaction and use, leading to a circle indicating that the organizational perception influences the individual one. With their own review done in 2003 [Del03] the authors show the relevance and the adaption of their model within the research community and allow themselves to adopt to the critique provided by other researcher. Thus they enhanced their model in the category "use" and "intention to use", which formerly was "system use" only, as well as the back links from the "net benefits" to the categories of layer 2. Though being used for all kinds of IS the IS Success model in its upgraded version was considering e-commerce solutions in particular. Yet, the author support and demand further adoptions to the specifics of other application classes as e.g. done with [RS08].

In [SR11] systematic literature research was done on the use and state of research on IS success revealing, that few multidimensional approaches are available and the one of DeLone and McLean is the most prominent and most often used. Two of the adaptations are presented in the following concentrating on the adaptation towards the specifics of KMS, allowing narrowing the existing model down to the application in the field.

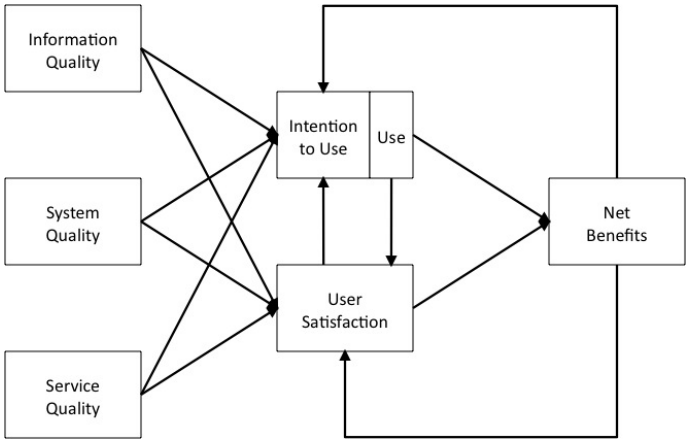


Figure 3.10.: IS Success model according to [Del03]

3.4.3. KMS Success

In [JSC09] several reasons for the necessity of determining the success were given from the practitioners perspective, as there are to allow for the organizations evaluation, to narrow down the management focus and to provide reason for investments in KM activities. In that paper it was also shown, that especially practitioners see KM(S) success strongly interrelated with the organizational effectiveness. Since KMS can be considered specialized IS and even definitions of KMS refer to them as ICT [Mai07] or IS [AL01] in a special purpose the application of the IS Success model is justified. Anyhow, Delone and McLean [Del03, DM92] designed their IS Success model the way it should be adopted and refined to specific system classes, as there are KMS. These kind of systems as a category are referenced with a sufficient amount of characteristics demanding further refinements in the model. The initial adoption done by Jennex and Olfman is presented in figure 3.11. The model developed by Jennex and Olfman first in 1998 as a reaction on the first IS Success model was published as OMIS Success model. OMIS stands for organizational memory information system, and reflected the fact that the model aimed at the evaluation of an organizational management platform. This however was changed to KMS agreeing that OMIS actually are the same as KMS which actually is also approved by [AL01]. Through the years and by the stronger focus on working knowledge through IS in organizations, the model evolved into the KMS Success model as shown in fig. 3.12. The later model also includes the revisions published by DeLone and McLean in 2003. In the initial model version it can be seen how “system quality” and “information quality” affect “user satisfaction” and “amount of use”, which combined are the “individual impact” leading to the “organizational impact”

The renewed model (first [JO04, JO06], finally [JO09]) itself addresses knowledge instead of information without neglecting the fact, that knowledge usually results from it. Accordingly, the category “information quality” changed into “knowledge/information quality”.

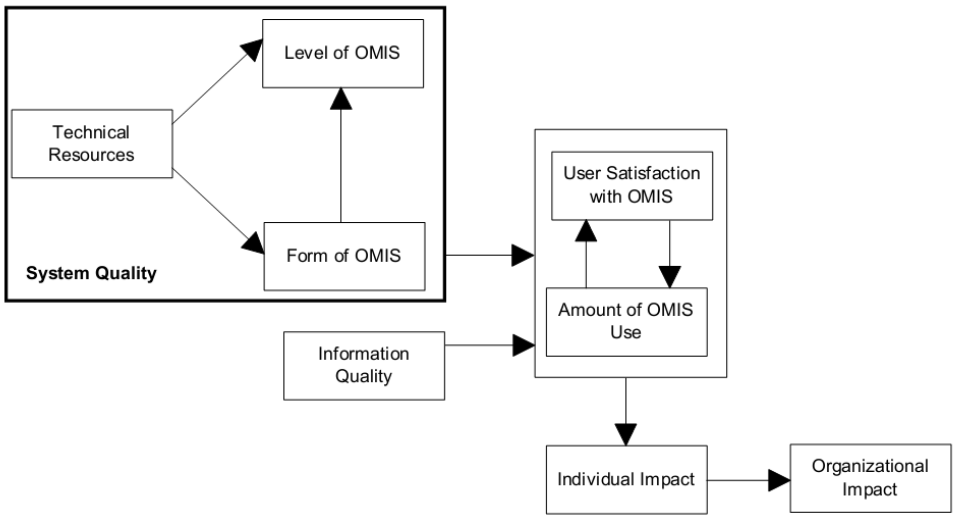


Figure 3.11.: OMIS Success model according to [JO06]

Furthermore, the authors create another differentiation on the level of use. According to their model "use" and "user satisfaction" belong together, whereas "intention to use" goes together with the newly mentioned "perceived benefit". The reason for this shift lies in the findings of their research, since Jennex and Olfman have found that the actual amount of usage is a bad indicator. This stems from the fact, that though mail might be used regularly up to daily, other systems might by not, however are not less useful. Consequently, they chose to combine the use with the satisfaction actually gained through the use. On the other side "Intent to use/ Perceived Benefit" is the dimension collecting the actual benefits experienced. The intention is to employ the perceived benefit model of [THH91]. As a consequence, this dimension collects all social factors affecting KMS use, as there are "perceived KMS complexity, perceived near-term job git and benefits of knowledge/OM use, perceived long-term benefits". This dimension is also included for the prediction of further use of the system.

Another addition displayed here is the refined granulation of the categories on the level of "system and service". Within the categories essential interconnections and elements were added, providing a more precise idea of what is to be done to ensure the success on the different levels. Still the model aims at a wide field of applications and allows for further refinements and individual configuration for the actual success to be determined. One of these adoptions of the model to the field of social media applications was delivered by Smolnik and Riempp [SR06] showing the way towards a more concrete investigation on the benefits to be expected of the application for such system. As an additional refinement to the existing model [SR06], as well as [JSC09, ROB07, RS08], name different indicators and methods for evaluation the categories of the model allowing for a more profound understanding of the design of the categories and their application. These indicators

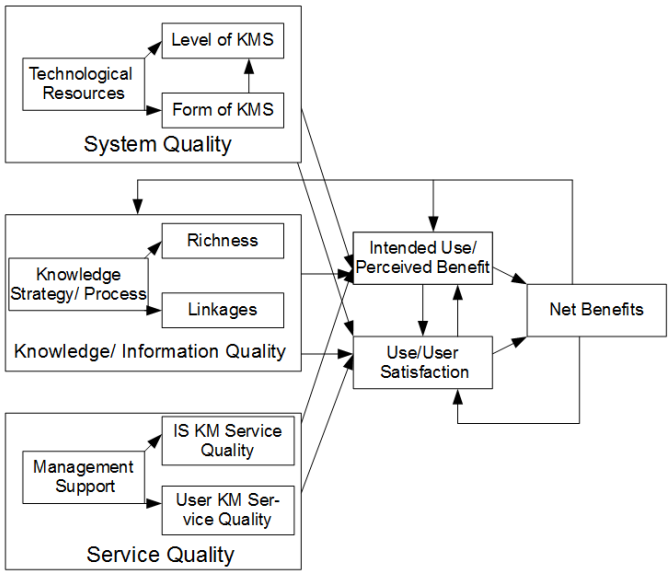


Figure 3.12.: KMS Success model according to [JO06]

listed in [JO06] are provided in table 3.4.3.

Having a closer look at the suggested methods to capture them, it can be seen, that these are mostly related or known from the field of empirical studies. These criteria and the method compilation are supposed to provide other researchers with a possibility to practically ascertain data on the success dimensions.

3.4.4. Success of Knowledge Management Systems

Another adaption of the IS Success model was provided by Maier and Hädrich [H+01] shown in fig.3.13. However, this is based on the initial IS success model from 1992 since it was created before the revision of the DeLone/McLean IS Success [Del03] was published. It was not revised with the renewal of the DeLone/McLean Model.

The extensions can be found by the addition of "knowledge quality", "knowledge specific service" in the first level and "impact on collectives of people" in the third level. With the knowledge quality Maier choses the same way as Jennex and Olfman namely the inclusion of information quality with the knowledge quality. Furthermore, Maier included communication quality into that dimension being the underlying principle for the possible transfer of information and knowledge. When extending the category knowledge specific service Maier did not directly aim at technical implementation of the system but of the systematic support such a system should experience from the organization. In detail the author is looking for the support in roles as e.g. knowledge broker, field specialists to be established within the organization under consideration.

However, the approach of the perceived benefit also supports the combination of tech-

Construct	Data Collection Method
Technical resources	User competency survey, observation and document research of IS capabilities, interview with IS Manager on infrastructure
Form of KMS	Interviews and survey of knowledge sources and form
Level of KMS	Survey of satisfaction with retrieval times, usability testing on KMS functions
KM Strategy/Process	Survey on drivers for putting knowledge into the KMS and for satisfaction with the knowledge in the KMS, check on if a formal strategy/process exists
Richness	Usability test on adequacy of stored knowledge and associated context, interviews and satisfaction survey on adequacy of knowledge in KMS
Linkages	Usability test on adequacy of stored linkages, interviews and satisfaction surveys on satisfaction with linkages stored in KMS
Management Support	Interviews and social factors of Thompson, Higgins, and Howell's survey on perceived benefit
IS KM Service Quality	Interview with IS manager on IS capabilities. Interviews with users on needs and capabilities. Suggest adding user satisfaction survey on service issues
User Organization KM Service Quality	Interview with user organization KM team on capabilities and responsibilities, and needs from IS. Interview with users on needs and capabilities. Suggest adding user satisfaction survey on service issues.
User Satisfaction	Doll and Torkzadch (1988) End User satisfaction Measure, any other user satisfaction measure
Intent to Use /Perceived Benefit	Thompson, Higgins, and Howell's (1991) survey on perceived benefit
Net Impacts	Determine individual and organizational productivity models through interviews, observation, tend to be specific to organization

Table 3.1.: Indicators for the KMS Success model dimensions according from [JO06]

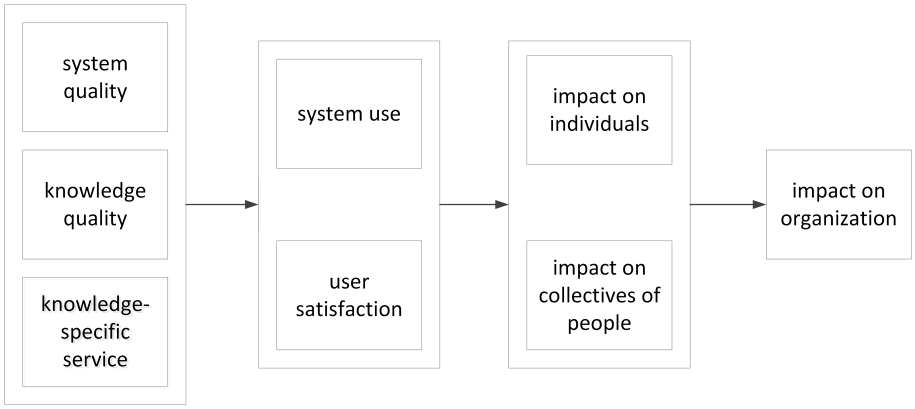


Figure 3.13.: KMS Success model according to [H+01]

nology and employee focused approaches for successful KMS, since the combination of both provides better results [YWA05]. Nevertheless, the model lacks the adoptions of the 2002 IS Success model remains with unidirectional influences and neglects the back flows.

With the discussion as presented here, the perceived benefits are the concept to be applied for the target group of SME. The KMS Success model of Jennex/Olfman therefore provides a valid construct to determine the benefits of a KMS and furthermore with its categories determining the success delivers issues to be regarded under implementation to ensure these benefits.

3.5. KM(S) for SMEs

With this section a short overview on the specifics of the target group of SMEs is provided. This is relevant for this thesis to explore the field of action, and its significance. With this section it is furthermore shown, that KM for SMEs has already been considered, however has not addressed the benefits.

3.5.1. Small and Medium Enterprises

Having a look at the term of small and medium enterprises (SMEs) it has to be recognized, that these can be differentiated in quantitative terms as well as qualitative terms [Kno09]. Although they do not provide a standard definition, EU guidelines [SME03] distinguish SMEs with the help of two quantitative characteristics. The two attributes in use are number of employees and annual turnover. With regard to the annual turnover. it is stated that the value of the balance sheet can be used instead, and consequently one or the other has fulfill the desired criteria. One of these two and the amount of employees must be met, one attribute of these does not suffice for the classification of an SMEs. Accordingly, an enterprise with less than 10 employees is a micro enterprise as long as the

enterprise's turnover is not larger than 2 million Euro per year. This indicates that an enterprise with 10 to 49 employees and a turnover of 10 million Euro (same value holds for the balance sheet) is considered a small enterprise. Moreover, a SMEs with 50 to 249 employees and an annual turnover of 50 million Euro (balance sheet: 43 million Euro) is a medium enterprise. In Germany additionally to SMEs the term "Mittelstand" [mit02] exists, which also counts enterprises with less than 500 employees into the group of medium enterprises, as long as their annual turnover does not exceed 50 million Euro. The quantitative differentiation is especially simpler when regarding statistical or political evaluation and hence is used accordingly [Kno09]. Anyhow, SMEs cover [PGHP06] a large amount of different branches of industry, commerce and crafts as well as many regional differences. The quantitative categorization therewith certainly is a pragmatic procedure holding few characteristics. The number of employees is supposed to show the enterprise performance, yet this only holds partially with increasing capital intensity and technological development. The annual turnover is however, directly related to the enterprise performance, yet for comparison the turnover per employee offers a more significant value. In addition to the two criteria the independence of the regarded enterprise from other enterprises is to be taken into consideration. Linked enterprises and partnerships count as one enterprise since these most often develop in the same line of thought and all parts contribute to the performance.
Other than in Europe no standard definition of SMEs exist, accordingly comparison is difficult. In the United States e.g. [SBA16], the enterprise qualifies either by returns or number of employees according to the branch. Furthermore, the term in use is small business instead of SMEs. The reason for this difference can be found in the differences of the enterprise under consideration and the size of the country and its according economy.

As for the qualitative differences several types of enterprises and their management can be differentiated, as well as ownership, management structure, financial situation and sociological circumstances. Overall three general characteristic can be identified according to [Kno09]. First, there is the linkage between enterprise and entrepreneur, which usually results in the entrepreneur also the CEO or the enterprise, management, owner, liability and risk all come down to one person. Accordingly, the entrepreneur characterizes the enterprise and is part in all enterprise political relevant decisions. Second, there is the weak hierarchy in the SMEs which is accompanied by an easy consensus between management and employees. Since most management tasks are concentrated on the owner and even single employees have a wider range of tasks to accomplish less, delegation can be found in the enterprises, which asks for an easier organizational structure. Anyhow, SMEs are said to have close and informal contacts among employees and with the management. Consequently, the owner/management can be considered closer [YWA05]. And finally, SMEs can usually be characterized as locally established, which means a certain closeness to the market and the customers as well as personal relationships. This usually is due

to the fact that the enterprise that the goods and services are done according to the individual preferences of the customers in close environment. Whether these criteria can be considered advantageous or not can be seen from table 3.2.

	Strength	Weaknesses
structure	• direct customer contact • productional adaptability • straightforwardness of the organization and the markets	• low market power • restricted resources in all areas • lack of costdegression
conduct	• decision flexibility • unbureaucratical organization • specific problem solving competencies • success depending on the qualification of the entrepreneur and few manager	• deficiency in organization and leadership • slim information base • stunted planning and controlling systems • failure depending on the qualification of the entrepreneur and few manager

Table 3.2.: Strength and weaknesses of SMEs [Kno09]

Though being small in the term SME have a certain impact in the economy. Following [Kno09], [SME03] SMEs are 99.8% of all enterprises in Europe, which employ 70% of all employees. For the economies this comes down to three factors: SMEs strengthen the competition. They cannot avoid the competition on the market due to their site, have in themselves a strong exit barrier due to the personal contact, since their are covering the niches they guarantee for a large variety in the offers and also work in marginal regions. Furthermore, SMEs stabilize economy as they are less intensive in capital and adopt faster and more flexible to changes. Finally, SMEs create a stable employment since being locally established with their branch in the region, which employs people and finances communes. Being less intensive in capital however, results in being [YWA04, YWA05, M$^+$02] shorter on resources as time, knowledge, expertise, as well as financial and human resources. The consequent managment of the according resources is hence important for SME [YWA05]. Regarding the use of ICT for SME [CHTLK$^+$07] suppose that it can provide SME with the access to innovation, marketing, efficiency gains, better quality and customer responsiveness.

3.5.2. Knowledge Management in Small and Medium Enterprises

KM in SMEs or small businesses has been a research issue for some time [SFS05, YWA05, WCC11, EKMP02, CC08]. With shortening innovation cycles and a stronger competition on the market, SMEs face the necessity to bring knowledge management approaches into their business operation [PGHP06]. This demands adoptions of the approaches mostly developed for larger organization [EKMP02], since SMEs in themselves hold a larger variety with regard to structures, problems, strategies and available resources. Through literature research it could be found that KM processes as well as critical success factors for KM have been identified.

As for KM processes, which were also a topic in the building blocks model [PRR06] or the SECI model [N+95], Fink and Ploder [DPFP09] identified 4 processes of interest for KM in SMEs: identification, acquisition, distribution/sharing and preservation. They claim these processes of highest interest for SMEs and hence narrowing down the number of processes known from the building blocks model [PRR06]. Nevertheless, the mere establishment of these is not central to KM in SMEs, without a culture of sharing in the according SMEs efficiency in KM cannot be achieved [DPFP09]. This is also reflected by the fact that social and cognitive aspects are said to accompany IT related activities in KM. With this statement a relation to general models like the TOI [BWP98] is given. The actual importance of KMS for SMEs is however arguable. Desouza and Awazu [DA06] e.g. claim that IS/IT is not to be included in the KM strategy of SMEs. Their findings emphasize the strong influence of all KM aspects related to socialization. Their work shows that knowledge in SMEs is to be practically applied and depends on social interaction due to the low amount of employees, instead of being stored in databases. They also justify this statement with the fact, that it is difficult to rely on something in which no foundation is given, consequently human and social aspects have to be considered first. With Wei [WCC11] the integration of these opposite opinions took place revealing that in the mixture face-to-face discussion is always preferred, but closely followed by e-mail. Besides the technology support the strong focus on social components indicates to affection to informal KM [HQ08]. Hence, KM is accomplished without formal terminology and structures. With regard to information processing in SMEs it can be observed, that SMEs have stronger issues with the so called information overload [Lam01]. This fact arises due to the limited amount of employees within such enterprises, which in combination with the overload results in problems with the appropriate goal-oriented processing of the incoming information as well as the permanently necessary adoption, storage and actualization of information in the enterprises knowledge base. Another problematic characteristic of SMEs is the often rather short-termed planning, as well as the lack of documentation of actions. In addition, SMEs, more than bigger enterprises, depend on the competencies and qualifications of every single employee [WLGM05]. Correspondingly, if an employee leaves the enterprise or retires without documenting and transferring relevant knowledge, gaps in the enterprise knowledge base occur, which might result in the loss of the necessary

competency head start.

Nevertheless, besides using a formal or informal KM approach, Wong and Aspinwall [YWA05] identified critical success factors for KM in SMEs. These were management leadership and support, culture, strategy and purpose, resources, processes and activities, training and education, HR, IT motivational aids, organizational infrastructure, measurement in descending order. Especially, the management leadership and support is to be emphasized relating to the concept of leading by example [RD08]. [YWA05] report that the management commitment form the foundation for a knowledge friendly culture, namely one encouraging KM initiatives. The actual culture to be knowledge-friendly is ranked second, and remains difficult to create since it has to encourage creation, sharing and application of knowledge. Moreover, every knowledge worker has the potential to lead to customer satisfaction and accordingly the organizations success [Fin09]. Consequently, [CC08] put forward a framework showing the interdependencies of structure, culture and technology for the implementation of KM in SMEs. The framework however, closely resembles the TOI model of Bullinger and demands a holistic approach for successful KM in SMEs, as do several other e.g. [DVM14].

Due to the existing specifics of SMEs relevant to KM approaches have been created to support SMEs in the implementation of KM, as e.g. [FLM+07, MS09, AHI+04, Tiw02, Mey05, Jas08], which are not all exclusively directed at SMEs. Yet, this shows that KMS use as a support is considered; however, not systematically included as recommended in e.g. [SL08].

3.6. Framework Fundamentals

Being confronted with the term "framework" to be presented as the outcome of the research work, a clarification on how this term is understood in the context of this thesis is to be presented with this section. The characterization hence should be remembered for the discussion on the type of the artifact to deliver the desired support on the decision-making process on KMS in SME.

When searching for possible definitions manifold definitions can be found, but only a few are presented here to visualize how broadly this term can be interpreted in the field of information systems and in a more general context. This relates to the fact that different publications use the term in a different manner describing different outcomes based on the used definition. Starting with a general definition the Merriam Webster dictionary [web16] describes a framework as "*a basic conceptional structure (as of ideas)* ","*a skeletal, openwork, or structural frame*" or "*frame of reference*". Similar is the definition provided in the Oxford Dictionary [oxf16] describing a framework as "*an essential supporting structure of a building, vehicle, or object*" or the "*basic structure underlying a system, concept, or text*".

These definitions are given rather generally. Since KMS are settled in the area of IS the

focus of the framework definition is also to be set there. Consequently, the IT standards and organizations glossary [SOG16] denotes the following on the term of a framework:

"*In general, a framework is a real or conceptual structure intended to serve as a support or guide for the building of something that expands the structure into something useful.*"

However, frameworks are also known from social empirical work, where they are usually referred to as conceptual frameworks and Miles and Huberman (1984) [MH94] refer to the term as: "*a conceptual framework explains either graphically or in narrative form the main things to be studied - the key factors, constructs or variables - and the presumed relationships among them*". [Wie14] explains that a conceptual framework is intended to present the structure and context of an artifact as well as the phenomena in the artifact.

Yet, to provide such framework it has to be developed. The process for developing frameworks in the object oriented context must observe four important guidelines according to [Ada95]: first, derive frameworks from existing problems and solutions. Second, develop small, focused frameworks. Third, build frameworks using an iterative process driven by client participation and prototyping. And fourth, treat frameworks as products by providing documentation and support, and by planning for distribution and maintenance. Related to the framework development process it is finally interesting to note that as Opdyke points out [Opd92] one of the main characteristics of a framework is that it is designed to be refined, good frameworks are usually the result of many design iterations and a lot of work involving sometimes structural changes.
Examples of frameworks that are currently used or offered by standards bodies or companies related to IT systems include [SOG16]:

- "*Resource Description Framework, a set of rules from the World Wide Web Consortium for how to describe any Internet resource such as a Web site and its content.*
- *Internet Business Framework, a group of programs that form the technological basis for the mySAP product from SAP, the German company that markets an enterprise resource management line of products*
- *Sender Policy Framework, a defined approach and programming for making e-mail more secure*
- *Zachman framework, a logical structure intended to provide a comprehensive representation of an information technology enterprise that is independent of the tools and methods used in any particular IT business*"

Summing up these definitions it has to be recognized that a framework specifically depends upon the context in which it is defined or created. In all cases, it serves the purpose of providing structure to the field of interest. However, how this structure is given, as classes or explained contexts depends on the application background. Nevertheless, the frameworks provided above show the wide range of frameworks available in the field of computer science. Narrowing this down to the field of IS research only the Zachman framework

is of relevance, showing that frameworks within the field are mostly concerned with architectures or methods for the development of IS [Mat11]. The comparative work [Mat11] mostly concerns enterprise architecture (EA) listing general characteristics of frameworks in the field, namely being pragmatic, abstract and depicting providing guidance on the methods and tools to use for the development of an EA. Well known examples for this category of frameworks are TOGAF or ITIL. However, also the IS Success model (see section 3.4.2) is a designated framework addressing the measurement of the success in different dimensions [Del03].

Chapter 4

Problem Relevance

This chapter is about to present the data collected during the initial problem verification. It confirms the practical relevance demanded by design science research for the problem under research. Hence, it is going to illustrate, that the problem is active, has an impact and does not have adequate solutions available [EL08]. The problem relevance documents the values collection from industry and knowledge base revealing the gap in research to be addressed with this work. Therefore two surveys from 2010 and one of them revisited 2014, are described as well as the result of the systematic literature research conducted on the topic of KMS for SMEs.

This section documents the parts actually proving the necessity of the research conducted in further steps of the research process. Hence, it is documented in which way the research conducted is relevant. The steps presented therewith relate to the first process step for DS in IS research as introduced by Peffers et al. [PTRC07], the identification of the problem and the motivation. hence the section shows the practical relevance as well as the relevance with regard to existing theory represented in the knowledge base. To prove actual practical relevance the target group was addressed, to gather their needs and demands the application of KMS for SME. To generate the proof of relevance a written survey as a questionnaire (see section 4.1) was used, since it provides quantitative input, to actually justify the demands integrated in the artifact. Moreover, this survey provides a broader overview, when compared e.g. a qualitative approach with interviews. Due to the variety of SMEs with regard to their branch, but also organizational structure or technical affinity, a larger amount of interviews would have been necessary to create representative results as well. Hence, by the conduction of a survey it is eliminated, that the results are specific to the individual organization. In addition, to guarantee validity of the findings over the length of the research process the approach of a quantitative survey could be repeated (see section 4.2). The second survey on the social media use for KM, actually addressed all kinds of enterprises however, revealed a group of SMEs showing relevant results. This survey is associated to the topic via KMS architecture and the according knowledge services as introduced in section 3.3. Based on the knowledge services, which

can be implemented with the help of social software, especially wikis, social media software provides systemic support within a KMS. The results gained are shown in section 4.3.

In addition, the knowledge base in form of literature was addressed systematically. Therefore the approach is a systematic literature analysis according to [KPBB+09] was used. With the help of this SLA (see section 4.4) the knowledge gaps in the knowledge base were identified, and thus it was possible to determine were an actual support for SMEs could start.

Finally, a summary leads to the definition of the design objectives, which are the basis for the following design phase as the center of DSR.

4.1. Initial Survey: Knowledge Management Application in SMEs in Mecklenburg-Western Pomerania, Germany

The survey on knowledge management and its application in SMEs, especially in the form of knowledge management systems was done in the preparation phase for this thesis. The results were gathered within the Master thesis [Gra10] and partially published in [Bor11c, Bor11a]. The central research questions to be answered with this survey were:

- How are SMEs in Western-Pomerania dealing with KM?
- If KM is applied in the organization how was it introduced and which problems occurred during introduction?
- Which implementation strategy was used?
- How is the KM applied in the organization?
- Is a KMS used at all?

Setting

The written survey was conducted in form of an online questionnaire, with focus on SMEs only. For this survey only knowledge intensive SMEs in Mecklenburg-Western Pomerania, Germany were asked to fill out a questionnaire, which should provide us with a current state of the art in KM and especially focusing on IT support within these enterprises. The organizations were contacted via their official contact addresses retrieved from yellow pages. The survey took place in November and December 2010. The according questionnaire was provided via an online platform and the link was sent to 596 enterprises, which fulfilled the criteria of being knowledge intensive according to [LF06]. The actual distinction on whether the enterprise was a SMEs or not was made based on the amount of employees, since an inquiry on the annual turnover was unlikely to be answered, which would lead to further decreases in the response rate. The actual questionnaire used can be found in [Gra10] and was constructed following the recommendations of [Por08, SHE05] especially with regard to the implementation of scales. Though focusing on the area of Mecklenburg-Western Pomerania, the results were assumed relevant for at least Germany in general since the approximately same amount of organizations are categorized SMEs

as in Germany (2013: 99.5% of all organizations were SMEs in Mecklenburg-Western Pomerania, 99.3% in Germany). Besides the mere quantitative characteristics also the qualitative characteristics as described in section 3.5 are alike for both groups. Moreover, when considering the organizations in Mecklenburg-Western Pomerania, as well as the organizations in entire Germany, many of them can be categorized as "Mittelstand", where the actual owner of the enterprise functions as the chief executive officer (CEO). Consequently, the management structures can be considered alike. Summing this up, the SMEs in the survey are assumed representative for Germany in general. With regard to the transferability to SME in Europe, the reference to the qualitative enterprises has to suffice, which were agreed upon in the entire European Union [SME03].

Results

Out of these 596 enterprises 48 filled out the questionnaire, resulting in a response rate of 7,89% since one of the answers was given by an enterprise which could no longer be counted as SME. Before elaborating on the result of the survey one fact on the distribution over the enterprise sizes: 6 answers were gained from medium, 14 from small and 27 from micro enterprises. Since these numbers do not fully resemble the official numbers for the distribution of SMEs (micro: 88.84%, small: 9.02%, medium: 1.9%) for the area [mit16a], as well as the fact that the basic population is not sufficiently big, an evaluation according to the different groups is not presented here. Regarding the obtained general results several points were interesting.

- Firstly, 9 out of the remaining 47 answering enterprises employ a systematic KM approach.
- Secondly, only 5 out of these 9 enterprises use a KMS to support their activities. When asking for the system itself the answers were: Wiki, Sharepoint2010, One Note, SVN and MediaWiki.
- Thirdly, one of the enterprises answered that it uses several applications to support KM and these do not have the possibility to exchange data. The other enterprises at least have this opportunity enabled.
- Fourthly, though KMS need a certain amount of administration [Mai07, Nor16], not all enterprises have a dedicated person for this task (only 4 out of 5).
- Typical problems under KM introduction was a lack of communication (3), lack of incentives (3) and employee refusal (2). Furthermore it was described in an open item, that the adaption of the KM and KMS to the demand had to be done after the implementation.

With regard to these results, it can be concluded that most enterprises still are not familiar with the actual meaning of the term KMS as introduced by Maier, and assume

any possible application a KMS that supports their handling of organizational knowledge. This impression was intensified by the remarks on the questionnaire invitation provided via e-mail indicating that the answers were not understood or asking, whether information management is the same (3 mails). Moreover, a total of 80% of the enterprises in the survey do not practice KM at all. The survey also put forward the question on how KM if practiced was integrated by the means of goals into the enterprise and what was expected of the application. The obtained results here were:

- The most common answers on the expectations were transparency of knowledge, improving documentation, distribution of knowledge.
- When provided with a list of objectives, the participants considered almost every objective as very important, though the list contained 12 different objectives.
- When asked for the individual accomplishment of these goals, half the SMEs answered they achieved them to a high till very high degree, whereas the other half indicated this degree was low.

Drawing conclusions, it can be stated that SMEs are not fully aware which goals belong to KM and therewith focus on basic functionalities. And even more important, it does not seem transparent which IT solution matches which goal. Moreover, the relation to business goals was not made or at least it was not indicated by answers provided in the survey. So SMEs want to improve, want to add to their business value and know that IT can somehow deliver to it. Yet, which solution supports precisely which goal needs further clarification. regarding the question of how KM was brought into the SMEs the answers gathered were:

- Firstly, none of the enterprises could name a specific strategy as suggested in literature (e.g. [MS09, FLM+07, Mey05, JF08, Tiw02, AHI+04]) for their application of KM.
- Secondly, only one of the enterprises actually writes down its goal for KM, and surprisingly these were not even controlled. All other enterprises rely on general oral statements on the goals for their enterprises, and control them by a regular personal estimation. Only one enterprise tries to control success by means of indicators.
- Thirdly, on the terms of how KM and KMS were introduced into the enterprise 6 answers said as a project, the rest mentioned a top-down approach.
- Fourthly, given the question of how much time their employees use for the fulfillment of KM tasks, 8 out of 9 enterprises answered less than 10%, two stated that it were even said less than 5%. Given 40 office hours a week this means less than 2 hours.

Interpreting these results it can be seen, that KM had not reached the surveyed SMEs in the area. Some enterprises certainly got in touch with the concept and made up their own

idea about it, yet a consequent alignment of KM and KMS to the business strategy was not found. Comparing this with the most often mentioned goals of KM provided through the questionnaire like: raising transparency of knowledge, improving documentation and distribution of knowledge. One possible conclusion might be, that SMEs here are not fully aware of the concept of KM and the KMS and mostly utilize it for tasks which could also fulfilled by information management. This was also indicated by a minor sample (5) of telephone questionings to some participants putting forward the question what the enterprises expect from KMS or why they do not apply a KMS. The answers provided were "more important issues" (2), "value addition unclear" (2), "no time" (1).

4.2. Retaining Relevance: KM/S Application and Value Perception among SMEs

With this survey repeating the initial survey of 2010 a reevaluation on the up-to-dateness should be provided. Nevertheless, a shift within the focus of the survey towards the actual use and benefits of the implemented KMS should be done as well. The results were gained within a Masterthesis [Pap14] and can be found described in detail there. The conducted online survey concentrated on the following research questions. Since by that time the basic structure of the artifact was already set, the aspect of knowledge services was included in the survey.

- How are KM and KMS applied in SMEs?
- What type of systemic support (KMS) are applied in SMEs?
- How do SMEs perceived the benefits of systemic support?
- How are the knowledge services operated in SMEs?

Setting

The survey was conducted as an online questionnaire, with focus on SME only. For the initial contact a mail list holding addresses containing the addresses of 1192 organizations (SME) from all over Germany was used. The survey took place in June 2014. The actual distinction on whether the enterprise was a SME was made based on the amount of employees, since an inquiry on the annual turnover was unlikely to be answered. The number of completely answered questionnaires gained was 37, resulting in a return rate of 3.1%.

Results

Though 37 organizations filled out the questionnaire only 34 valid answers could be gained, since 3 organizations could be categorized being large organizations due to their number of employees. As for the answers contained in the results consequently 40.5% were provided by micro enterprises, 43.3% by small enterprises and 8.1% by medium enterprises. Com-

pared to the initial survey from 2010 more micro enterprises answered and fewer small enterprises. However, the sample data used for initial contact in this survey was larger and not restricted to the area of Mecklenburg-Western Pomerania. Differing results in the general characteristics of the answering SMEs can be summarized as follows:

- Of the answering organizations, containing mostly small enterprises, in 32% stated to have more than one location. This is especially of interest since it implies a rising number of interfaces which have to be considered for knowledge transfer indicated by more sites of an enterprise.

- A rise in fluctuation among employees in the enterprises also indicates a larger demand for KM support, since knowledge has to be secured from the leaving employees for the new ones.

- More SMEs use a systematic approach to apply KM (35% compared to 19% in 2010).

- The fluctuation and the systematic approach correlate positively.

- Regarding the handling of the term knowledge management 24% of the answers still represent only have a weak idea on the meaning and 9 % have no association with the term at all. This number could be marked as stable.

These results reveal a positive tendency in KM use, yet many SMEs (one third is not acquainted with the term and another not making active use of the concept) still have not accessed the field of KM at all. Regarding the general aspects motivating KM application in the organization a rise in the use of incentive systems (38% from 5% in 2010) and the positive recognition of knowledge sharing (53% from 30% in 2010) could be noted. As 60% of the organizations are well aware of what KM means and what it has to offer, 4 of 12 enterprises answering they use KM could also named problems they faced under the implementation process: missing communication on the implementation(6), missing changes in organizational culture(1), missing integration in the work routines(4), employees refused KM(3) and lack of incentive systems(1). Relating this to the TOI model as introduced in section 3.2.4 this shows the missing consideration of the organizational and individual issues. When considering the goals of KM following findings were made:

- All objectives of KM were rated equally important. At least theoretically all of them could be considered however, the results can also indicate insecurity in providing an answer to the question among the 12 organizations applying KM. The concrete association of the benefits to the measures taken hence was not possible.

- Least important among KM goals was the personnel development, a change in enterprise culture, improvement of the communication between management and employees and the assessment of knowledge-oriented processes (denied by 50 %).

- The controlling of the goals in 16.7 % was not done at all, 66.7 % use the evaluation by e.g. management and 8.3 % each implement an audit or concrete control variables. Hence, the value to be added was to be controlled at least partially. However, the goals are formulated rather generally and without being related to monetary terms. The alignment of KM/KMS to benefits to be created was still done only by reference to general terms.

In addition to the revisited aspects of the survey conducted in 2010, this survey contained questions on the support for individual knowledge services (as listed in the KMS architecture of Maier) to determine how these services are supported within the organizations. Furthermore, the realization of the success determining dimensions of the KMS Success models was gathered. The most important notion on these aspects were:

- The most precise answers were given on the knowledge service "search" indicating that this service receives the most recognition. All enterprises could name internal as external possibilities, which where however vague (Internet/ Google - Intranet/ Database).

- For the service of "collaboration" technical possibilities (Outlook, cloud applications, Intranet) were named as well as non technical (meetings, cooperation with external partners, call), which reveals, that first the organizations are not fully aware of the technical support and furthermore do not rely only upon it.

- For the "learning" service no concrete support but "tools for e-learning" however, when usage was indicated the SMEs pointed to seminars or trainings available offline.

- "Publication" was done by texteditors, if the question was understood at all, since many answers reflected to publications available instead of the one produced internally. Consequently the allocation of the research was described instead of the application support used to externalize knowledge.

- As for the success dimensions of service, knowledge and system quality it has to be recognized that once more, when asked on a factor it was estimated highly, which was strongest for the system quality, yet, the degree of the individual realization does not align to the evaluation.

Based on these results, it has to be noted first that the formulation of the questions must be done rather carefully to avoid misinterpretation. Second a ranking of the services was indicated, "search" being most important, "collaboration" than and least important "learning". However, true collaboration in the sense of a shared artifact is rather seldom, collaboration often is strongly reduced to communication for exchange of knowledge and information. With regard to the remarks received on the questionnaires, these were the issues holding the most insecurities, since the SMEs indicated that they did not see the relevance of the categories.

As for the limitations of the survey it has to be noted, that it was answered by one person per organization only and consequently can only show a subjective impression. Furthermore, a tendency for positive alignment could be given since especially in surveyed enterprises the respondents were owners or managers of the enterprise, which usually want to convey a positive impression of their enterprises.

4.3. Survey excerpt: Social Software and Wikis for KM in SME

Another survey conducted within an diploma thesis [Wil11], was concerned with the usage of technical support for KM in general. The intention of the survey was to provide answers to the following research questions to give an overview on the application of social software for KM.

- How do SME in Germany apply social software for their KM?
- If KM is applied in the organization, how and when was it introduced?
- How is the social software for KM applied in the organization?
- Which KMS/ technical support is used at all?

Yet, the data introduced here is an excerpt with regard to the results is provided, since for the scope of this thesis only the results related to the target group of knowledge-intensive SMEs are presented. The full survey was conducted within a diploma thesis and can be found in the appendices of the thesis. Nevertheless, the results for the group of knowledge-intensive SMEs already provide a general overview on the application of KM in SMEs all over Germany, and in particular their usage of social software, especially wikis.

Setting

This survey focused on how social software and especially wikis can support KM. This is done interpreting these applications as a means to support the knowledge service "collaboration" [Mai07]. As such these applications are to support the knowledge transfer between different individuals. In December 2010 and January 2011 the survey was distributed online and as Excel file, and 510 enterprises were invited to answer. 141 complete answers could be retrieved resulting in a response rate of 27.65%. Out of the 141 answers 48 were given by SME (or enterprises which apply to the definition "Mittelstand" [mit16b]), consequently these enterprises have an amount of employees up to 500. 31 answers were given by enterprises with a total amount of employees between 500 and 1000, the remaining answers were provided by larger enterprises. Since the objectives of this work are SME presented by the results for the first group the results from this group are presented only. Only when comparison with the rest of the data is useful the results gained for the group of larger enterprises were included.

Results

To start with the topic of KM the questionnaire included the questions whether KM is used and if, when was it introduced:

- 40 out of 48 SME apply KM, resulting in 83.3% of SME dealing with KM. However it has to be kept in mind, that these are "Mittelstand" enterprises, so they are significantly larger with regard to the number of employees, when compared to the SME of the other surveys.
- SME started KM earliest in 2001 (3 of 40), but the majority started in 2003 (17 of 40), whereas most other enterprises implemented KM between 2001 and 2003 (46 of 62).
- KM was introduced into the enterprise by: "employees initiatives" (10 of 40), "by the use within a single department" (9 of 40), "by the initiative of upper management" (14 of 40) and "do not know"(7 of 40).

Summing up these results it can be concluded, that 4 out of 5 SME have implemented KM throughout the last 10 years, mostly due to the initiative of single employees or the upper management.

Consequently, it was asked which applications were in use for KM purposes, to see whether a full KMS architecture could be identified as suggested by Maier [Mai07]. The answers given can be seen in table 4.1

Application	Amount of answers (out of 40)	Percentage
Intranet	16	40
DMS	33	82.5
CMS	31	77.5
Groupware	10	25
Workflow Management Systems	3	7.5
Data-Mining	2	5
Data Warehouse	8	20

Table 4.1.: Groups of application in use for KM in SME

Comparing this to the larger enterprises it was recognized, that differences in the use of Intranet solution (75% of enterprises with more than 500 employees use this application type), workflow management systems (75%) and groupware (75%) exists. When going further into details on the use of social software following answers were retrieved:

- 7 of 40 SME use social software to support their KM initiative. 24 enterprises stated that they have no use for social software, 9 stated that they cannot answer.

Subsequently, the question arises why they are unaware of the benefits such system can provide, or if social software really would not lead to benefits.

- The main intention in its use was "Provision and structuring of contents through the user" with 47.8%, which was considered "highly relevant" or "very highly relevant" by 54.1%. In comparison large enterprises answered: "optimal usage of knowledge"(70%), "easier identification of knowledge"(68%), "better distribution of knowledge"(67%) and "better provision of information"(63%).

- Asking for perceived changes in their KM by using social software, the results on this question did not differ significantly between the enterprise groups, and the basic population of SME answering this question was rather small. The overall most prominent perceptions were "a more efficient usage of knowledge" (77%) and "less effort for information procurement" (84%), yet only 40% reported "cost savings".

Concluding from its rare usage the potential of social software for KM apparently is not highly regarded. However, the enterprises apparently see a supportive function for their KM. In comparison with larger enterprises however the focus is different, since SME seem to focus on the knowledge provision by the single user, seemingly to get the individual to transfer his or her knowledge into a system. The questionnaire proceeded with specific questions on the use of wikis delivering following results:

- 15 SME and 46 larger enterprises have a wiki installed

- The wikis were installed in the years as shown in table 4.2. Hence it can be seen that SME follow the trend and apply wikis later.

Year	SME (out of 40)	Large enterprises (out of 62)
< 2004	-	4
2005	-	2
2006	-	4
2007	1	7
2008	2	14
2009	9	15
2010	1	-

Table 4.2.: Year of the introduction of the wiki

- Wikis were introduced on behalf of "initiative of a single employee in a project" (3), "a single department" (3), "the upper management" (7). In 2 enterprises the way of introduction could not be named.

- 76.7% of the SME having implemented a wiki and use it at least once a week.

- When using a wiki securing a good quality of the contents is important, even if resources are sparse. SME mostly rely on particular persons being responsible for certain topics (45.6%). This value is the highest when compared to other enterprises where 37.5% (up to 1000 employees) or 19.6% (more than 1000 employees) answered that they established topic responsibles.

- The type of wiki used in the SME was in 6 cases a MediaWiki, in 5 a TWiki, 1 DokuWiki and the remaining could not name the platform.

These results show that the wikis are well integrated in the enterprise, as well as accepted. However, following barriers under implementation were named: "Management has other priorities" (74.6%), "Fear of losing control over information" (70.7%), "competency level of employees does not suffice to deal with technology" (64.9%) and "IT infrastructure lacks compatibility" (63.9%). Moreover, more than half of the enterprises were unable to name which value/ benefit such a system can deliver (55.8%), in addition 51% of the enterprises reported security issues with social software.

With regard to these results it could be found that SME tend to use well known technical solutions, but in general the opportunities technology offers are not recognized. In addition, a control question was added asking whether wikis do support KM or not. The result was that only 4 out of 15 SME consider wikis as helpful for KM. This supports that there is lacking awareness of what value applications can deliver. Nevertheless, frequent questions on how KM can be understood at all in the pretest or feedback on the questionnaire, showed that the enterprises are of the opinion they apply the principle of KM, though the understanding of it varies widely. A complete KMS as suggested by Maier was not found. With regard to the perception of the social software applications for the use in KM, it has to be noted that it varies, expressing that enterprises are still uncertain which value can be expected.

4.4. Systematic Literature Review: Using KMS in SMEs

The intention of the literature research was to find solutions already documented in the field of SMEs and KMS to gain an insight on the state of the art. The results were gained within the students work of [Zei11] and were published as [Bor12a]. The method of the systematic literature research [KPBB+09] was chosen to ascertain a systematic research in the knowledge base available on conducted research. As suggested by the method of the systematic literature research the work was focusing on answering the following research questions:

- RQ1: Which activities on the held of KMS in SMEs have been documented since 2006? This time slot was covering the time from 2006 on since the work started in 2011 and the initial idea was to focus on results from the last 6 years since those were not to far back in history. This question was posed using activity looking specifically

for answers on following issues: Which applications were implemented to be used in SMEs? How have the applications been implemented? What do SMEs expect when implementing KMS and which specifics do they keep on hold?

- RQ2: Who is active in researching the field? And when were they active? Here we were aiming at finding the possible community supporting research around the field of KMS and SMEs. This includes the question for universities, research facilities or industrial partners working on the topic.

- RQ3: Which approaches are in use for research in the field? This question aims at showing with how research around the topic is committed as there might be literature work, case studies, surveys or purely theoretical work available forming the knowledge base.

These 3 questions were to be answered with the help of the results of the systematic literature research.

Setting

Following the approach of a systematic literature research [KPBB+09] few facts have to be clarified before any results can be presented. With regard to the availability the search was conducted across five publication series which all are part of Saunders ranking of important sources for publication on IS [Sau08]. These were:

- ECIS (European Conference on Information systems)

- EJKM (European Journal on Knowledge Management)

- HICSS (Hawaiian International Conference on System Sciences)

- PAKM (Practical Aspects of Knowledge Management)

- JoKM (Journal of Knowledge Management)

The ranking of these journals and conference proceedings with their topic scope were related to the field of research, and for this reason they were expected to deliver results on the topic of KM and KMS. Consequently, results specific to the field KMS in SMEs fall into the group as well. The intention was also to find more articles since it should be proved whether there were more articles then in [SFS05], deepening their investigation on the level of KMS. When conducting a literature research valuable results are gained by using a process which can be repeated and is fully transparent in its choices [KPBB+09]. The according process consisted of 4 different steps, presented in the following.

The first step is the population of the knowledge base. Before using the different search engines available for the individual publication series, the purpose of the search had to

be recorded in search terms. The decision was made to search within the title and abstract of the publications only, since not all publication series supported the search of keywords. Moreover this decision was made due to the fact, that terms like "knowledge" and "management" are rather common within research publications, yet they may be of different relevance when found as a single mention in the title or keywords when regarding the topic of KMS in SMEs. Consequently, the search was facing rather frequently used terms, however most often not related to the field of interest. The lookout for appropriate search terms included consulting various dictionaries for possible synonyms however there is no synonym for the term "knowledge management" and consequently this was the only initial search term. With the following intervention a concentration on refining the search results gained from the population step should be accomplished. In this case the goal was to filter the articles gained for KM for those covering the topic in a SMEs specific manner. Accordingly this made "SME" the most suitable search term for refinement. Yet, due to the different options offered by the search engines more precision was demanded. This resulted into allowing "SME", as well as "SMEs" and for the synonym perspective included "enterprise". The final search term after these two steps looked as follows:

$$F = ((Abstract\ Knowledge\ Management\ \vee Title\ Knowledge\ Management) \wedge (Abstract\ SME\ \vee Abstract\ Enterprise\ \vee Abstract\ SMEs\ \vee Title\ SME\ \vee Title\ Enterprise\ \vee Title\ SMEs)) \wedge Date\ Range\ (2006 - 2011)$$

The actual search using the overall search term as provided above in a fully supportive search engine would allow entering the term at once accordingly and provide the results. Taking the results from the search the next step is the article selection. After having gained the results from the automated search the manual process was to scan the papers for their relevancy. By a closer examination of title and abstract, or in case of insecurities whether the article was relevant for answering the research questions the introducing paragraph was scanned, the decision had to be made which papers finally really were relevant and which were merely results containing the search terms without being related to the held of interest. There were three reasons for excluding papers:

1. the article is KM related only and does not cover KMS by a certain degree

2. the article does not cover SMEs though maybe mentioning it

3. the article might be concerned with Enterprise Systems (ES) and KM but follows the approach that it is only to be understood what influence KM might have on already existing ES. Accordingly, the article is not concerned with KMS as indicated by Maier [Mai07]

Literature research - Results

When starting to search the first step was to determine how many papers were available to search through in total and in the individual conferences, the according result is presented in table 4.3. With about 1400 paper in total which might be related to the topic a sufficient basic population was provided.

	PAKM	JoKM	ECIS	EJKM	HICCS	total
papers total	33	407	498	119	329	1389
Issues	2	36	6	24	6	

Table 4.3.: Overall amount of publications

Within this amount of papers the initial population step was accomplished resulting in 370 papers from the different publication series as shown below.

	PAKM	JoKM	ECIS	EJKM	HICCS	total
papers	33	156	37	100	44	370

Table 4.4.: Population step

Finally, table 4.5 shows the result after the intervention step. These results already show that SMEs and KMS are not in the main center of attention for the KMS community. Based on this preselection reading the retrieved articles was started to further decide what is relevant for the research questions and what could be neglected. After this step a closer look at the papers, namely reading them completely, was necessary to exclude further articles manually. However this reduced the number of relevant papers even further to 14.

	PAKM	JoKM	ECIS	EJKM	HICCS	total
papers	1	19	3	8	6	26
final	1	6	-	1	2	10

Table 4.5.: Result of the intervention step

The results gathered by reading the final papers were to support the research work in answering the above mentioned research question.

Being confronted with a rather limited set of 10 articles relevant for the topic [SD06], [BVF08], [CCC09], [Gra09], [MRGMMR11], [KA10], [EELR10], [KV10], [Jud07] it could be concluded that there is no sufficient answer on RQ 2. The researchers come from all over the world, which could be expected since the publication series were chosen to offer this possibility and none of the authors appeared twice. However, there were two times authors from Spain. In addition, the relevant papers were published in different years, with a slight rise of publications in 2011, where 3 of them were published.

The answer for RQ 3 looks as follows: the articles cover case studies as well as surveys or literature, usually a practical aspect is combined with theoretical approach which is introduced or should be evaluated [SD06]. The methods of research are therefore various and often very extensive as well as specific. Due to this their reuse appears to be difficult. When considering the empirical viewpoint two categories were found, classifying the evaluation methods: objective and subjective. Whereas objective methods are based on indicators related to the activities under evaluation (usually monetary): the subjective ones rely on individual ratings gathered by surveys or interviews. It could furthermore be found, that some articles tried to provide a general approach for designing a KMS in SMEs recognizing the need for such. With regard to RQ 1 it was found that through the relatively few papers published in total only few applications were covered in details, as e.g. [Gra09]. More often the papers were concerned with the general networking thought [BVF08],[KV10] and accordingly gave no precise suggestion on what to use where. It was more often assumed that a central information system should be in use [MRGMMR11], [BVF08], [CCC09], [Jud07]. One paper even asked for the content provided [Jud07] and whether there is a tipping point of knowledge necessary for a full acceptance of a system for a community. Interesting to read was that KM is considered beneficiary for the applying companies in total and can lead to real benefits in the companies [MRGMMR11]. All results show, that the main focus lies on KM, KMS are just the medium for realization. The emphasis remains that a central point in KM is the organizational culture which is supposed to provide a supportive framework for KM initiatives. Only one paper focused on the full implementation of a KMS as such to the point of productivity in a SME [SD06]. When looking at the gained results it was found that there is only little material available on KM or KMS in SMEs though a lot of articles have been published on the general topic without being restricted to SMEs. Compared to the numbers of the European Commission for Enterprise and Industry showing that more than 99% [SME03] of all enterprises are SMEs this leaves room for speculation. On the one hand it was revealed that only little effort was made to document case studies in enterprises and accordingly to prove whether general ideas hold for SMEs as well as for any other enterprise, e.g. barriers to be found in the process of implementing KMS. Contributions from the conduction of case studies are of value for comparative issues. The barriers themselves are well known from literature e.g. [BWP98] but to which extend they can be verified in practice still remains open, especially with regard to SMEs. Considering the availability of articles on how to chose a suiting KM application KMS for an SME and the "right way" to implement it can be stated that the material does not provide decision support on that issue. Two related issues can be identified for this: first there might be the lack of interest from the scientific community in the real practical issues on KMS and second the big variety of available solutions and SMEs has not been addressed by creating a general approach yet. The articles found did not document the decision making process only how the already chosen solutions were put into practice. Finally, another issue is whether the results hold

for small scale business units as they have been published for SMEs. From the general point of view this would hold at least with respect to the manpower available for certain tasks and especially when considering the time resources available. On the contrary these units are part of larger companies being able to cover for the expenses, and the individual units therewith being able to rely on support within the development of new solutions.

4.5. Summary

Within this chapter it was presented how the relevance of the research topic was proved. To achieve this the problem on the one hand had to be defined and on the other hand ensured, that the found problem was not yet covered sufficiently in research. To document the problem definition two surveys have been conducted clarifying the actual treatment of KM/ KMS in SME. The focus of the surveys was on the general attitude towards KM as well as the question which systemic support was used. Through the surveys it could be shown that:

- the systematic KM approach can hardly be found in SME
- systemic support/ KMS applications are used, though not necessarily connected to the topic of KM
- the benefits of KM usage could hardly be named
- the benefits of KM/KMS usage could hardly be related to organizational goals
- through replies on the questionnaires in pretest/feedback mechanism the issue was named that the benefits of systems used are unclear when compared to the costs
- by control questions and feedback it was shown that the concept of KM often was not completely realized by the answering individuals
- the decision for a certain KMS support is not to be determined in a systematic manner

These issues were then interpreted as the topic of relevance and combined into the research questions as shown in section 1.2. Hence, these issue are to be addressed with the artifact to be created. By the actual repetition of parts of the questionnaire the ongoing relevance of the topic was confirmed in 2014. In addition, the already existing solutions available from the research perspective were determined by the conduction of the SLA showing only few results on the topic of KMS for SME are available. Consequently, within this chapter the relevance of the research interest for practical application, while securing the gap in the existing knowledge base, could be shown. The issues found are transferred into objectives for the artifact as shown within the next section.

4.6. Design Objectives

By the activities described in the preceding chapter the general research interest was narrowed down to the research questions (see section 1.2). Following the DSR approach as suggested by [PTRC07] this section is designated to finishing the second step of showing the objectives of the desired solution.

Asking SME on the demand and interests in the field of KM as well as the accompanying technical implementation the survey as described in detail in section 4.1 revealed the shortcomings the recent known approaches in KM and KMS held for SME. The survey furthermore revealed the research work conducted by e.g. [PGHP06] in general gained little attention by SME and application among SME. However, much interest in the field of KM and KMS could be recognized in the contact to the SME. Similar results were gained in the third survey on wikis and social software. Though originally not focused on SME the sample of organizations falling in the German definition of "Mittelstand" showed a significant lower application of KM and KMS than larger enterprises. In addition, the organizations were unable to connect the benefits of such systems to the organizations success or name them at all, though when talking about KM/KMS in general the question on why this should be done, and what would according activities add to the organization. Usually these questions are justified with the limited resources available.

Regarding the third survey, this group of organizations often stated to use wikis but did not see their contribution to KM in general. Both, the first and the third survey found that the wide variety of applications for KM confuses SME in the choice, which was also confirmed by [CES15]. By the conducted survey it was revealed that the according approaches have hardly reached SME. Consequently, it could be concluded that though implementation approaches exist they do not consider the point of interest for SME in their decision making process. Besides problem definition by survey conduction also several approaches for KM in SME [FLM+07, AHI+04, MS09, Tiw02, Mey05, Jas08] were found and described in detail in [Gra10]. General KM literature suggests the alignment of KM to organizational goals [PRR06] and technology support to be thoroughly embedded in the organization [BWP98, YWA05], yet it remains open how this can be accomplished. This lack could be proved with the systematic literature analysis. However, facing the demographic changes, knowledge transfer and the establishment of KM as part of quality management [Pfi16], SME are confronted with the topic as such. This gap in combination with the variety of products available on the field of KM add up to the decision makers in SME, who have to manage this issue besides the manifold tasks to be accomplished in their general business process for value-creation. However, SME need being able to name an outcome to be expected for the justification of the efforts to be taken and the costs to be covered from the sparse resources. Yet the survey results revealed, that the implementation and the concrete benefits to be expected from the application and implementation of KM and KMS remained still vague for the decision makers in SME. Summing this up,

the surveys and the accompanying systematic literature research provide the motivation and research criteria of this research work. The intention consequently is to provide a solution filling this gap of missing value-oriented decision support on the subject of KMS implementation.

To address the problem various issues are to be considered an combined along the decision making process for a technical solution. The focus however is not on the contents to be provided as e.g. accomplished with the NIFO framework [DVM14] but on the channel to offer them. The underlying assumption hence is, that SME are able to implement an application on their own. Nevertheless, the decision support to be provided within this PhD project has to ensure that the implementation chosen becomes successful in the organization. Hence, a balanced and comprehensive solution, supporting KM in SME in general and not merely an IT-driven solution [OHB+06] should be accomplished. To provide such solution several points of interest have to be combined, which can be described the design objectives:

Objective 1	Provision of decision support on technological solutions for KM
Objective 2	Consideration of SME characteristics (sparse resources, concentration on value creating activities, large area of acting for the individual employee)
Objective 3	Integration of value/benefit-orientation for the justification on used resources as well as to be able have a indicator for the systems success
Objective 4	Inclusion of the support for holistic KM, which includes the according concepts and explanations, as well as the intentions of KM
Objective 5	Consideration of the specifics in KMS/ systemic KM support in comparison with other systems and application in work tasks

Based on these objectives the first design phase for the artifact was accomplished, as described in the next chapter.

Chapter 5

A Framework for the Benefit-oriented Decision-making Process for KMS Support in SME

This chapter is about to present the initial design phase of the artifact as the result of the presented thesis. The initial design phase followed the identification of the problem relevance in the situation of KM in SME and associated problems as shown in chapter 4. The design was created based on the combination of known and well-established concepts in KM as presented in section 3. For the actual artifact creation a constructivist approach was chosen, combining known concepts into the desired outcome. The first section describes the decision on the artifact type which according to DSR [HMPR04] can have various forms. The second process step of DSR as suggested by Peffers et al. [PTRC07] consequently is completed and the actual design process of the artifact begins. Consequently, the second section describes the requirements to be addressed by the artifact creation. The section is followed by the explanation of the actual initial version of the artifact. Finally, the evaluation steps conducted to validate the first solution approach completing the first design cycle are provided.

5.1. The Type of the Artifact

Based on the general research interest in the field of KM and KMS for SME a verification of the recent state of the art clarified to concepts of interest and lead to a convergence to the actual research question (see 1.2). This approach also complies to DSR ensuring the relevancy of the conducted research [HMPR04]. By the identification of a missing support for practical KMS application in SME the subsequent step was to address the issues expressed by the conduction of a survey in the relevant target group to ascertain that the identified gap was truly existent and the planned research outcome was relevant for the considered organizations.

According to the DSR approach the result of the research process is to provide an artifact of use for the different communities: researchers as well as practitioners [HMPR04],

transporting the results gained in the research process. The artifact is to address the actual problem identified [HMPR04, PTG+06]. Based on this general remark on the nature of the artifact the suiting realization for the problem at hand, the missing support in the benefit-oriented decision process for KMS support had to be determined. The objectives of the artifact defined in section 4.6, consequently should be addressed with the help of the artifact. The objectives however, reveal manifold demands towards the artifact. The center of attention is the decision process for KMS support, hence it could be ruled out to provide an application or piece of IT as such. For the decision on the artifact type then the remark of Hevner [HMPR04] was considered, who suggested meta-artifacts as the result of DSR helping to build concrete implementations. Interpreting this to the artifact to be created, it is supposed to build a concrete implementation of a KMS. Following Wall et al. [WWES92] this could be distinguished even further to meta-artifacts for the IT product, since the artifact to be created is supposed to support the decision making process on the KMS product. Besides, the mere decision support the objectives show, that the artifact has to combine and provide explanations on several concepts important for the decision making process. Hence it must be able to display complex structures.

Based on the uncertainties on the terms information and knowledge already shown in [MR01] and approved in the survey on KM(S) in SME (see section 4.1 for details), one of the first intentions to be included in the artifact was to resolve those issues by showing the concepts of relevance and their interrelation to deliver suiting KMS support while considering the benefits to be achieved. Though manifold literature already exists on KM in general (e.g. [GT07], [Leh10], [vdOH03]), models in particular (e.g. [N+95], [PRR06], [Gro09a]), on KMS (e.g. [Mai07], [BFL13], [GBV+09]) or even KM for SME ([FLM+07, MS09, AHI+04]), which did not reach the target group, another book or compilation was not the actual desired outcome. Nevertheless the interrelations of the concepts for practical application should be shown. Following this idea, while keeping in mind that no long explanations were wanted, the definition of a framework as "a framework is a real or conceptual structure intended to serve as a support or guide for the building of something that expands the structure into something useful" in the the IT standards and organizations glossary [SOG16] showed the type of artifact in question.

In the case of the identified problem a framework consequently can provide the problem-oriented solution to the answer to the initial research question on "How can the successful implementation if a KMS for SME be achieved ?". Since the term framework however remains vague on what has to be included it left the actual design to the research process. Even when looking for a definition it became clear that framework as a term is not precisely defined (see section 3.6). Hence the decision on the artifact type was made in favor of a framework. As a framework on KMS decision support it is supposed to provide feasible guidelines revealing the actual application of the KM concepts known and interrelated for practical use. The concepts included in the framework were gained from the knowledge base, as also described in chapter 3.

5.2. Initial Framework Design

Adapting the DSR approach (see section 2.1), after the identification of the problem and the verification of the according objectives, a first version of a solution was designed. Addressing the problem and offering appropriate support for SMEs in the field was accomplished based on the literature's state of the art available on the topic, the knowledge base. To achieve this a combination of existing concepts, linking them through analysis with regard to the according requirements was compiled. These actions start the actual design cycle of within the DSR. Though the concepts existed before, the contribution can be found in their combination to approach the identified, which has not been done before.

The starting point was the decision process for a KMS application. The actual recommendation however, should match the organization working with the framework. Moreover, the recommendation was supposed to provide benefits to the applying SMEs. This general decision making process is illustrated in figure 5.2. The base for the decision to be made are the demands of the organization. This for once also reflects objective 2, the specifics of the regarded SMEs. However, the demand also integrates the benefit/value discussion as stated with objective 3; the concept of value was included in the general decision making process. This is done based on the economic viewpoint, that by the fulfillment of demands, benefits can be generated. Hence, from the demand the recommendation is generated, which in the following is implemented and produces values. This is depicted in the lower (boxed) part of the figure. Nevertheless, the recommendation and the benefit have to be accessed as well, and the concepts used are to be integrated in the framework.

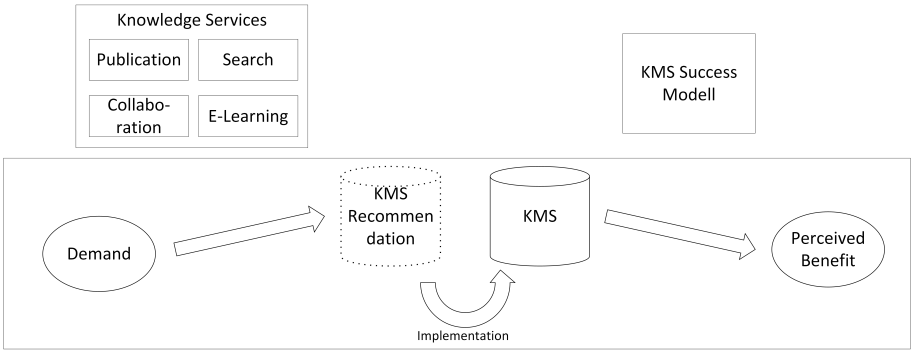


Figure 5.1.: First version of the framework for benefit-oriented recommendation of KMS support for SMEs

For the refinement of the decision process the starting point for the first version was a review of existing technological support for KM issues. This includes KMS and KM applications and is supposed to consider their suitability for the problem at hand. Yet, taking into account that most applications are very specifically designed for a single application purpose [Leh10] and the market changes rapidly, a recommendation of application classes instead of single applications is more suitable with regard to the validity of the

research outcome. This approach and also known from other fields of IS research as e.g. CSCW (3C Model [Teu96]). By this reduction also individual organizational decisions are integrated, which then can be finalized according to the specifics of individual SME, as these are integrated in the market analysis and implementation.

Consequently, a possible classification or categorization within the field of KM had to be found for categorizing according application classes. this addresses objective 5, namely the consideration of the specifics in KMS. Literature [Leh10, Mai07, BFL13] shows the variety in KMS and application classes used for the technical realization. However, when looking at the technical setting of KMS in general two kinds of realization could be seen: central and decentral [Mai07]. This classification is of a rather general nature and can be found for the architecture of IS in general. Aiming for a classification certain general architectures (see section 3.3) could be identified. Anyhow, this classification did not support the categorization in need for decision support since most application classes, e.g. wikis or messenger systems, can be realized either way. Service-oriented architectures as e.g. [Mai07, Rie12, HR07] provide a focus to the functionalities the individual parts of such system provide. This was especially of interest since the services these architectures offer strongly resemble the core tasks of KM. This was already described with the architecture of Maier (see section 3.3, fig. 3.7), where the layer 2, 3 and 4 were described as holding the core services of relevance for KM. Similar holds for the architectures of Riempp and Minonne (see section 3.3, fig. 3.8).

When comparing the central knowledge services it can be seen, that these are similar in different architectures. Hence, it is concluded that the knowledge services are agreed upon and thus, the individual services offer an orientation point for the support such KMS can provide. However, the architectures interpreted individually also indicate that other services might be missing and are not part of the architecture. This leaves room for adaptations and was intended in e.g. the KMS architecture of Maier [Mai07]. Having a more detailed look at the architectures it can be seen that systematic KMS architectures as such are designed in an idealistic way demanding adaptation to the organization's context to create an instance for implementation.

Especially with regard to the resources available in an SME (objective 2), a full implementation of a KMS as e.g. displayed in Riempp's architecture [Rie12] or Maier's generic KMS architecture [Mai07] is overstraining the resources available for such a project in an SME. The orientation towards the KM services to be fulfilled by a KMS however, shows service orientation with such a system. Based on these generalizations and the functionalities identified in section 3.3, the KMS architecture thoroughly described by Ronald Maier [Mai07] including the core knowledge services "publication", "search", "collaboration", and "learning" was chosen as a suiting starting point in a generalized approach for recommending SMEs on the application to implement for their KMS. Consequently, this concept was integrated in the framework on the recommendation process, showing that the actual recommendation is to be gained by interpreting the demand with regard to the

knowledge services available. The usage of this concept addresses objective 1 and 5.

Being aware of the importance of value, the concept of the perceived value as "consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given" [Zei88] closely resembles the perceived benefits as mentioned in the KMS Success model. Therefore for this work it is assumed that value is the overall concept summing up the individual perceived benefits. Further on in the framework it is referenced as benefit-oriented, since value orientation suggests a nomination of a numerical value, though the actual working level of the framework is the benefits. Nevertheless, the recommendation is also supposed to include the benefits to be gained by the implementation of such system. The general assumption made based on the discussion in section 3.4.1, is that the highest demands signalize the highest benefits to be achieved by the implementation of the according support [SFIB07, Zei88, BGVW06]. This decision is e.g. supported by [Mig09b], who stated that without the integration of the demand KMS cannot be successful in organizations. Prioritizing and deciding on knowledge services and their importance based on the benefit, they can offer to the organization within a KM initiative. However, this allows a way of adapting the idealistic general holistic approach of such idealized architecture while aligning it to the needs of SMEs and integrating the value discussion in the recommendation. By including these concepts both objectives, 5 and 3, are addressed and related to objective 1. Then, by narrowing down the number of knowledge services to implement and therewith provide a categorization for decision, the benefit orientation in the decision process for SMEs is addressed. This is represented by the addition of the knowledge services in figure 5.2.

To be able to describe the demands it is necessary to capture the specifics of the organization/SME (objective 5) at hand, which is supposed to be done within the regarding organization by the analysis of their existing structures and expectations towards KM and KMS support. The actual demand gathering is using systematical support employing social-empirical means (interviews, survey). The intention for this step at all times should be the full coverage of the employees, since especially for small organizations every other sample would suffer from problem of sample representativeness [SHE05].

So far the framework focus lies on a possible decision regarding the application class to recommend. Yet, the evaluation of benefits of such solutions implemented in an organization is covered only partially. To strengthen objective 3, the benefit of the KMS has to be further addressed. Anyhow, literature [HB07, RD08, GT07] argues that the value of knowledge related work can hardly be estimated in monetary terms, and consequently the same difficulty arises for KMS. The problem thus has to be addressed separately. Approaching the issue from the IT-related perspective, the value or benefits of IT can be related to KMS through the definition of a KMS as provided by Maier (see section 3.3). KMS being an instantiation of ICT, can be considered a branch of information systems (IS). As such the line of argumentation on the benefits to be perceived by the user as

argued by DeLone and McLean [DM92, Del03] with the IS success model holds for the determination of possible values and benefits. Even by systematic literature analysis [SR11] it has been found that the model has been widely accepted and also adopted to field of KM [JO06, Mai07]. As indicated in [GT07] the problems of evaluation of KMS and the low availability of valid models [SR11] support the decision on adapting the KMS Success model for the evaluation within the framework as designed here. This decision is furthermore based on the fact, that the underlying IS Success is one of the best researched models for the evaluation of IS, which recommends adaption to more specific systems as with the provision in the KMS Success model [JO06]. This for once was done by Jennex and Olfman [JO06] and once by Maier [Mai07]. Both KMS Success models reflect the dimensions as suggested by Delone and McLean into the KMS systems proposing adoptions as shown in section 3.4.2. Since Maier's KMS Success model did not follow the enhancements of [Del03] and the KMS Success model as suggested in [JSC09] provides more dimensions with a more elaborated description, the latter is the more convincing choice.

Moreover, the KMS Success model by Jennex and Olfman [JO06, JSC09] avoids the conflicts with monetary units which is well documented as being difficult [GT07, RD08]. It reflects the different dimensions of KM/KMS with the first layer showing the responsibilities within the technical implementation, the second layer containing the individual user and his intentions, which determine the use of the technical implementation. Finally, the third layer sums up the benefits into the organizational dimension (see section 3.4.3) for further details). The integration of the KMS Success model provides the different relevant dimensions necessary to be adequately fulfilled for a successful implementation of a KMS. The concept as depicted by the addition of the KMS Success model to figure 5.2, especially addressed objective 3. A side effect of the constant use of a well established model provides the chance of comparison within a multi case study, allowing for further insights as long as the individual dimensions are covered in a similar manner. This idea also is part of the framework, since the possibility allows the framework to be further used as a reference catalogue showing success dimension of companies with similar or different contexts as an additional point for orientation in the beginning of a KM initiative within an SME.

So far missing is the specific integration of objective 4, the holistic support for KM. Hence, the context of the organization providing the culture in which the implementation should work is missing in a directly manner. However, an integration is essential for KMS success, as a standalone technical support hardly will be accepted [NK14, BWP98]. The use of the KMS Success model already provides the service quality dimension indicating the surroundings of the technical solution have to be addressed as well. Moreover, the demand capturing provides a possibility to gather information on the organization and hence integrate them into the demands. However, to provide full support and also enhance the integration of objective 2, the holistic KM has to be referred to the implementation

of the actual KMS support.

Another point apparent at this design stage is the emphasis of the benefits only in the late process step of "Success Determination", otherwise only the demand indicates the importance of the benefit for the decision making. The success dimensions however, should already be integrated in the recommendation and implementation. This holds especially for the service and system quality dimensions, since these also give an impression of what the SME can provide to their employees. The system quality is also has to be addressed under market research and implementation, as this success dimension names the factors to be considered for a successful dimension. And a successful implementation is necessary for otherwise, the demands would indicate the need for the solution to be implemented, but the barriers of the installation would prevent satisfaction and hence benefits to be perceived.

With the version of the framework as shown below the objectives have been addressed as summarized in table 5.1.

No.	Objective	Concept in framework
1	Decision support	general process, criterion: demand
2	SME characteristics (sparse resources, concentration on value creating activities)	demand for knowledge services
3	Value/benefit-orientation	demand for knowledge services, KMS Success model integration, KMS Success model dimensions for implementation
4	Concept support for holistic KM	emphasis in the implementation of the KMS, used in the demand specification
5	Specifics of KMS	reduction to application classes and knowledge services, market analysis, usage of KMS Success model

Table 5.1.: Objectives in artifact design

Aiming for an applicable artifact the framework can also be depicted in a process-oriented manner, denoting the process steps and aligning the according concepts used as shown in figure 5.2. This representation was also chosen, as the decision making on a technical implementation is a process in the organization, which is to be extended by the framework under design. In the addition the framework shows the reuse of the perceived value in a new implementation cycle, as the categories also deliver valuable information on the demands. This circle also emphasizes that the determination of the benefits does not close the process once and for all, but that it needs constant observation and according adaptations with the change of the demands. This once more addresses objective 4, since a permanent integration in the organization is necessary.

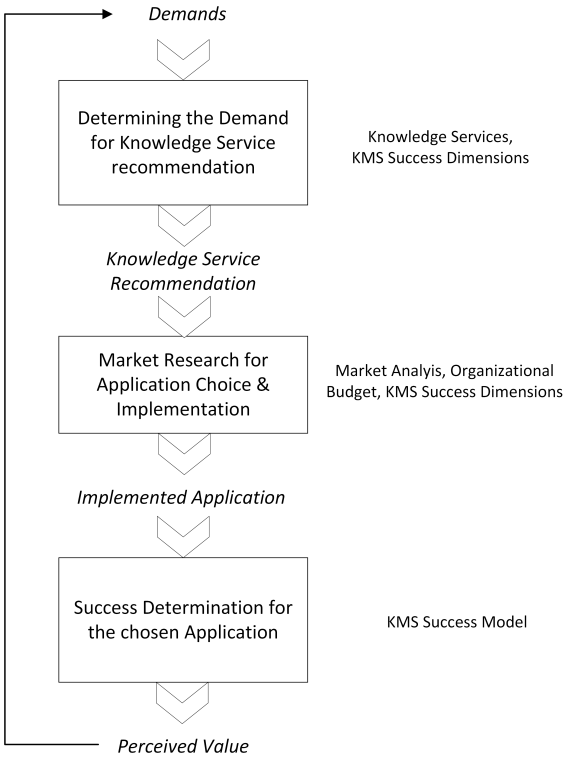


Figure 5.2.: Process-oriented description of the first framework version

Besides offering full decision support, restrictions have to be made on the process. The emphasis is on the recommendation and the determination of the benefits to be gained from the implementation. As a consequence it is assumed, that the implementation and conduction of a market analysis in general are known and have not been explained in detail.

5.3. Validation of the Framework

With the finished design of the initial version of the framework the question of validity and applicability arises. For further refinements on the framework and for feedback on the validity of the results gained so far, the decision was made in favor of the conduction of case studies. For this attempt it has to be noted, that the framework though designed for practical application, was not intended to work as a standalone decision support, but relies on feedback from the researcher. Hence, only the conceptual version as presented with figure 5.2 was available. Consequently, an explicit description was not available, the framework was visualized as the schematic depiction shown above. A textual explanation as provided in the this section was not given however, the interrelations could be explained by the researcher. The schematic view was supposed to clarify the connection between the concepts involved. Though further internal evaluation might be possible discussing the

concepts and their likely interrelation, feedback from the field was considered necessary to verify the applicability in the target group. Accordingly, the internal theoretical validity was expected based on the choice of the concepts integrated and the line of argumentation as provided.

With the practical validation the DSR feedback loop was implemented initiating the practical application of the created artifact in the audience of relevance [HMPR04]. The central question for the case studies to answer consequently was: Does the framework so far support an SME sufficiently in its decision process on a KMS support? Besides the full implementation of a KMS, several individual parts were evaluated and explored to gain practice-related feedback on applicability and suitability of the concepts in use. the detailed description is given in chapter 6.

Chapter 6

Practical Application: Case Studies

In the following chapter, the case studies conducted for this thesis are presented in individual paragraphs. For this thesis however, the case studies presented each are holistic cases serving a different purpose and hence each was conducted separately. In the following four cases are presented, which all are individually connected to the topic of constructing the intended framework supporting the benefit oriented decision support on KMS support for SME. All cases were conducted after the creation of the first version of the framework and hence, were aiming at the evaluation of different aspects of the framework so far. The actual case studies were part of student theses and thus are presented in their short version only in the following sections. The full version consequently are available in separate documents as reported with the description. The case studies can be classified as exploratory, conducted to actually observe, how the theoretically constructed artifact and its parts perform in actual application.

The results gained through the conduction of the case studies are in the following generalized and integrated in the next version of the framework, which is presented in chapter 7.

6.1. Case Study Research Planning

To plan case studies according to Runeson and Höst [RH09] following steps should be taken. This also resembles the phases of case study conduction as defined by [Yin09] (define and design; prepare, collect and analyze; analyze and conclude)

- Design: within this phase the objective of the case study is set and the further steps are planned
- Data collection preparation: the procedures and protocols are to be prepared
- Execution phase: actually conduct the case study and collect the data
- Data analysis
- Reporting

The individual execution steps are documented in the separated sections. However, to show the planning all case studies are presented using the same structure. Figure 6.1 illustrates how the case studies are placed in the design process.

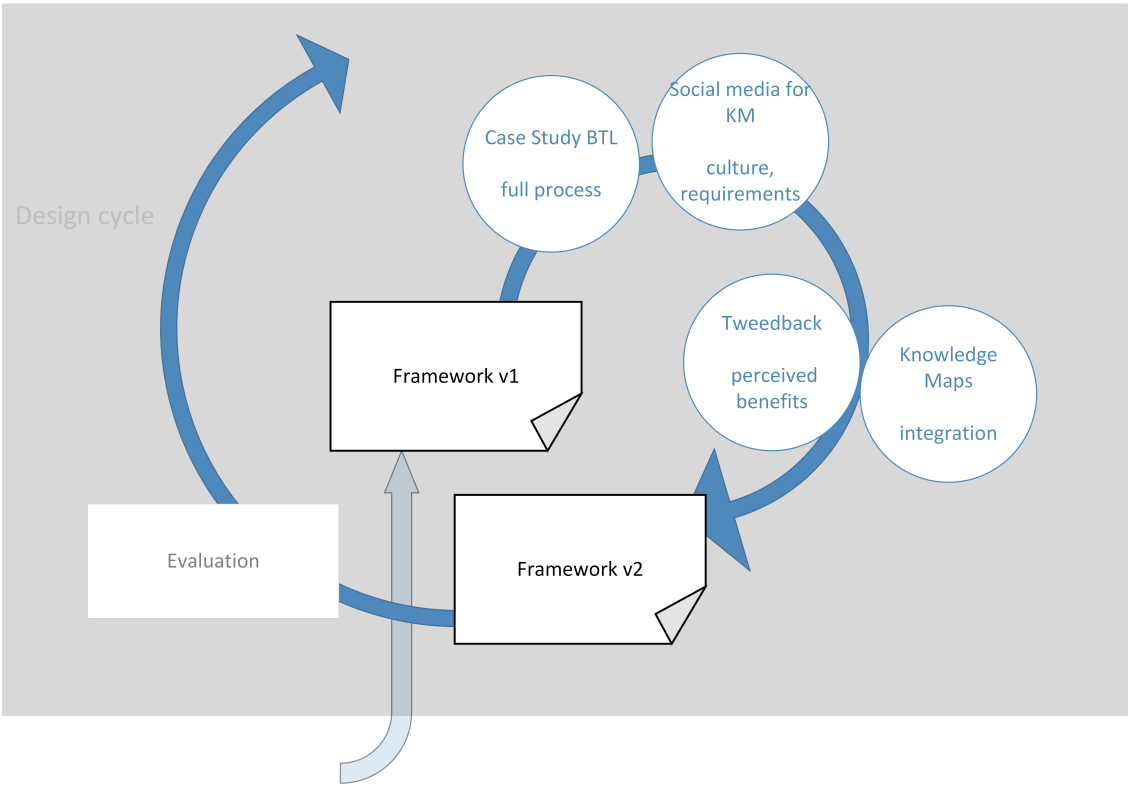


Figure 6.1.: Case studies in the design process

The first case (see section 6.2) consequently was exploring how the framework can be used in practical application proving its effectiveness. The main question in this case study was how the framework performs in real life application. The case presents an SME actually looking out for KMS support, and thus willing to use the framework for successful introduction. The further case studies do not aim at the complete execution of the framework, but focus on individual aspects to be covered within the decision making process. The second case on social media for KM in SME (see section 6.3), shows especially the requirements gathering part and how the organizational culture affects the decision making for the implementation in the knowledge services of "publication" and "communication". With this embedded case study of two organizations, the central question under research is how the organizational culture is to be integrated in the KMS support. Social media technologies in this case study were consequently considered from the viewpoint of knowledge transfer to colleagues and customers, as well as communication and collaboration channels among them.

Finally, the third and forth case studies question parts to be addressed with the framework. The third case (see section 6.4) on knowledge maps is focusing on the holistic KM

approach, beginning with the individuals holding knowledge. Though at the start intended to document the overall decision making process, this case in public administration had to take one step back to the initialization phase showing, how KM and process management are related to one another. The actual research question was how, the decision making process for KMS support has to be designed within a small scale business unit. The last case study was addressing the benefit perception of a knowledge imparting application. The focus of this case study on Tweedback (see sec. 6.5), which is a classroom response system to be interpreted as an implementation of the knowledge service "e-learning", is the operationalization of the KMS success value addressing the benefit orientation of such system.

The coverage of the framework by the case study for validation is shown in figure 6.2. It can hence be seen that all parts of the framework are covered appropriately for evaluation.

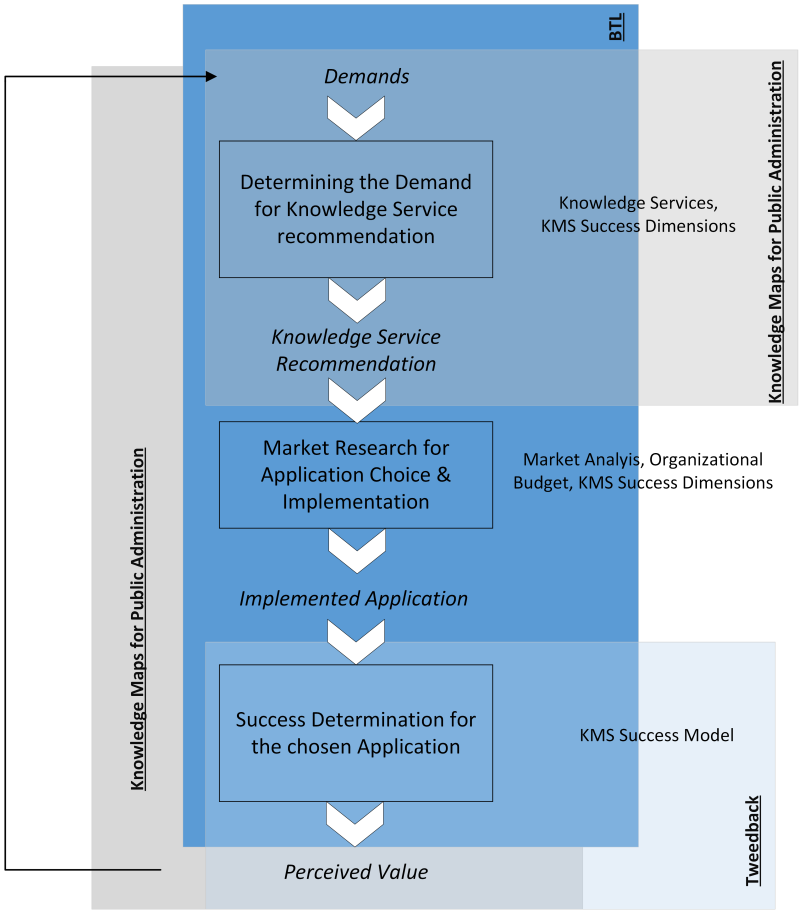


Figure 6.2.: Case studies on the framework

This chapter is dedicated to provide a general overview on the practical work conducted within this work. For this reason a general outline of the case studies is provided here, whereas for all details the students theses have to be looked at.

6.2. Framework Validation: KMS Recommendation and Evaluation for BTL

Research questions

The case study conducted at BTL (Bio-Test Labor GmbH) took place between May and September 2012 in Mecklenburg-Hither Pomerania, Germany. Parts of the results have been published in [BVC14]

1. Can the framework for decision support on KMS for SME be applied?
2. Does the focus on knowledge service appeal to the working reality of an SME?
3. Which benefits are experienced upon the installation of an KMS?
4. Is the demand analysis for the decision support determination sufficient?

Setting

Based on the first complete draft of the framework for decision support on KMS for SME, the case study was conducted using the following steps:

1. Observation phase: accompanying the administrator, we looked at the common IT infrastructure and routines of the organization.
2. Interviews on recent situation: were held using a questionnaire to clarify following issues; level of awareness and application of KM, expectations towards KM and KMS, handling of documents in work routines, identification of knowledge sources, estimation of efforts for information gathering, support with knowledge in the enterprise, communication in the enterprise, confirmation of results gained by the observation.
3. Determining the requirements catalog on the knowledge services as proposed by Maier and accordingly chose appropriate software for installation.
4. Installation of the chosen system in the enterprise, including the linking to older sources in use.
5. Employee training on the software.
6. Utilization phase, including a documentation of the chosen software solution with its issues knowledge wise, as well as technical (duration: 2 month).
7. Success evaluation based on the KMS Success approach as suggested by Jennex/Olfman [JO06].

The sources on the actually conducted run through the framework to implement KMS support can be found in the description of the case study as master thesis [Rec12]. The thesis focusing on the realization of knowledge service in KMU also provides the full detail description of the analysis within the case study. Beside, the questionnaires created and analyzed also further descriptions gained by observation can be found. These were mainly collected by the student working in the IT department of the SME, consequently these

are remarks gained from memory minutes of the student. Hence the observation can be considered a participatory observation. For the data analysis however, a triangulation was given by the supervisor, who ensured the scientific perspective.

Organization The enterprise at hand is BTL, a biological testing laboratory close to Rostock, Germany. Its fields of operation are biology and agricultural ecology. Accordingly, the work mostly concentrates on the development and application of procedures/processes for testing pesticides and newly cultivated plants, before they are to be accredited for the market. In addition, cultivation procedures for organisms (wanted as well as unwanted) to be used in experiments and behavioral studies are developed. Finally, resistance and tolerance studies belong to the central business activities of the enterprise. Summing this up, BTL considers itself in service industry, and is used to close cooperation with research facilities.

As for the enterprise's organization: it is employing 12 people on 3 sites with an annual turnover less than 2 million Euro. Consequently, it can be classified a small enterprise. Two managers are owning the enterprise. Approximately, one employee leaves the company a year. Two to three new ones may enter however, the latter number includes interns leaving after 3-6 month resulting in a steady number of employees. The technical infrastructure obtained through observation, showed that 12 PCs and notebooks are operated spread between the 3 sites of the enterprise. Other devices e.g. smartphones, PDA's, tablets were not used. On all systems different version of the Microsoft Windows operating system are running (from XP to Windows 7). Additional software in use is Office, Citavi (literature management), reference manager (literature management), Adobe Photoshop (image processing). Further software is installed however, not relevant for business activities or directed only towards the data manipulation using laboratory machinery. As for the network infrastructure it can be stated that 2 of 3 sites are connected. Yet, the average transfer rate is below 0.5 Mbit/s. On the main site the only server is allocated, as a file server only.

Results

Demand Analysis With regard to the means of KM, it was stated that external knowledge is acquired rather seldom, yet knowledge in general is considered very important for the enterprises' business processes. Nevertheless, previous to this case study the enterprise was not employing systematic KM.

As a consequence the availability of information and knowledge sources onsite is reduced to mainly working hours, a remote access to the enterprise network is not provided. This includes, that remote work is not supported which is on the one hand side due to the low bandwidth and on the other hand influenced by the characteristics of laboratory work. Regarding the localization of the documents and information it was found, that most items concentrated on the main site's file server. Even the available paper literature is concentrated there. The access to the different sources is not restricted however, employees

do not seem to be interested in that condition and restrict their information need mostly to their working tasks for accomplishment. Asking the employees for their sources of information following answers were given.

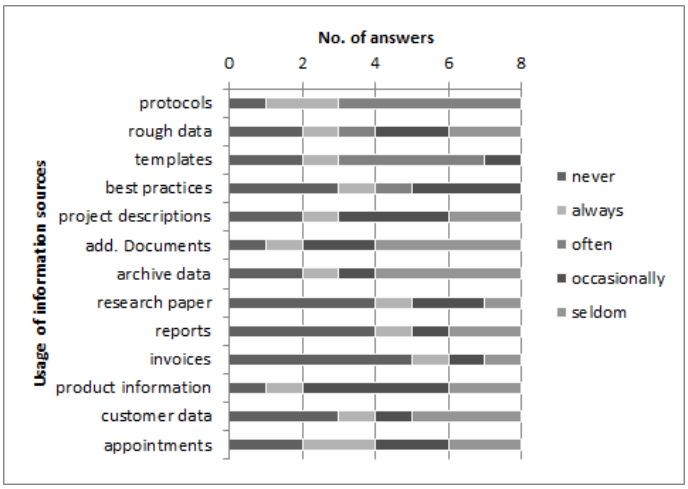


Figure 6.3.: Information sources

The sources named most often (see fig. 6.3) were external sources as there are books and the Internet since these are the ones holding most information for the identification process of the organisms to be worked on. The main business processes of the enterprise mostly are experiments, which results in the according documentation as protocols. However, these are not standardized and can be found in various formats. With regard to the sources used less frequently (e.g. in6voices, research results and reports), it has to be recognized that these are mainly addressed to the management and are of no relevance for the other employees. Finding different information takes time (see fig. 6.4), however most information can be found within 30 minutes, forms and protocols within 10. The search for research paper and literature consumes more time. The concerned employees claim, that this process usually takes more than 1 hour, yet this is relevant only for a few employees concerned with the task. Accordingly we asked for the mechanisms to find information and gained the result as depicted in figure 6.5, this indicates that computer based search is hardly of any support by now.

Comparing the different questions, several discrepancies between the claims of usage and the search for information can be revealed. Several employees said e.g. they would not use any search to look for appointments, yet only one employee stated not using the information at all. This leads to the question, whether employees can use information without searching for it. Taking a closer look at the usage of available search functions, it can be recognized that only 50% of the employees take advantage of them and only for few options. Consequently, the others are assumed unaware of the functionalities. However, the result confirms the general assumptions on colleagueship in SME: asking a fellow worker is the most common choice to find something.

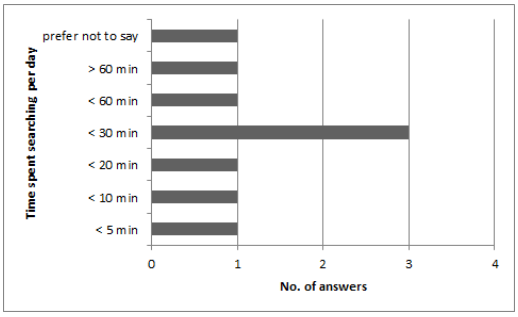


Figure 6.4.: Time spent searching for information

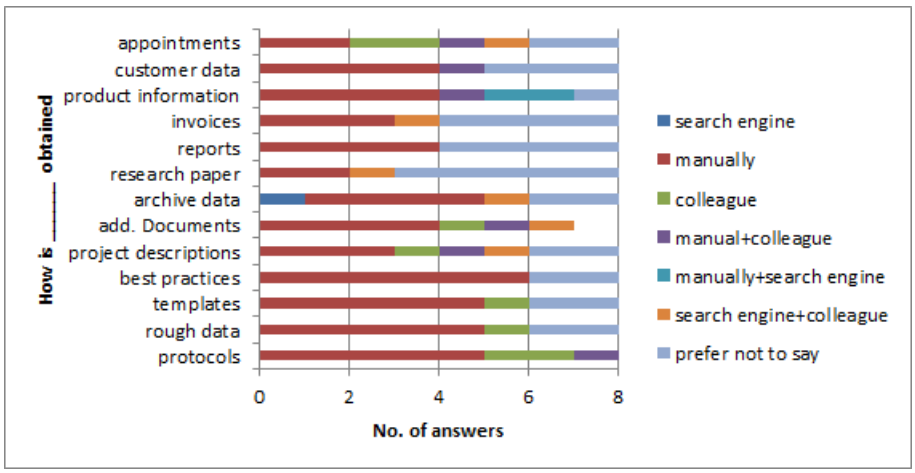


Figure 6.5.: How is information obtained

Representation of information is mostly done via common formats as there are Word or Excel files, as well as picture formats. There is no indication on which documents are new (through the means of formatting) and documents are not linked to each other. Storage is done centralized as well as decentralized however, this is accomplished without version control. Moreover, there is no more metadata available than the one generally stored automatically. Few documents have to be released by the management, e.g. reports for customers. In addition, the employees rarely provide information gained from their own work electronically for colleagues. Information provision is generally limited to common pieces of information concerning the enterprise.

This shows the state of the art in the enterprise being without concrete measures of KM, yet not without technical support. Anyhow, the awareness or the active demand for measures of KM and its opportunities were not found, beside one of the managers being highly interested on what this could offer. Partly, he had to be disappointed as well, since he was hoping for data analysis of lab results for patterns in projects, which cannot be considered a priority of KM/KMS.

Demand Determination The questionnaire used to gather the wishes and expectations towards KMS is divided in 8 different sections: level of awareness and application of

KM, expectations towards KM and KMS, handling of documents in work routines, identification of knowledge sources, estimation of efforts for information gathering, support with knowledge in the enterprise, communication in the enterprise, confirmation of results gained by the observation. Within the sections, the questions itself were already directed at the services search, publication and collaboration as provided by the service orientation of Maier's architecture for KMS [Mai07]. The service of learning was not covered in detail as it was ruled out by the context of the enterprise and the management, at least for the technical implementation. The full questionnaires can be found in [Rec12].

Determining knowledge service needs was part of the questionnaire, showing that knowledge is considered of high importance for the enterprise. Since BTL is working in the service sector and research is considered a highly knowledge intensive field, the focus for knowledge service determination is set there [LF06]. To begin with several knowledge domains of the enterprise were identified. The main domain is the interpretation of field studies. Furthermore, the identification and analysis of arthropods and method development can be named. Since field studies follow a predefined procedure to guarantee, a certain service level for the customer the knowledge on the process and its efficient operation are of high importance. Reusing knowledge shortens the time and effort to create new offers for customers. Moreover, the knowledge on document status and colleagues workload is of interest as several colleagues work on the same process. Most knowledge on arthropods is found in scientific literature, and the experience on the identification process can hardly be transferred or externalized. This can only be transferred by socialization [N$^+$95], which cannot be the core issue of a possible KMS support use within a small enterprise when processes are not accompanied by permanent PC use.

The other knowledge domain, concerning the analysis of plants and insects with regard to illnesses and defects, is characterized as mostly standardized procedure depending in efficiency on work experience. These experiences are mostly exchanged orally however, the process can be supported by KMS assuming, that they are to be accessible from all sites of the enterprise at all times. In addition, the support of SOP (standardized operating procedures) is of value, as is the awareness of the existence and scopes of further projects in the enterprise.

The third knowledge domain to be covered is method development for customers, which again relies on work experience, as well as the access to research literature. During development shared documents are needed however, they are by now not used for documenting tests on the methods. Moreover, in addition to the knowledge domains, general enterprise knowledge is needed, as is information on employees' knowledge and customers involved in projects, which might carry specific project relevant knowledge. Information from team meetings is not yet saved centrally, nevertheless a need for such functionalities is expressed. What was neglected here was the access to knowledge on method improvement from research literature. However, this can be gained from outside the enterprise only, demanding a connection to external information and knowledge sources.

Summing this up, a central system storing process knowledge and experiences is suitable to address the enterprise knowledge needs. This leads to the use of a document management system, which might be complemented by groupware functions e.g. contacts and collaboration on documents. The software to be installed should cover standard office formats and address the fact that not all employees have designated PC workplaces.

Software choice Based on the demands described above and economic aspects (investment and maintenance cost, training effort) a system support was chosen. The concrete criteria for this choice were: user friendliness, integration with the existing Microsoft office environment, license cost, scope of performance, training effort, necessary technical infrastructure, and documentation support. Integrating the products already in use with the desired KMS promises a higher acceptance and less training effort. This however, is according to Jennex/Olfman KMS Success [JO06] a significant indicator for a system's success. The final decision on the system was made in favor for Microsoft SharePoint as a system for collaboration and document management, which in addition also provides a centralized calendar and contact management. Aspects supporting this choice were the opportunity to adapt the interface and structure to the enterprise's needs as well as that information representation is not restricted to the interface provided, but can be extended to other programs. According to [Leh10] SharePoint can be considered a portal system used in intranets based on a client server system. Yet, SharePoint does not demand a server farm which spares resources. Being a Sandbox system the individual parts are displayed as a website. The user interface of SharePoint can be generated by the administrator, and yet allows for individual adoptions by each user according to his needs and consequently each user can create his personal portal holding information only valuable for him.

Implementing the knowledge services Since learning as a service to be implemented was already ruled out during the first questioning of the management, only the three remaining knowledge services according to Maier are covered here showing the implementation using Microsoft Sharepoint.

Publication support is realized by the use of several document libraries within SharePoint. These allow for a better overview and structure and furthermore provide context for the published documents. For each library the same structure is used to create an environment demanding minimal effort from the user to get acquainted with it. The implementation of this service also contains a push mechanism, so the user can chose to be automatically informed on new documents in his or her field of interest once he or she has subscribed to it. Furthermore, Microsoft Office 2010 was integrated with the Sharepoint installation ensuring that documents can be opened within the SharePoint environment. Besides, the document libraries a wiki was established to support collaborative working on knowledge artifacts. To create a suiting starting point of the wiki several IT related

articles were published from the start, as was a general structure of the knowledge domains of the enterprise. Since wikis and publication within were not familiar to all employees, training was provided. Finally, the system should gather information from team meetings, which were until then noted down individually into paper notebooks. Now this information should be published as an intranet blog to be accessible for everyone. This on the one hand provides date and category of the entry (team, project or special meeting) and on the other hand has editing functions very similar to Microsoft Office and therewith lowers the entrance barrier.

Search is supported on a basic level only by the standard installation on Microsoft SharePoint Foundation. It does not support full text retrieval or search over the complete intranet, nor does the search include certain document types, e.g. pdf. To address this problem the Microsoft Server Express 2010 was installed as addition. Though being developed for the SharePoint Server Version, this add-on allows for more sophisticated search support in the Foundation version as well. There it is integrated and displayed as an extra website, which supports searching the old file server, as well as the newly established intranet. This add-on supports crawling more document types and especially pdf's, which is highly important for the enterprise since most scientific papers are published in this format. At last, the advanced search based on meta data is supported.

Collaboration is not supported directly with specific functions of the Sharepoint installation, but by the installation of a DMS itself, which supports parallel work on documents. It was decided that no further support, e.g. instant messaging, is needed due to the number of employees in the organization and them usually not working on PC's all the time. Comments and remarks can be posted within the DMS and are displayed in an extra column of the document library providing feedback to authors as well as other users. Moreover, a contact list of customers and employees was introduced, which was integrated with the already existing outlook client to address the problem of decentralized contact management. As a last point, a picture gallery allows for social interaction also beside the official work tasks, which according to [Jas08] raises, the acceptance of systems. To put this installation into practical use for all employees on all enterprise sites, a VPN was established enabling employees to use the intranet installation. However, some functions as upload and download of larger documents are limited due to the restricted bandwidth in the area.

Success evaluation The software was installed, customized and trained by the administrator of the enterprise, who also is the major support for the system. After two months of application time a questionnaire to determine the success of the installation and implementation was issued. The parts of the questionnaire address the parts of the KMS Success of Jennex/ Olfman [JO06] as introduced before. Besides the general information

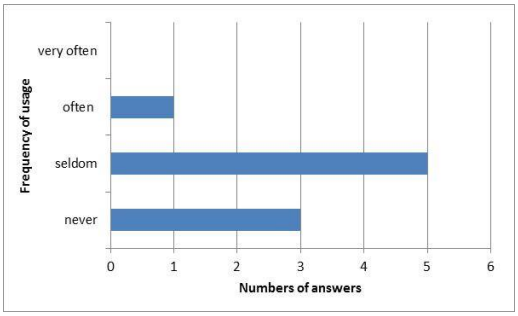


Figure 6.6.: Usage frequency for the installed solution

on the answering person, there were questions on usage, information/knowledge quality and motivation/intention to use the system. There was no further questioning on system quality since this was already considered in the observation time. Moreover, usage as well as user satisfaction were assumed the focal points for successful adaption of the system into the enterprise.

With the general questions, it was inquired, what the precise working field of the employee was and whether he or she was using a permanent PC workspace. On this issue, 4 of 9 answers denied using such a designated workspace, which combined with the high amount of laboratory work leads to the assumption, that mere availability of the system does not guarantee its usage in this enterprise. As for the barrier of having to work with new software, 5 of 9 employees answered that they do not have problems to adjust, 2 gave no answer, and the left one found it less easy or difficult. The answers regarding the actual usage of the system are shown in figure 6.6.

The answers reveal that only one person actually uses the system regularly, which is rather disappointing, even if it is a manager. Moreover, the actual time per usage rarely exceeds 15 minutes (4 times up to 10 min, once up 10 to 15 min, once 15 to 30, once more than 30, 4 times “prefer not to say”). The reasons for using SharePoint named were: to provide work experience, curiosity, find support for own work, and interest in KM. Though being provided with the answering options “management demand” and “incentive system” as a reason for usage no one named them - so far, usage was not depending on external reasons. Although these results appear to be rather disappointing, to weigh the actual result the working conditions, and number of employees have to be taken into consideration. Some employees already use the system for sharing their experiences though not being permanent PC workers and should therefore be considered as role models.

The functions mentioned to be used most often were DMS and search, whereas the wiki was not used regularly. The later shows that the willingness to provide initial information into the system is still deficient, as is the reach of the system. As for the meeting blog: it is considered to hold valuable information, however, the employees use it only in addition to their written notes resulting in an irregular use. This is, again, also due to the fact that not all employees have permanent PC access, whereas a paper notebook can be easily

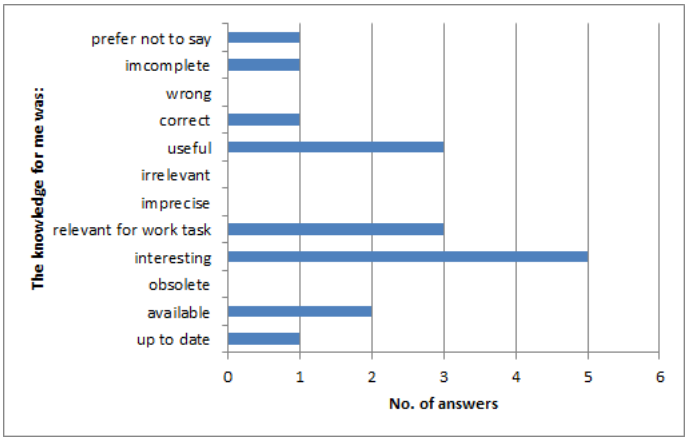


Figure 6.7.: Answers gained on knowledge quality

carried into the laboratory. Asking the employees for the precise reason, why they did not use the SharePoint system following results, were gained:

- Information was incomplete
- Usage was too complex to accomplish besides the general workload
- System was not accessible from workplace
- No support for my tasks

The time factor was mentioned most often (5 times) indicating a lacking integration into the work processes, as well as a missing adoption in organization culture. Until then no KM specific support by the management in this sense was given, however, employees indicate it is missing. Consequently, it is noted that the problem is not the system itself but its process integration. This problem can be reflected back to the TOI model of Bullinger [BWP98] published, yet the organizational dimension has to be improved. It proves that an enthusiastic management might be helpful, but is not sufficient. For the third category of information quality, the employees were asked how they evaluate the information provided. The results are shown below in figure 6.7.

It can be seen that only one negative aspect was mentioned, namely information being incomplete. This is remarkable and should be changed. However, by that time of implementation can be easily explained: after 2 month it could not be expected that everything was transferred completely into the new system. Moreover, the employees should be encouraged to fill found gaps, so to make the base grow. Finally, the motivation of the employees was analyzed. Therefore, we asked whether SharePoint support helps to accomplish tasks more quickly. Yet 5 of 9 employees could not/ would not answer the question. Only 2 employees perceived a positive effect for their work. In contrast it was asked whether they see a positive influence on their colleagues work. Here we gained 6 positive answers and 3 times “prefer not to say”. Accordingly, it seems that estimating the effect for others is far easier and provides a positive result.

Resume Considering BTL a knowledge intensive SME with little knowledge on the topic of KM the SME showed very high expectations towards the introduction of KM and implementation of a KMS. With this background and the rather specific workspace situation the implementation of the system can be considered partially successful. As for the individual benefits following was found:

- Employees have developed a personal idea on what KM is and what a KMS can deliver
- The access to documents is more efficient (faster, centralized)
- Content display in SharePoint is clearer than before
- Employees feel support for their work

Based on the individual benefits the following organizational benefits were identified:

- Aware employees see the use of KM and are more willing to externalize their knowledge
- The KMS holds entries in the wiki which can be retrieved in case the now responsible employees are no longer available
- SharePoint is fully installed ready to support further projects
- Knowledge elements can be organized easier what leads to shorter access times
- The installed meta search integrates old assets from the fileserver with the new one in the intranet This might not be fully reflected in the results of the questionnaires; however, the effects of the systems are delayed since many employees do not primarily use a PC workspace for their daily work.

Regarding critical remarks on the KMS and KM start in the enterprise the work showed regards:

- Though Microsoft SharePoint Foundation is free of charge the cost for an IT administrator (by the means of time) should not be underestimated
- Introducing the system with a specific work scope e.g. within a project is more promising when it comes to the question what should be put there and where to start, it provides employees with a more specific point to start for documenting their results
- The integration of the KMS and working with it into work processes still remains crucial, especially with regard to the fact that most employees do not have permanent access to a PC on their workplace.

In addition to the results gained on the enterprise, regarding the validation following results could be gained and were published in [BRL14]. To start with the overall validation shown, that the framework as such could be operated and hence can be considered effective. Nevertheless, several requirements for further work on the framework could be identified:

R1 More details on the individual process steps are needed, to provide a better understanding on what to expect out o the process, and to accomplish the individual steps.

R2 Emphasize process integration already in the initialization and furthermore in the

implementation phase. This integration also implies the consideration of the TOI model.

R3 Concrete goals for implementation are necessary and hence, the alignment to the organizational goals needs to be accomplished.

R4 Further define the demand, as the contents to be delivered by a KMS could also be of interest.

6.3. Using Social Media for KM in SME

Research Questions

For the case study, which took place in spring 2012, containing two SMEs wanting to use social media for their KM, following research questions were of interest:

1. How is social media used in the organization?
2. How is social media integrated in the organizations business processes?
3. Which benefits are realized by the use of social media for KM in the organization?
4. Which potentials concerning KM are not realized within the organizations?

Especially, with research question 3 and 4 we address the problem of naming concrete benefits of the use of certain technologies for KM. This still remains a problem due to the character of knowledge which hardly can be measured in monetary units, whereas SMEs with the specific short-termed action horizon look for fast pay-off opportunities. The application of the framework for value-oriented decision support on KMS support, consequently was supposed to support the activities within the initialization phase regarding the demand clarification. The full length description of the case study can be found in [Wil12], where also the questionnaire details are provided. Besides, the results were also published in [Bor12b, Bor12c].

Setting

This paragraph shortly presents the two participating organizations, which were willing to use social media to address the KM problems in their business processes. For both companies the CEO and 2 employees were involved in the phases of the case study. The case study took place in February/ March 2012. To actually produce the described results, it was the intention to gain information on a) the demand to develop the KM b) the support to be granted by social media and c) models to integrate the responding Social Network Services (SNS). To retrieve the demand, interviews were conducted based on questionnaires gathering the subjective viewpoints of the CEO as well as some designated employees. Within the interviews the existing systems, the expectation towards

new systems and the general needs in the field of KM were explored. The focus lay on the transfer of knowledge between employees, as well as to the customer. For those reasons questions on the possibilities to share opinions, experiences and insights, as well as the already existing SNS usage were put forward.

The case study in this regard was planned as follows delivering the necessary data sources:

- workshop with main users to gather context of the enterprise, expectations towards a KMS support and possible associations
- questionnaire to gather the individual usage of related applications
- data analysis for knowledge service support
- comparison of possible concepts with the conditions in the respective enterprise

To collect the data participatory observations were used, since the student was part of the workshops and conducted the respective surveys. He wrote down his observations and the data analysis necessary for the framework usage in his master thesis [Wil12]. It therefore clearly has to be distinguished what results were gained for the actual usage of the framework and what data are remarks on that usage to be used for evaluation of it. In addition, it has to be noted, that the SMEs demanded anonymization and hence are only referred to in general without names.

Organization 1 This organization was founded in 1992 in Wismar, Germany. The value creating processes of the company are mainly situated in the field of consulting and engineering. Their main business activities are consulting services for other SMEs for e.g. certifying/ auditing processes, as well as image processing and technical image construction. The organization employs 10 people (7 full time, 3 students), and the average age of the full time employees lies between 50 and 60 years. It covers 50 to 70 orders a year resulting in a net sales volume of approximately 700,000 Euro in 2011. The orders usually are processed by phone and afterwards face-to-face consulting. The organization considers itself in the b2b sector. According to the definition provided in section3.5, this company is a small company.
Organization 2 The second organization in the case study was founded in 2007 and is located in Berlin, Germany. The values of the organization are created in the field of Amazon retailing, e-commerce and re-selling. In 2001 the business activities resulted in approximately 1,000,000 Euro net sales volume. To achieve this volume the organization has to cover around 100,000 orders a year, mostly for private customers and consequently can be placed in the b2c sector. The organization has 16 full-time and 10 part-time employees, all under the age of 30. Moreover, a high fluctuation of employees exists. They accomplish order processing mainly via e-mail, sometimes by phone calls. Considering the definition this company is volume wise as well as by the employee number a small company.

Results

In the following the results of the case study are described. Therefore for each of the organizations two partial results are provided: a) demand identified in KM and b) identified Social Media solutions. The results were gained by the specification of questions addressing the determination of the current social media systems in use, as well as the recent expectations towards a KMS regarding the 4 knowledge services to be implemented. Furthermore, the survey was supposed to provide an impression of the organizational culture, supporting social media at all.

Situation in organization 1 In organization 1 following demands could be identified: A wish for more information on the decisions made concerning the organization was uttered, e.g. CEO opinions as well as possible new orders and assignments. Moreover, a better collaboration with emphasis primarily on employee-to-employee communication should be established. This also included the desire for information sharing using shared documents. In addition, the employees asked for better and especially more opportunities to develop ideas. Consequently, an idea management is needed, which was not yet addressed directly. There is a central weekly meeting but hardly time to talk about new ideas and since an extra permission to use working hours for special activities is necessary, employees do not dare to ask for extra time. Furthermore, when new ideas arise and are exchanged they are not documented for further actions and consequently often neglected. After emphasizing the strong social component in KM, which is manifested in the organization's culture it was hinted, that if KM is a topic, time has to be spared for arising tasks, though it might not lead directly to revenues. In the organization there is also rarely any money left to address KM problems. Finally, the need to use knowledge for further acquisition possibilities was uttered.

When looking at the recent state of the art in the organization the situation with regard to systemic support was described as follows: though being acquainted with the Internet and the ideas of SNS the organization was not using social media for a long time. The enterprise tried using an instant messenger, which turned out to be unreliable, not freeware, and the complaint was that it did not allow for exchange between more than two people. Almost half the employees mentioned, that they are not interested in using an instant messenger at all, since they do not see any benefits in its use and feel it would disturb their work. Consequently, emails were mostly used to transfer ideas and information. Individual employees used solutions like Skype, which was in between forbidden by the CEO and afterwards not re-established. The time used for activities within the whole company within a week within a certain SNS is given in figure 6.3.

Concerning the search for information: there is an Intranet solution in use, which was also available from outside of the organization by a static IP address, however, only two employees are actively working with it. As reasons for this were identified: it is too complex in access rights, actually finding a piece of information is difficult since the structure of the solution, and the names of the documents are not self explaining.

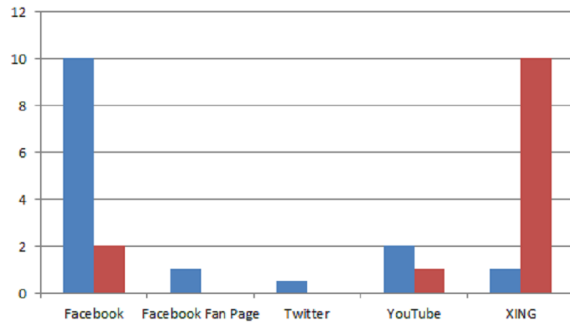


Figure 6.8.: Hours spent using SNS per week (red: organization 1/ blue: organization 2)

In addition, mobile solutions like smartphones were not common among the staff, only two employees own one. And after repeating the question for SNS illustrating it by examples, it turned out that there is one employee who started using Xing for acquisition purposes. In the beginning this was not supported by the CEO, yet after it turned out that these activities actually lead to new customers it is agreed on. Still this leads to another problem: there is a need for further information on the abilities of the other employees and their skills. The activities on this field last now for about a year. Moreover, two employees are privately acquainted with Facebook. Finally, the need for tacit knowledge sharing was uttered in combination with the establishment of electronic workspaces, so one can meet despite being on different locations.

Summing the results gathered up, we gained the following impression: the organization was willing to engage in KM, however, was not yet able to come up with concrete ideas on how to do this and if so only considered the technical point of view. Even more important is the actual integration in the business processes and consequently the understanding, that time has to be spared for KM tasks. With the example of the Xing usage, direct monetary benefits were seen and accordingly that solution was allowed, yet a strong wish for a direct monetary benefit to be named for further activities was uttered. Moreover, we gained the impression that due to the age of employees not much about the possibilities of social media was known, the personal engaged employees establishing these media in the company were missing as the CEO was not engaged in this topic himself. Moreover, he did not support possible initiatives due to the sparse resources. This attitude became also obvious when the interviews showed that the employees were interested in the possibilities a wiki can offer but were blocked by the CEO's doubts regarding time lacks and communication overload.

Situation in organization 2 During the interviews in organization 2 these demands were determined: One of the first points mentioned was a necessary idea development and management solution, which should furthermore also include customers. By then an exchange on these issues only took place informally, and ideas were easily forgotten or no longer worked on. The participants actually wanted a kind of idea collection base,

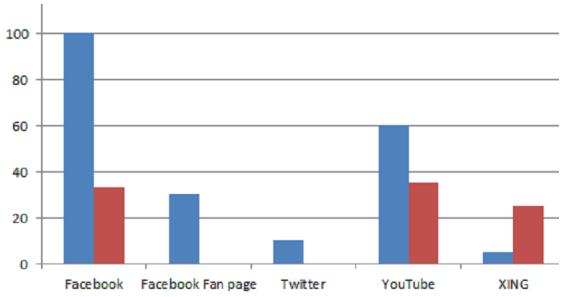


Figure 6.9.: Percentage of employees using SNS (red: organization 1/ blue: organization 2)

offering the possibility to collect, search and comment on ideas including a weekly review. In addition, the strong fluctuation among the employees was identified as a problem which needed to be addressed with the help of KM. These resulted in the fact that abilities and skills of colleagues were unknown, which was complemented by the wish for a stronger communication on work problems between the employees. A stronger transparency on the organizational knowledge structure was desired. Additionally, the insight was gained that a working calender system for assignment and exchange coordination purposes was missing as well. The need for exchange also resulted in the idea of using a wiki, also for customer purposes, to allow for a constant provision of information and knowledge combined with the possibility to comment and discuss the available items. It would be best, if this was connected to the Facebook fan page and enclosed an internal twitter account.

Moreover, a demand for web 2.0 technologies was uttered to stay up-to-date as a sales company. This should result in a new website including social media like a Xing business page and a twitter account, that automatically tweets on product updates and innovations within the organization. The organization could also imagine to use a virtual world to improve video and call conferencing, sales presentation and other remote meetings. Therefore, they emphasized the advantage of an avatar moving instead of the real person, which would save time and money resources. In contrast to organization 1 the second organization is already active in social media. Most of the rather young employees privately own a Facebook profile and these are up to 6 years old. The organization also maintains a Facebook fan page for about 3 years, which at that moment had about 200 followers. Furthermore, they run a twitter account which is filled automatically and was running for 3 years. The percentage of employees having access to different SNS is depicted in figure 6.9. The organization is also working with Xing, mostly to find new employees or experts needed within a certain field. Every employee owns and uses a smartphone, even if it is only for private issues, so they are acquainted with the offered possibilities.

Regarding extra tasks the employees mentioned, that they need to ask for permission to spare time on things, since there is a strong need to produce actions that can be invoiced. This is especially disturbing for developing new ideas. Moreover, in the field of KM they

	Organization 1	Organization 2
Idea collection	very high	very high
Wiki	very high	middle
Personnel index	middle	high
Calendar use	middle	very high
Virtual World	not interesting	high
Knowledge sharing	middle	middle
Improved instant messenger	very high	very high
Information accuracy activities	low	not interesting
Discussion forum, blog	not interesting	middle

Table 6.1.: Evaluation of possible solutions and actions from the field of Social Media

indicated that there is a need to update calenders to be able to gather information on meetings and staff this way. A calender should be agreed on and the employees were to use it, yet it has to provide suiting access rights to look into colleagues calenders. For pure document exchange the main channel in use was email. Almost every employee has an instant messenger installed, however, mostly for private use, even Skype is in use for private as well as business use.

The overall impression of this organization was that they were interested in almost everything available in the social media sector, which was related to the rather low average age of the employees and their personal interest in the available solutions. Yet, the problem is to integrate the social media efficiently into the business processes. A strategic plan of how to apply the available solutions was missing, as was someone assigned responsible for the alignment of systems in use to KM. The organization had already realized, that they have a certain need for KM and that it was constantly growing, yet by then they had not adapted their organization culture to this need. They could not name the specific benefit of their Facebook activities besides staying in contact with their customers, hence had the vague idea of using the media for their idea management.

Solutions to implement Summing up the demand analysis these were the main fields of interest for the organizations in the case study: communication among employees as well as with customers, knowledge transfer and innovation management. Besides these demands table 6.1 provides an overview on the solutions and activities from the field of Social Media and KM, which were considered to be implemented additionally to support KM. The likelihood of implementation and usage was provided by the CEOs using a 5 point Likert scale varying between “very high” to “not interesting”, this was to indicate the organizations acceptance and organizational culture support.

It can be deferred that organization 1 tends to implement a wiki, mainly for the idea management, so ideas can be stored and discussed and are no longer forgotten. As a

means for general knowledge sharing this is only interesting on a long term. However, the organization recognized that they were in urgent need for an improved communication, and chose to improve its instant messaging system. Asked for the reason for their choice they named the extra status information available (e.g. availability, recent activities). The organization does not see further use for discussion forums or a blog, as they on the one hand argue that a discussion can be included in a wiki and on the other hand refer to their weekly meeting.

Organization 2 is also interested in using a wiki but on the long term, for them it is more important to improve their Facebook activities and be better informed about their actual available skills, which vary strongly due to employee fluctuation. They also want to improve the instant messenger use, especially with regard to further information and the separation from private use which lead to a high variety of products in use. They regard the idea collection as important as well, but by then were not sure which solution to use.

It was surprising that none of the organizations was willing to work on information accuracy, which from the researchers point of view is due to the fact that both are just beginning to coordinate their activities and are not aware of the problems arising in that field. Even the question of who would be reliable for the maintenance of the technical solution and the necessary support in the case of questions did not arise. In addition, it was found that some demands can easily be addressed by changing the organizational culture in relation to social media, as for example the very critical attitude of the CEO towards innovations from that field. Also the wish for quick wins apparent in SME was confirmed by the behavior of the organizations constantly emphasizing an easy implementation and a fast pay-off.

By extending their IT solutions both organizations could overcome the insecurity of mail exchange they mentioned. Moreover, overhead by mass mails and resent mails could be reduced. But it is not the technology only, there is a need for a change in working mentality from push to pull, yet this needs user-friendly publish and search facilities. In addition, both organizations have to be aware of privacy issues, which may arise due to using private profiles or seeing the activities on a wiki. And finally the integration into the business processes must be clarified to be able to determine who owns important knowledge and is bound to enter it into the systems.

Besides the results gained for the organizations, the results for the validation of the framework can be summarized as follows. As for the emphasis of this case study, it could be seen, that meetings for the demand analysis work. The results have been published in [Bor14a]. Nevertheless, this also interrelates to the organizational culture, since if the CEO is very dominating it is more difficult for the employees to express their opinions. The framework was validated as being effective, however, demands for further refinements, to e.g. have the same questionnaires at hand. The resulting requirements hence are:

R4 Further define the demand, as the contents to be delivered by a KMS could also be of interest.

R5 Integration of the organizational culture in the demand phase was indicated, revealed by the different structures of the organizations in the case study.

R6 More details on the individual process steps were demanded by the student work, since this supports comparability. Especially the actual recommendation remains unclear.

R7 A stronger focus on initialization phase within the method is needed to gather all demands and prerequisites to also specify the demands under consideration.

6.4. Using Knowledge Maps for Knowledge Representation in Public Administration

Research questions

Following the perceived benefit approach as a means for success evaluation for KMS support, this model was going to be operationalized and tested within application. This was the purpose of the knowledge map project in public administration, which for this work followed the following research questions.

1. How can the KMS Success model be operationalized for KMS Success evaluation?
2. By which means is the perceived benefit approach with the KMS Success model suitable for public administration?
3. Can the knowledge maps be utilized as a means of KMS support within the established framework for KMS decision support for SME?

The full results are presented in the student works [Hen13] and [Mel13], which accompanied the project especially with regard to the social-empirical data extraction. The results have been published partially with [BHM14].

Setting

Applying the model of building blocks of KM (see sec. 3.2.3), the identification block can be implemented using knowledge maps as suggested by Eppler [Epp01] as a means for allocating knowledge. This case conducted for the event management for public events in the municipal administration of Rostock, Germany, documents the application and the use of such knowledge maps, as well as the evaluation using the perceived benefits approach implementing the categories of the KMS Success model.

The according plan for the case study consisted of the following steps:

- Workshop to motivate and clarify expectations
- Conduction of the interviews for process and demand specification
- Survey conduction via questionnaires for acknowledgement
- Data analysis

- Workshop for result presentation

The data sources for this case study mainly were the experiences and feedback gained in the workshop and the interviews conducted for the framework application. Data was respectively gained by participatory observation and were documented by memory minutes. The triangulation was given since three persons (2 students and supervisor) took part in the workshops and reviewed the data. Hence, again it has to be considered, which data belongs to the actual activities as part of the framework and which are additional remarks on the applicability. All data is shown in detail in the theses [Hen13, Mel13].

The municipal administration of the city of Rostock took part in the pilot phase of the project "Wissensmanagement für MV" (KM for Mecklenburg-Hither Pomerania) initiated to introduce the means of KM to the public administration in the federal country in 2013. The administration in the city of Rostock, being one of the biggest public administrations involved, took part in the pilot phase of the project, which had the objective to test several means of KM, their effects on the organizations and the suitability for public administration.

Within the municipal administration the activities around the event management were chosen since these involve several departments, can be considered to form a knowledge-intensive, as well as unstandardized process and demand restructuring measures due to inefficiency issues. Moreover, the demographic change often referred to in KM literature [Cal08], is about to effect many parts of the administration, since most of the employees (which were mostly women) working there are facing retirement within the next 5 years (about 30 % of all employees). The concerned employees however, have an intrinsic motivation to conserve their efforts for the coming generation and for this reason are interested in transferring their knowledge to either other colleagues or a system. Due to cost issues, problems and restrictions for finding new qualified personnel a direct transfer to the successors is usually not possible. Consequently, a stronger competency based network and archive is required to allow new employees to become acquainted with the work.

For the case study a team of 2 students and the author provided help during the implementation process of the knowledge maps and their evaluation based on the KMS Success model [JO06], [JSC09] and the included perceived benefit. The municipal administration of the city of Rostock cannot be considered an SME as such. Thus, the part under consideration did not include more than 50 employees without having an additional budget to implement the chosen knowledge maps, while being confronted with the financial restrains of the public sector. Moreover, the public administration is confronted with the fact, that their services cannot be valued financially and therewith is especially interested in the use of the perceived benefit. Consequently, the circumstances are similar to those of an SME and the methods chosen for application fit in the same scope.

However, since the public administration has strong restrictions on the security of personal data, all information provided here are presented anonymously.

Results

Knowledge Map Choice According to [Pro98, PRR06] the identification of knowledge sources denotes the beginning of the KM implementation process in the building block "knowledge identification". Initially presenting all types of knowledge maps from Eppler [Epp01], namely knowledge source, knowledge asset, knowledge structure, knowledge application and knowledge development maps, only two types were chosen for the implementation within the pilot for public administration within the first workshop. the choice was made based on the expected utility.

The knowledge asset map was chosen due to its resemblance to the well-known Excel tables in visualization and the combination of competency profiles and allocation in persons contentwise. During the initial interviews it also became apparent, that this information was the addition required and wished for, to enrich the already existing digital telephone registry into a valuable source of information. The goal was to provide a clearer way to find a suitable contact person by their competence. Furthermore, knowledge asset maps were regarded to be the best fit to support a network by visualizing the existing and required knowledge as well as competencies for the event management. They were preferred to the even stronger visualizing knowledge source maps due to their resemblance to tables known in municipal administration and the estimation of the IT department, that those could be more easily supported technically. In addition, the means of knowledge application maps was chosen to clarify the importance of interdependencies between the tasks of the process and to motivate a focus on process management, which is often suggested as a complement to knowledge management to allow for an easier access to the different knowledge resources and provide a clearer structure [Gro09b, SG15]. The knowledge maps themselves help to categorize the individual elements within the context in which certain knowledge is to be applied. Nevertheless, knowledge maps are not to contain the knowledge but to reference to it [Epp01, Leh10].

Assessment of knowledge and implementation of the maps Due to the event management process, which determined the context of this case study being unstructured, the first step for a knowledge application map was the clarification of the process and the shared responsibilities. The process was not modeled according business enterprise modeling rules, as e.g. EKD suggests [SSPW14]. It only served the subjective to structure the process into parts which were relevant for the assignment of knowledge sources. The initial intention was to address the process definition issue with the help of expert interviews with 2 long-term employees. The first interview was dedicated to the explanation of the process enabling the external research term to roughly model the process. The second interview was directed at confirming or correcting the constructed model. The corresponding process model should be labeled with knowledge and competencies necessary to fulfill the individual steps with the help of further short interviews and questionnaires. The choice for the expert interview was also based on the fact that much of the knowledge was indicated to being tacit knowledge only, which has not been externalized before.

Competencies	Employee A	Employee B	Employee C	Employee D
Personal competencies				
Resilience	o	o	o	X
Sense of responsibility	o	o	X	X
Conversation techniques	o	o	o	X
Relational understanding	o	o	o	X
Social competencies				
Empathy		o	o	X
Sense for cooperation	o	o	X	X
Factual knowledge				
Knowledge on laws	o	o	o	X
MS-Office skills		o	o	X
Knowledge on internal information systems		o		X
Methodological competencies				
Problem-solving skills		o	o	X

Table 6.2.: Knowledge asset map (extract) for the event management process - legend: X - strong skill, o - advanced skills, (empty) - basic skills

During the first interview it was revealed that even longterm employees were not completely aware of all process steps to be taken. This process was entirely decentrally organized and the point of determination varied due to the perspective of the involved departments. Accordingly, for the knowledge application map, a valid model could not be provided and the steps in the individual departments could only be described by the employees involved. It manifested that a simple mapping and visualization of knowledge application in a process as e.g. shown by Eppler is hardly possible given the process of event management and would lead to a confusing illustration. As a consequence the knowledge application map was used only to systematically approach the individual parts of the process and determine the according knowledge to be entered in the knowledge asset map.

During the final presentation of the knowledge asset maps (see fig. 6.2, the map is anonymised) to the employees of the concerned departments, the initial feedback was positive. In addition, the representative of the human resource department acknowledged the value of the profiles included in the map for further hiring and personnel development.

Knowledge determination Knowledge and competencies are closely related to another as is e.g. shown in the knowledge staircase of North [Nor16]. Based on the connection of competencies being the ability to act best on the existing knowledge, the conclusion is

that what actually is done by employees to be observed is a competence, which should be based on knowledge. Yet, in contrast mere knowledge can hardly be shown and the municipal administration was aiming at this higher level of knowledge since the objective is to support the employees in gaining the competencies essential for their work. The competencies to be assessed where categorized as described by vom Brock [vBBS07] in his acting competency model: social and self competencies, as well as methodological and factual knowledge. The competencies as described in role profiles resemble the factual knowledge and provide a rough overview on the general knowledge demand. Nevertheless, the provided job/role profiles were not sufficient for the determination of the knowledge to be used for the knowledge map. In addition to the mere knowledge further questions on the information and knowledge transfer in the public administration were included. On the one hand this was done to show the effect of the elements of the TOI model [BWP98] and on the other hand to show the way into recommending technical support according to the knowledge services as introduced by Maier [Mai07]. The resulting questions in the questionnaire and interviews can be found in the appendix of [Hen13]. With the help of those questions several knowledge maps were created, which were presented to the employees involved in the event management for comments in a central meeting, as shown e.g. in table 6.2.

Critical remarks on the created maps Though not being a technical implementation, the created knowledge asset map was supported by the IT department. It represents an approach, which can be transferred into a technical solution and for whose content provision an approach was provided, showing it cannot be the scope of the IT department alone. Nevertheless, critical voices mentioned a necessary training on the creation of the maps and an accompanying regular update of the map especially contentwise demands resources and efforts.

Regarding the perception of the maps feedback indicated, that the process of creating the map on the first hand, seemed to be of higher use than the outcome as a map itself. The reason for this was assumed to lie in the expertise of the involved employees, which activated their knowledge during the creation process and for this reason had no need of the lookup possibility. Consequently, they claimed to have no need of the externalized information. Nevertheless, the younger colleagues argued that such a map would have eased their job entry since the information flow heavily relied upon known structures. Anyhow, fears regarding misuse of knowledge as known from the TOI model [BWP98] were uttered by the staff council representative. Concretely, this was the fear of being replaceable and the pressure to provide too many details on ones work and competencies, which is not allowed due to German law. In addition, the question on the responsibilities and maintenance arose since during the pilot project the work was done by persons external to the organization. Later time and expenses have to be covered for by the public administration itself.

The actual evaluation in terms of questions to be posed and an implementation of

the dimensions of the KMS Success [JO06] were a part of the case study. Yet, due to the delayed implementation and missing training time those were not applied, but the perceived value was collected in the central introduction only.

Evaluation In the actual evaluation following the central introduction meeting an online questionnaire was used. Almost all questions (to be found in [Mel13]) were accompanied by a 5 point Likert scale with the addition of an item "not specified". Overall 12 employees answered the questionnaire, yet only 8 answers were to be used for interpretation. These results were combined with the statements from the meeting and categorized according to the dimensions of the KMS Success model. The statements however, mostly connected to the dimensions of "Intention to use", "User satisfaction" and "Net benefit". The remaining statements were mostly addressing the issue of the unmodeled process influencing the possible quality of the knowledge captured in the maps. These mostly covered the effort necessary to model the process and find the according knowledge, an effort which would not be necessary with completely modeled processes supporting a fast identification of relevant knowledge sources and the usage of knowledge application maps.

By the means of the questionnaire, a classification in the "Intention to use" could be made, namely the employees which were relatively new and depending on others knowledge and the long term employees holding the knowledge in demand. For the category "User satisfaction" the employees stated that the effort for the creation of the map was appropriate. Yet, they also indicated that the effort has to be covered somehow, since they cannot handle it on top of their daily workload permanently. The time must be integrated in their working hours for otherwise they would tend to skip KM tasks for the fulfillment of their operative tasks. Regarding the "User satisfaction" the employees also stated that the maps as such do not support the knowledge transfer, yet they wished for such support in further phases of KM in the municipality. With regard to the "system use" the employees wished for an integration with the existing telephone registry or at least a well known file location. Summarizing the evaluation of the method and tool of the knowledge maps the focus on the employees and the concrete inclusion of their needs and opinions were perceived as an advantage working against the fear of "yet another system". This approach consequently, allows for a strong integration of the users with the technology based on their demands.

With regard to the validation the results showed and published in [BHM14], that the framework as such is effective, yet, for the application in larger organizations and in this case public administration several restrictions are to be considered. Moreover, the time needed to implement such a project needs to be regarded, since public administration involves many approvals to be collected. The knowledge maps as such could also be evaluated with the help of the KMS Success model. Furthermore, the case showed the interrelation with the process management and the difficulties in externalizing knowledge. Consequently, the following requirements were compiled.

R7 A stronger focus on initialization phase within the method is needed to gather all

demands and prerequisites to also specify the demands under consideration.

R8 Emphasize the process awareness, so that in the initialization phase the allocation of the knowledge is easier.

R9 Discuss the integration of the system with regard to incentives and maintenance.

6.5. Benefit-determination for KMS Relevant Applications: Tweedback

Research questions

After the first case studies the actual benefit orientation of the framework needed a stronger focus in operationalization and validation. To gain the respective results, also with regard to the number of answers in an evaluation, a case studies on the evaluation of a classroom response system (Tweedback [1]) was demanding evaluation support. Being related to classroom learning and consequently knowledge transfer, as well as holding itself knowledge by collecting feedback, Tweedback can be argued being an application supporting the knowledge services communication and learning. Within the case study following concrete research questions were of interest:

1. How to thoroughly and systematically evaluate Tweedback?
2. What results can be derived from the evaluation of Tweedback?

These questions consider the operative work on the application, however, the evaluation in the end is also supposed to provide us with a general idea on how to evaluate such applications allowing for an easy adaption in further use. For success of an application like Tweedback in the terms of perceived benefit, the strongest response available is the reaction from the audience, since clearly no monetary outcome or concrete content to be created can be named. Hence, by cooperation our operationalization of the KMS Success model was used for the evaluation upon Tweedback and is documented with this case.

Setting

Tweedback by then was a prototype of a modern classroom response system (CRS) to be tested within lectures, asking for the value the application can add for the students in the different scenarios. CRS in general [KL09] have been voting mechanism where teachers asked multiple choice question prompting students to answer by clicking the corresponding button on a special voting device. Modern CRS are no longer dependent on these expensive devices, but use the mobile devices already at hand. Consequently modern CRS evolve to feedback systems including multiple choice questions on the contents, questions from

[1] www.tweedback.de

students, as well as specific presentation parameter, e.g. distinctness, to be rated. Though this feedback can be provided directly in smaller audiences, larger audiences are more prone to turmoil. Hence, modern CRS offer a way of providing extra live feedback using mobile devices (as smartphones, pads or notebooks). Tweedback is the implementation of such CRS and offers all feedback parameter at once. It is capable of durable access, a feature supporting permanent access of the feedback documentation. To reach a maximum of participants Tweedback is a web application and is thereby accessibly only with a web browser, which nearly every modern mobile device has installed. All data that was collected is also documented in the masterthesis [Kwa14], and again it has to be separated between the data collected to actually work in relation to Tweedback and on the other hand the experiences gained on the usage of the KMS Success model. The later are observation notes made by the student and the researcher taking part in the research project to evaluate Tweedback.

The evaluation took place in lectures in the winter term of 2013/2014. The results were determined and further described within the scope of a master thesis [Kwa14] and furthermore published for a research audience in [BVC14]. Some restrictions on the possible scope of the questionnaire were to be considered as well. Since we decided to apply a paper based questionnaire directly following the lecture using Tweedback the time for the conduction of it was limited to a maximum of 15 Minutes since students and lecturers had to spare the time and should not be overstrained. The experience this way was still fresh directly answering after the lecture, whereas an online version was likely to be answered sometimes after the lecture, when the remembrance of the application and its use might already have fainted.

For this first phase of the evaluation, 6 lecturers were interested in using Tweedback for enhancing their lectures with regard to communication in the lectures. Within 2 lectures available for evaluation the questionnaire on the perceived benefit was combined with the one on the didactical effects. Consequently, at least every second student took part in th part covering the perceived benefit. The questionnaires were spread in the last lectures of the series so that the students had already experienced several sessions and gained some routine in using the application. For the actual analysis of the results, the completed questionnaires were loaded into a system allowing for the statistical analysis with SPSS.

Results

Employing the KMS Success Model for the benefit determination This section is about to show the process of the survey development, the KMS Success model.

Tweedback was addressing lectures with larger audiences and numerous categories in which data had to be collected. Consequently, the decision for operationalizing was made in favor of creating a survey as a questionnaire to be handed out to the students in the audience. This also supported the fact, that Tweedback itself was created to allow anonymity. The preparation of the questionnaire was done by the determination of the

individual categories to be considered and the search for already existing questionnaires on the model to be adapted to the scenario of use. For the composition of the questions the experiences of earlier surveys among SME employees on their perception of a KMS system as e.g. the BTL case study, see section6.2 as well as published questionnaires from [OL07, ROB07, BALOO09] were employed and complemented.

In the following, the individual categories (knowledge/information, system and service quality) and their intentions in the application case are introduced accompanied by exemplary questions used for their evaluation. Most questions however, were posted as a statement with an item with a 5 point scale for the recipient to indicate whether the statement provided holds for him/her. The complete questionnaire can be found in [Kwa14]. The perceived benefit approach consequently was the only one allowing for feedback on the application, since the mere usage numbers provide an result but no clue on their indications. Furthermore, by the use in lectures no monetary value can be determined, monetary success hence could be excluded. Possibly the results in examinations could provide an indication on the usefulness of the system, yet to make the connection between the user in the system and the student in the examination is a) hardly possible b) critical with regard to data security issues and c) neglects all other factors influencing the learning success. Hence, the perceived benefit approach as used in the KMS success evaluation context is providing valuable feedback on the value delivered to the user, the student.

Knowledge/ information quality: The idea of Tweedback is that instead of posting questions on slides or comments of the lecturer some time after the actual lectures, this can be done directly in the context of the lecture. Consequently a better contextualization is of the knowledge provided by the lecturer is supported. However, the main intention is not the content provision to the students, but the reflection upon the events within the lecture. Thus, the questions in this field are rather general and focus on whether the audience experiences the use of Tweedback as knowledge complement to the lecture. According items are: the contents provided in Tweedback for me are useful/useless; the addition of Tweedback to the lecture for me is useful/useless.

System quality: is supposed to summarize all characteristics of running a stable and user-friendly system, allowing a positive experience without barriers in runtime. This should also hold for Tweedback. With this evaluation category, possible technical problems arising in application were to be captured. Consequent items in the questionnaire were: The technical stability was very bad/ very good?; The application works without problems with my device (yes/no); The access to the application for me is simple/ complicated.

The *service quality* addresses the embedding of the application in the environment. In case of Tweedback this means the integration in the lecture and learning process. Here the students are supposed to assess, whether the integration by the teacher was well done or whether technical problems prevented using the full potential of Tweedback. The items put forward on this are: The integration of Tweedback in the lecture is very bad/ very

good; The participation in Tweedback for me is simple/ complicated.

Finally, the survey covered the **user satisfaction**, which reflects the value of the application created by the fulfillment of the expectations. This category is based upon the assumption, that he or she is willing to use the application again if it is valuable to the user. Consequently, the questions were: I recommend the usage of Tweedback to others (yes/no); I intend to keep using Tweedback (yes/no).

Results of the survey In general a basic population of 60 participants from two lecture series was achieved. These on the one hand was "Introduction to Computer Science" and on the other hand "Computer network and data security". The table 6.5 shows the active and passive participants of the according lectures.

	Using Tweedback actively	Using Tweedback passively	Total	Percentage active users
Introduction to Computer Science	18	20	38	47.37%
Computer networks and data security	14	8	22	63.63%

Table 6.3.: Active and passive participants in Tweedback

It can be seen, that the amount of active users in the audience of "Computer networks and data security" appears to be significantly higher than for "Introduction to Computer science". A possible explanation might be the addressed audiences. Whereas "Computer networks and data security" was designed for students with a clear relation to computer science, which are assumed to have a higher interest in such technologies, "Introduction to computer science" comprises several study formats from business administration to aqua culture, holding different types of students. Nevertheless, the active usage was embraced by a sufficient amount of students to allow for an analysis of the impact of Tweedback. Regarding the answers on the overall passive or active usage, we gained 32 positive answers and 28 negative answers, resulting in 53.3 % active users. For the knowledge quality delivered by the application we used the questions on the addition to the lecture and the contents provided through Tweedback as shown in the table below 6.4.

The values show that in average the addition of Tweedback to the lecture is perceived more positive than the mere additional contents provided. This becomes even more distinctive when crossing the values with the statements on active and passive use. Then the passive users score an average of 2.96 on both questions, however the active users give the content a 3.41 and the overall addition of Tweedback to the lecture a 3.8. An active user seemingly generates higher profits from the use of Tweedback and in addition the

	The addition to the lecture for me is...	The contents provided by Tweedback for me are...
useless - 1	3	3
2	9	13
3	18	26
4	17	14
useful - 5	11	3
average	3.41	3.46

Table 6.4.: Knowledge Quality

contents are not the only incentive for the usage. This reinforces the tendency for the added value to be found in social media, which could e.g. be the network effect. However, this demands further clarification in further evaluation phases. In addition the numbers on the user satisfaction were determined asking for the overall satisfaction with Tweedback in the lectures and whether the students would recommend the use of the application. 44 of the students were satisfied, 7 were not, and 34 would further recommend the use of Tweedback, whereas 16 would not. It is easy to recognize the positive tendency on both questions, yet it is irritating that though students are satisfied with the application they do not recommend it further. This might be due to the fact, that the peer group is already present in the lecture or that the possibility to use Tweedback is strongly depending on the offer by the lecturer. Nevertheless, for the first evaluation this reason remains open. For further research more detailed input on this issue is needed.

Summing up the results gained by in the survey a positive tendency and a general approval to the usage of Tweedback in the lectures could be found. This refers to the second research question, showing that the methodology of the operationalization of the KMS Success model works fine and is also the changes within the lecture are also perceived by the audience. This was especially of interest with regard to the category of service quality, since in the lecturer introduction this was the focus of the work beside the working technology.

Overall, the used approach offers a systematic approach on evaluating the usage of Tweedback in lectures besides the generally known user satisfaction, taking into consideration the content dimension (knowledge quality) and the further usage (user satisfaction/ intention to use) operationalizing a model well-known from the measuring of IS/ KMS Success. This provides a systematical approach and consequently answers the first research question, however, allowing for an easy reuse.

A major problem in the questionnaire, which also holds for questionnaires in general, was the lack of details to be gained, since we avoided the use of open questions as they are unlikely to be answered. Nevertheless, e.g. the search for technical difficulties demands

a higher degree of detail which cannot be delivered by this type of survey trying to preserve the students' anonymity as it is provided during application time. Nevertheless the results were delivering valuable input for the application which by then was still under construction and the methodology was reused respectively. Nevertheless, requirements for the further development of the framework could be found by this case study:

R10 The integration of predefined questionnaires can support the fast execution of questionnaires.

R11 Including the discussion on scales and sample sizes should raise the awareness for importance of the statistical means within this framework.

6.6. Summary

Within this chapter the validation of the framework with regard to practical applicability was presented. As an overall resumee it could be shown, that the framework as such is effective. Anyhow, improvements are desirable to improve the independent application and the understanding of the concepts' interrelations. With each case study presented requirements were identified and summarized in figure 6.10, which represent the basis for the next design cycle.

Conclusively, the case studies have shown, that the level of detail is insufficient for the decision making process to be supported efficiently. Though providing relevant results, for case study research also the threats to validity as introduced by Yin should be considered [Yin09]. First, the construct validity for each case study must be given. To support this for all cases not only a single source of evidence was used, and either by review of the gained results by the informant (BTL), by presentation in the finalization meeting (Social media, Public administration) or discussion with the participants (Tweedback) a feedback was gained. Second, the internal validity had to be secured by the possibilities of data analysis. Therefore it has to recognized, that each case study took place within a student work resulting in at least three persons reviewing the interpretations, namely the student, the supervisor and the reviewer. In contrast to the internal validity, the external validity is concerned with the theory application in case study. Partially this issue is concerned in defining the domain in which the gained results can be generalized. This domain was restricted by the general target group of the target group of knowledge intensive SME, which applies to the cases of BTL and the social media application for KM. With regard to the cases of Tweedback and public administration it has to be considered, that both cases were only dealing with the exploration of partial concepts used within the framework and hence do not have to suffice the target group. However, the public administration only was a pilot example using a small scale business unit similarly restricted as SME and hence being close to the target group definition. With regard to Tweedback the research object has to be defined: here not the applicability in an SME but the usage

of the KMS Success model on a KMS was done, which was given with the application of Tweedback being an instantiation of the knowledge service learning. Finally, the reliability is given by the detailed description as provided within the student theses. With the help of the theses hence a replication of the results can be achieved, though a full replication like an experiment is not possible for qualitative research as done with case studies. By considering these threats within the planning of the case studies the according threats to validity could be addressed.

For BTL the decision was made on the support for the publication and search knowledge service and a Sharepoint solution was implemented supporting a better filestructure and a place for exchange of documents. The case study clearly revealed that it was possible to achieve a decision using the concepts integrated in the suggested value-oriented framework, though it became clear that the narrowing down to a single knowledge service to be supported was too restrictive. Subsequently the case study showed that the general construction of the framework is a valid idea and facilitates the decision making process several shortcomings had to be noted.

The strongest critique among them was the missing benefit of the mere framework for an SME. In the available version it hardly provides further knowledge on the concepts to the organization, nor does it support in the decision process on the KMS solution without further explanation. Furthermore, strong support in the process from the researcher had to be provided without providing enough transparency on the recommendation given. Regarding the framework concepts it was noted that the input for the knowledge service demand needed revision. The demand to be manifested in the knowledge services but in combination with the quality dimensions was demanding more structure. In addition the dimensions known from the TOI model showed their influence on the success of the implementation, especially the integration in the organizational processes.

Besides the main case study of BTL further practical applications of framework parts delivered valuable validation input. For this stage in the framework design this was especially the case study on the use of social media for KM. (see section 6.3). The case study tested organization possibilities in the initialization phase as well as the use of social empirical models to be integrated for the demand clarification. This test showed that initial workshops could be equally helpful as a written survey, and sufficient for demand specification, since desires can be captured directly. Moreover, by the inclusion of two enterprises in the case study, it emphasized the need of strong formalization to provide comparable results among different organizations. Though from the mere classification the organizations could be considered similar, especially the age structure among employees and the fluctuation strongly influenced the organizational disposition towards social media.

With regard to the single parts tested in the third and fourth case study, it provided the necessary amount of how much readily designed texts for questionnaires has to be available and can be included in the framework. This is also important due to the remarks to make

the framework more easily applicable. From the third case study especially the alignment with the organizational development and culture has to be emphasized as part of the framework, since the fail in the consequent execution of the framework can be related to the unresolved problems in that design dimension of KM activities.

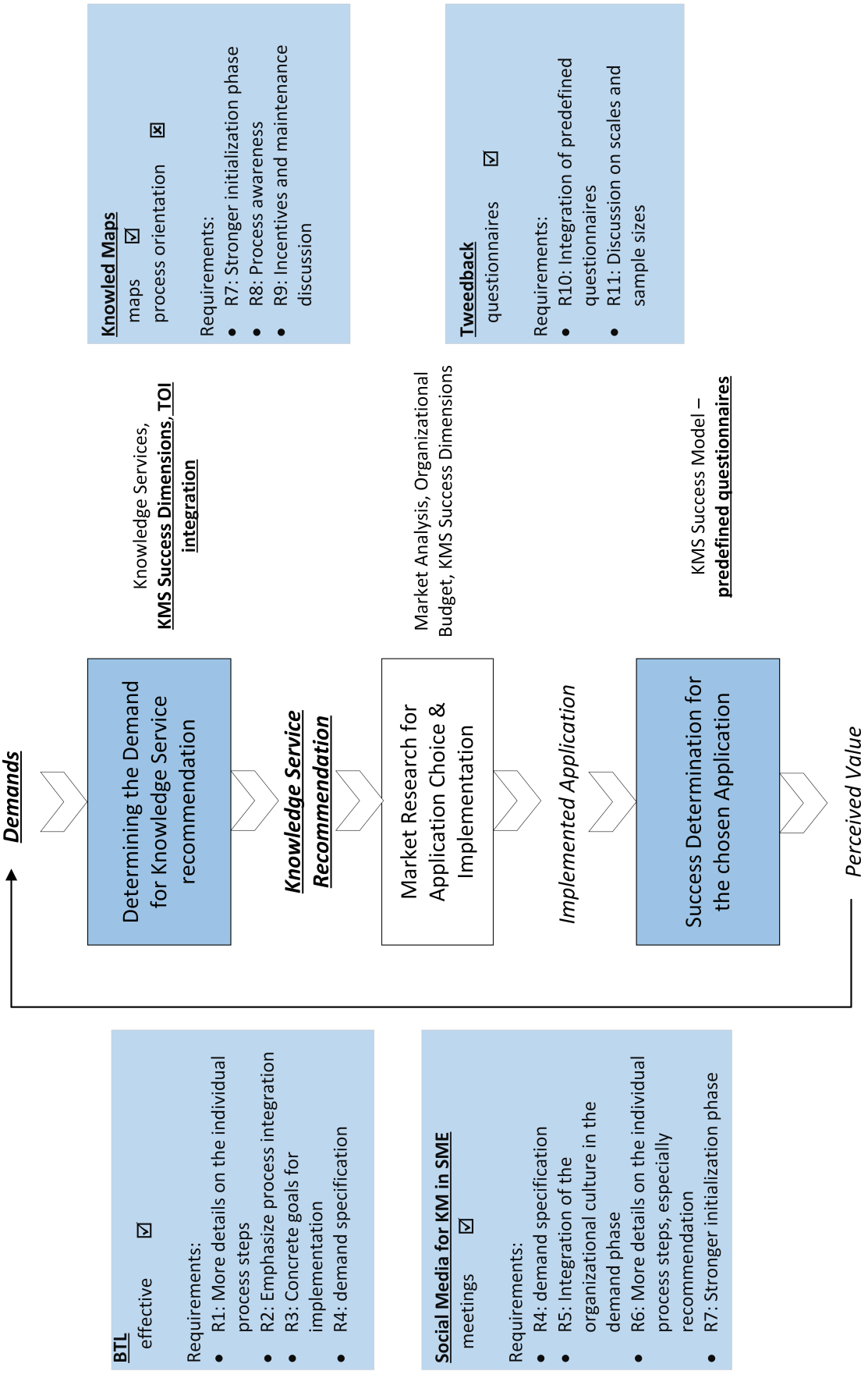


Figure 6.10.: Contributions and requirements gained from case studies

Chapter 7

Enhancing the Framework: Knowledge Demand and Method Manual

Following the DSR approach the insights gained from the validation by the case studies had to be transferred into the framework for improvement. The gathered requirements consequently are to be addressed with the next design phase. Upon the analysis of the requirements different emphasizes in the design process can be found. The most significant requirement from the practitioners perspective is the one demanding a more detailed description of the actions taken along the decision making process (requirement R1 and R6).

Besides these refinements however, R4 indicated a need for some fundamental work necessary to address the demand, which has to be gathered within the framework. Besides this issue oriented towards practical application, R4 indicates a need for the clarification of the decision base, the demand. Within the framework it is the central component for the decision-making, yet by now not sufficiently represented. This demand is referred to as knowledge demand, it requires further research. This preliminary issue and its accomplishment are described in section 7.1. The section hence presents the discussion on the knowledge demand, the research activities conducted to address it and how the integration of the concept in the framework can be accomplished.

Based on this general discussion, this chapter presents the enhancements made within the actual framework. The following section (see section 7.2.2) consequently describes the refinements of the so far conceptual framework with regard to its applicability by the inclusion of a method and method manual. With this step the design process especially addresses the requirements 1 and 6. The remaining requirements are addressed in the details of the method manual. Finally, section 7.3 presents the next version of the framework as the artifact of this thesis including the conceptual framework as well as the method manual to be treated as a unit.

7.1. Accessing the Knowledge Demand as the Foundation of the Framework

The framework is based upon the assumption that a practical framework should address the organizations reality and accordingly the problems have to be reflected in the framework. To base the frameworks choice of suitable KM Support in a problem-oriented manner, the actual basis for that decision-making should be clarified. For this thesis and the according framework the basic assumption is that the demand determines the benefits to be perceived. The benefit-oriented recommendation for implementation thus is oriented towards using only truely supportive systems instead of implementing a system only because it is available.

One of the main questions in KM is what knowledge is needed, where and when, and how can it be brought there. Also Probst et al. [Pro98] provide an initiation phase in their building blocks of knowledge management, which includes the knowledge goals and the knowledge identification blocks. The phases are dedicated to the clarification of the questions above.

When adapting this to the reality of SMEs, the knowledge demand contains the answers on the above listed questions. The knowledge demand in this organizational sense furthermore reflects the knowledge goals since the demand denotes what knowledge is needed for further development.

For this framework the knowledge demand is supposed to be a problem-oriented entry point to support implementation of KMS in SME in a benefit-oriented manner, since a KMS is supposed to hold and transfer the respective knowledge necessary for organizational development. This was indicated as being essential for KMS by [JO06, JO09]. The knowledge demand consequently is the demand to be satisfied for the creation of benefits by a KMS.

The knowledge demand arises from the organization, its problems and strategies for the organizational learning as described with KM in general. Thus, the inclusion of the knowledge demand also supports the holistic approach to KMS, indicating that KM is more than the implementation of a system or application. The involvement of the knowledge demand also reflects the facet of the KMS Success model that benefits are created by the use and the intention to use the technical support provided by a KMS, so benefits are perceived due to the need, the demand that is satisfied by using that implementation under consideration [Del03].

This section presents the discussion necessary for the integration of the knowledge demand as demanded by the requirements from the case studies. The research activities for the clarification of this issue hence are presented including the conceptual background as well as an observation study conducted. Parts of the results on the discussion have been published in [Bor14a].

7.1.1. Conceptual Discussion

Approaching the knowledge demand, it has to be considered that it contains two dimensions. The management of an organization might express the idea of starting a KM initiative, yet the individual employees are the ones putting the technical implementation as a KMS to use to satisfy their demands. The topic of the knowledge demand, here in connection with a recommendation on the knowledge services to be implemented, has to be covered for these two interest groups. On the one hand there is the management initiating or at least supporting the KM to transfer or generate knowledge to fulfill a determined objective. With this organizational demand once again the context is provided for the individual demand, since it excludes the personal interests of the employee not connected to its actions in the organizations. On the other hand the consumer, the user, the knowledge worker has to perform the tasks for objective fulfillment within the process under consideration and accordingly has to apply the knowledge to do so. Consequently, his or her demands and needs should have a strong focus as well.

Though being used in literature frequently [Pro98, Gro09a] no method for the determination of the knowledge demand could be found. And although definitions like from [RK94, p.68], who defined the knowledge demand as: "the kind, the amount and the nature of the knowledge an employee needs to accomplish his or her tasks" can be found, no common agreement on such definition was achieved. Hence, to approach the knowledge demand within this thesis, the approach is to examine if the connection of knowledge and information can be transferred to the demand. The information demand is covered e.g. by the information demand analysis (IDA) [Lun07]. Since this approach provides a fully structured analysis for the information demand, several questions with regard to the knowledge demand arise:

1. By which means differs the knowledge demand from the information demand?
2. Can "knowledge demand" and "knowledge need" be interpreted as the same thing?
3. How can this knowledge demand be derived, e.g. is it a possibility to start of with the IDA and only make additions to the findings?
4. Which parts of context differentiate knowledge from information?

The first question results from the fact that knowledge usually is defined as information in a context, it should be proven whether this holds for the knowledge demand in relation to the information demand as well. In addition, the general question on the difference between need and demand is to be discussed, since [Lun07] claims it being of no importance though e.g. [Krc05] defines the terms differently for the term of information. Afterwards, the third question includes the consideration whether knowledge demand analysis is simply information demand analysis in this certain context. Nevertheless, [Lun07] shows, that already the information demand is based on a wide range of context determinants.
To gain the desired results different aspects are to be discussed. Nevertheless, as for the terms of knowledge or KM it is assumed that no general valid definition of the term can be provided. However, the demand is considered essential since it is basic for the benefits to

be expected. The experienced utility leads to the value as described by macroeconomics defined in [weba].

Knowledge Demand vs. Knowledge Need

Though the term of knowledge demand is used in literature, a clear distinction or definition of the term is not provided. Hence this work starts with the underlying concept of information to provide an insight to the topic. The base for Lundqvist [Lun07] to state that the difference between information demand and need actually is not of essential importance, is justified by explaining the overall concept of his information demand. He assumes the information demand significant in general for the entire organization and hence a mixture of the concepts usually distinguished, as done by e.g. [PRW07] and shown below in figure 7.1. The information need as presented in figure 7.1 hence equals the demand of the

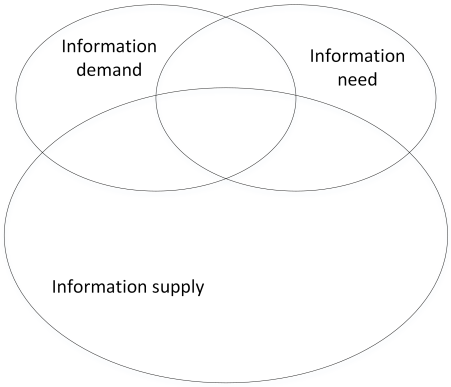


Figure 7.1.: Information demand and need according to [PRW07]

individual and covers all information the individual considers necessary to fulfill a task. Consequently, the information need is subjective. In contrast the information demand considers the information actually necessary to fulfill a certain task in the organization. The demand therefore is considered to be objective. In his thesis Lundqvist argues that the differentiation can be neglected depending on the perspective or the purpose to which the information demand is to be determined. It was his goal to establish a methodology to determine the information demand and therefore the subjective individual need was considered as well as the objective demand for fulfilling the task. As a result the IDA by Lundqvist [Lun07] includes both, information need and demand, summarizing them using the term demand as the focus on information flows needs both parts as essentials.

Transferring this generalization upon the discussion of knowledge demand as necessary for the framework to be established within this thesis, the same assumption of irrelevance can be made. As for the suggestions on the knowledge services to be employed in the organization it is not important where the demand stems from and for its derivation certainly both components, need and demand, are to be considered. Consequently, the term of knowledge demand is used within this thesis referring to the overall concept of

knowledge needed to work in an organization and accomplish the work tasks, independent from the one uttering it.

Nevertheless, it should be recognized at this point that knowledge differs from information by complexity and so does the knowledge demand. When following the definitions referring to knowledge as only being existent after information processing within the human mind, no actual knowledge demand can arise but it is always going to be an information demand. A possible illustration of this association between knowledge and information demand is provided by [Her08] and shown in figure 7.2. It can be seen that the organization defines the knowledge necessary for fulfilling the tasks. This is represented

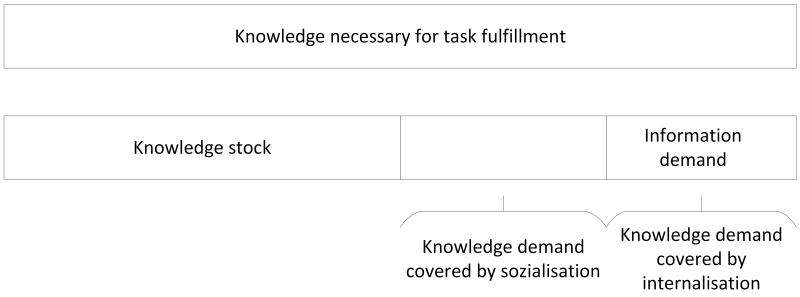


Figure 7.2.: Knowledge demand according to [Her08]

in the upper bar. The lower bar shows how this demand is satisfied. Parts of the knowledge almost always are already available within the individual. The leftover part has to be gained. [Her08] distinguishes the demands and their satisfaction according to [N$^+$95]. Thus the knowledge demand is either satisfied via socialization or internalization. However, internalization refers or externalized knowledge, which by some sources is identified as information. Within this work we do not follow this line of argumentation and thus assume that there is an knowledge demand distinct from the information demand. This aligns with the definitions on knowledge provided in section 3.1, where the context denotes the difference. We therewith acknowledge the complexity, which cannot be reduced.

Organizational and Individual Knowledge Demand

To be able to integrate the knowledge demand in the framework it has to be clarified where it occurs and how to gather it. Referring to known theory on the information demand and knowledge in general figure 7.3 visualizes the coherences.

On the left the information demand is denoted as known from e.g. [Lun07]. This information demand with all its influencing factors is already argued to have a rich context. On the other hand we assume the general knowledge demand to be influenced by the organizational knowledge objectives as e.g. mentioned by [Pro98]. These supposedly show the direction into which the organizational knowledge is to be developed, what on the one hand determines the information needed due to being a management decision. On the other hand this influences the actions which can betaken if a certain skill set is available

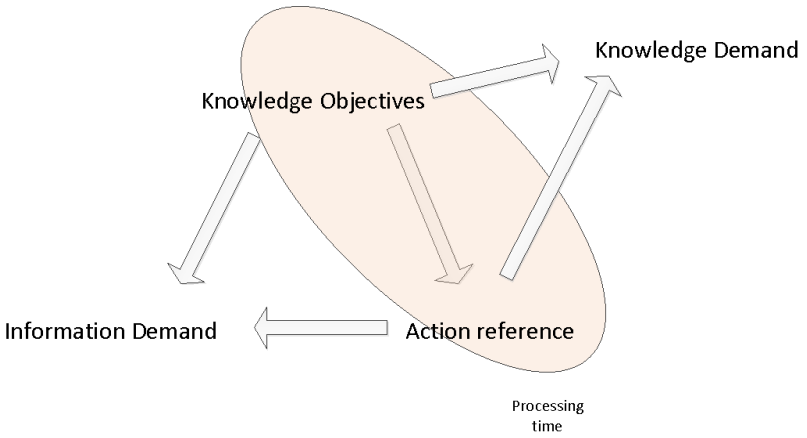


Figure 7.3.: Interrelation of information and knowledge demand

or not. And finally, knowledge demand is supposed to enable to act as indicated by the knowledge staircase by [Nor16], and consequently contains a action reference. Anyhow knowledge has some characteristics distinguishing it from information which should be taken into consideration here, as for instance Newell [New82] states that all knowledge occurs only after processing. One of the issues among these is durability: knowledge is usually valid for a longer time period whereas action information is valid at the moment gained for the action to be taken. This however, is directed to the layer of processing time to be seen in the figure. Only if this is passed at least once knowledge is constituted. Accordingly, true knowledge demand can only be estimated with regard to processing time. This is also a reason promoting the idea of using observations instead of pure interviews, since observations resemble the individual need at the possible processing time. One way to assess the demand would be to ask the employees for their demands. However, with reference to the existence of the process of socialization and the difficulties registered for the externalization of knowledge [N$^+$95, RD08] it has to be considered, whether answering questions is sufficient for retrieving all necessary facts.

To estimate the extent of the knowledge demand, the relation between individual and organizational knowledge demand has to be considered. The organizational knowledge demand in this case provides the frame in which the individual knowledge demands occur. Though an employee has knowledge demands also towards his or her knowledge development in general for this thesis only the demands within the organizational context are of relevance. These are represented by the colored areas in figure 7.4.

These knowledge demands are the ones to be considered in the framework, since they are to be satisfied by either socialization or internalization within or wit the help of the KMS to be implemented. Therefore, the necessary contents have to be provided, which is the point where the actual systemic support occurs. Hence, the knowledge demand relevant for this thesis is concerned only with these parts of the individual knowledge demands within the organizational knowledge demand. For the demand to be satisfied

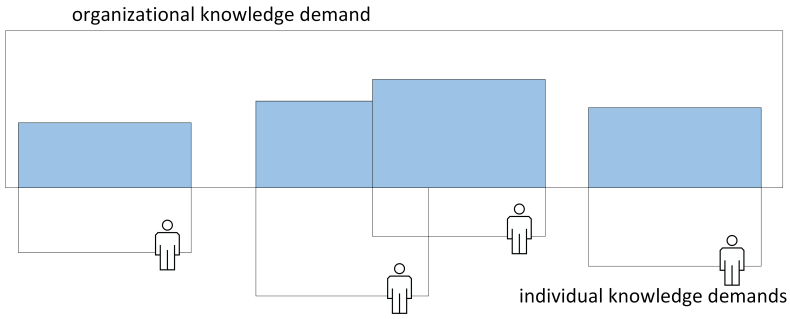


Figure 7.4.: Knowledge demands in the organization

the organizational culture provides the frame in which the individual can satisfy the according one. The culture e.g. determines how sharing of knowledge is established in the organization. This concerns the socialization and hence the transfer of tacit knowledge. Nevertheless, also externalization has to be encouraged and the time and context has to be created. Consequently, this knowledge demand is to be satisfied according to the individual preferences, which, in addition, determine the channels in use for the satisfaction. The individual knowledge demands in the organization as a consequence within this thesis is the one to be analyzed with the help of the KMS Success model and categorized with regard to the knowledge services.

To approach the knowledge demand in practical application and determine how exactly to integrate it in the framework, the decision was made to conduct a series of observations. The decision was made in favor of observations to prove several assumptions concerning the knowledge demand, which cannot be addresses in interviews or questionnaires.

7.1.2. Observation Study

To further investigate on the relations of the components as described above observations were to clarify the knowledge in need and the categories determining it. For the planning of the observation we refer to [SHE05], and hence the design of the observation study had to be settled first.

Study Design

Since the intention of the observation was to see, how the knowledge demand is perceived in practical application, the decision was made to focus on knowledge-intensive processes. These were not chosen because they contain the only activities having a knowledge demand, but they were promising a higher probability to actually observe the expected phenomena. With a general observation this would have raised the efforts for the observation, yet the results were not expected to be significantly different. This is due to the property of knowledge-intensive processes, as well as knowledge-intensive tasks, in general

to be rather unstructured allowing for a wide range of free decisions. Hence, observations had to be carefully planned. Since structured observations demand a predetermined set of observation categories, the observation study had to take place in two stages. Before being able to provide necessary categories supporting structured observations, an open unsystematic observation was conducted as a pilot to visualize the characteristics of such process related to the knowledge demand. This first observation conducted in May 2013 in the financial administration of the University of Rostock was also supposed to deliver working hypotheses on the knowledge demand.

Since knowledge intensive work certainly included silence periods where the individual is sorting out things for itself the observed has to be asked to think aloud [FKG93] to come up with relevant and interpretable observation data. Moreover, this facilitates the observer to understand the events during the process. The most critical criteria for the determination of the hypotheses were that they should allow for determined categories easy to be observed to allow for a clear conformation or rejection.

For the observation series several hypotheses were made to gather the knowledge demand, which then were matched to observation criteria as shown in table 7.1. As for the externalization aspect and due to the length of the possible observation periods, the observations were accompanied by a short questionnaire on the internalized knowledge, skills, further sources of knowledge and frequency of collaborative work, frequency of communication and the publishing of knowledge objects. As for the embedding in the field of KM, knowledge preservation should be looked at as well, namely whether they are are personal, interpersonal or team efforts in the field. Furthermore, the interest is on the education of the employees/ knowledge worker, to gather information on this field questions on further education were posed.

Based on the first pilot observation hypotheses and observation categories were determined for the observation series. For further explanation; Hypothesis 1 refers to the coherence of the knowledge demand and the work conducted, hence it has to be observed what is done and referred to the knowledge demands. During the first observation, the participant pointed this out, as he switched between different tasks and commented that he refers to different knowledge.

As for hypothesis 2, it is expected that the knowledge demand actually differs for different employees due to their already available tacit knowledge and skill set. Therefore, the skill set of the actor has to be gathered, which can be done by the questionnaire accompanying the observation. Hence, no additional observation categories are listed for that one. This hypothesis appears to be common experience, when reflecting upon the individual development in work life. In the pilot the participant referred to it by pointing out, that he earlier needed to look up or ask for certain pieces of knowledge, which he had then internalized. Anyhow, he claimed he falls back to that behavior when a new work task comes up.

The next hypothesis 3 is closely related and addresses the issue of “learning by expe-

rience". Where the knowledge to work through the knowledge-intensive task was gained once, through the repetition of the process or similarities at least parts of the knowledge are reused since they were internalized by the employee. Hence, the look up frequency was determined as a observation category.

Based on the socialization aspect of knowledge as provided by Nonaka and Takeuchi [N+95], it is assumed that the social exchange strongly influences the knowledge demand satisfaction. This can be either a knowledge source or a participant in the same process. The electronic collaboration consequently can be assigned to this hypothesis 4. The three observation categories hence reflect these issues and were all three observed in the pilot. The cooperation was the reason for interruption and the participant furthermore referred to special parts of his working environment as collaborative support.

For hypothesis 5 we are referring to the assumed occurrence of the knowledge demand as visualized in figure 7.3. It has to be assumed that when the KIP/ work task demands it, the employee is able to process certain information into knowledge. This was confirmed in the pilot when the participant received certain process information via mail, but uttered that he only needs it for another process, when he looks it up again. The observation category used above hence can be reused, assuming to show that more information sources than knowledge sources are utilized.

Finally, in the pilot it could be seen, that the participant used different kinds of competencies to accomplish the work tasks. All of them can be connected to some kind of knowledge, yet not every kind of knowledge can be provided via a KMS, as it is the focus of this PhD thesis. Consequently, the competencies, which according to [Nor16] can be deferred from knowledge, were categorized using the approach of [vBBS07]. These categories where used for observation, assuming that social and personal competencies usually cannot be gained easily while reading documents, whereas factual and method knowledge can.

Working with the look up frequencies of knowledge and information objects however not always describes the issue to be observed best. The nature of the objects would have been of interest as well. Yet, in the uncontrolled environment of this observation study, the exploration of that issue would have demanded strong interference with the participant and hence would have disturbed the work task execution.

The conduction of the observation series took place in cooperation with students in a seminar at the Chair of Business Information Systems. For the observation series an overall of 12 observations were conducted as described in table 7.2. Each observation was done using a protocol, which afterwards was analyzed with regard to the hypotheses. From the table it can be see, that the observations made were long-termed, which is the reason for the low amount of observations.

No.	Hypotheses	Observation criteria	conf?
1	Knowledge demand is dependent on the KIP	Task and result expected, process- wise: idle times (within process), structure(dness) of the process, repetitiveness	+/-
2	The actual knowledge demand is dependent on the skill set of the actor		–
3	The operative knowledge demand occurs less often than the operative information demand.	Lookup frequency during observation time (free field for ticking events: Of these knowledge artifacts, Of these information for work process)	+/-
4	KIP depend on social interaction, determining the sources to fulfill the knowledge demand, this includes 1. Needing knowledge from other persons 2. Needing other persons within the process to fulfill task 3. KIP work including collaborative environments/ documents/ artifacts	1. Consulting other persons during process (no/yes + how many times), 2. Process pauses for the worker due to legwork from others (yes/no), 3. Collaborative artifacts used (documents/ forum/ blog/ intranet/ E-Mail/ messenger)	+
5	KIP rely on processing information into knowledge, however not all information is processed into knowledge	Lookup frequency during observation time (free field for ticking events: Of these knowledge artifacts, Of these information for work process)	-
6	KIP include the regular application of different acting competencies [vBBS07] resulting in demands for: social competencies; personal competencies; method competencies; professional skills, as such the professional level determines the knowledge demand	knowledge types in form of competencies	+

Table 7.1.: Matching of hypotheses to observation categories for the protocol

No.	Process description	length	processor qualification
1	Programming deadline assignments	100	apprentice (1st year)
2	Customer process: Planning programming and requirement specification	105	CEO, University Diploma
3	Programming statistics public assistance benefits	60	Senior software developer
4	Questionnaire development on user behavior	40	Master Students “Business Information Systems”
5	Process optimization exam organization	90	Diploma in Business Administration, 5 years work experience, 1 year on job
6	Bash Script development for automated log analysis	90	0.5 years on this job, Master degree in information technology
7	Self observation - preparation of seminar paper	120	Master student “Business Information Systems”
8	Self observation - generating project documentation	60	Master student “Business Information Systems”, working there for 1 year
9	IT administration for science institution	120	Master student “Business Information Systems”, working there for 2 years
10	Mirroring databases (new scheme)	60	0.5 years on this job, Master degree in information technology
11	Allocating financial resources (university)	120	1 year on the job, university Master degree in business administration
12	Exam organization	120	24 years on the job, diploma in the field

Table 7.2.: Observations made

Results

For the results, overall 21 interruptions were recorded within the observed processes and in addition, one process that needs several days for accomplishment though not being interrupted during observation. The kinds of interruptions can be classified into two categories: reasons of the working environment and process related interruptions. The working environment settles for coffee breaks, meetings and colleagues entering with questions or problems. Two thirds of the observed interruptions were related to that kind.

The process-related interruptions included waiting for legwork, asking colleagues for help or opinions or waiting for the right information to be entered into the working system. Eventually (once) the process was interrupted due to the fact, that another KIP could be continued, which had a higher priority. These numbers refer to the hypotheses 1 and 4. For hypotheses 4.1 and 4.2 each of the observation criteria could be seen, illustrating the social component in knowledge-intensive work. For hypothesis 1, the interruptions meant changes in the knowledge demands, as when participants stopped the process, they usually turned to another task, demanding different knowledge.

With regard to the amounts of information and knowledge objects, the use of 25 knowledge objects and 38 information objects was recorded. The amounts of the objects only therewith confirm the hypothesis. In addition, more processes were found using a high number of information objects, whereas the number of knowledge objects used usually is low. The identification of knowledge objects had to be done by the observer and eventually lead to asking for more details than the content that could be seen under observation. This refers to hypothesis 3, and can be confirmed as the numbers tell that more information is needed than is knowledge. Yet, the objects do not reveal, how much of the information is processed into knowledge (hypothesis 5). Furthermore, it is hardly possible to see already internalized knowledge applied to the tasks although the participants were encouraged to "talk aloud" and describe the knowledge applied (hypothesis 2). Accordingly, in further observations one process should be observed several times to reflect this. The hypothesis on information being processed into knowledge can therefore not be supported with this observation. For recheck, however it was possible to observe the same participant of process 12, 2 years later, doing the same task. By then it could easily be noted, that he did not need to address new knowledge sources, whereas the usual two systems for information were opened. With observations like these, hypothesis 2 could be proven, and a linkage to the skill set is proven. However, only one repetition does not confirm a hypothesis.

For the technical support providing the sources for knowledge demand satisfaction, the observation showed the use of various application programs to be used for the accomplishment of the processes. 10 times text processing applications were used, 6 cases showed the use of email clients, also 6 observed the use of messenger systems, whereas in 7 cases a database was used and only 4 cases indicated intranet resource use. Moreover, several general editors, development environments and browser were used during observation. These numbers showed that hypothesis 4.3 can be confirmed and furthermore show the usage of information systems and knowledge sources within the process. Hence, it can be documented what sources are preferred and needed most.

With regard to the use of knowledge elements in form of knowledge requested from colleagues or found in documents, 93 occurrences were observed. 24 times the observed employee asked a colleague for help (16 oral, 8 written requests), the remaining 69 times knowledge elements were searched electronically. So actually hypothesis 4 can be redefined with approximately one third, of the used sources are social. One third of other elements

were located internally (21), whereas the other (48) where retrieved from the Internet. Anyhow, this observation step missed the verification on whether a knowledge or an information elements was used. Anyhow it shows, that a partial demand is satisfied through social contacts as well as systemic support. Yet, how often the process was depending on the input from other persons remained unclear due to the short time of the observation and working interruptions. Nevertheless, in processes 6,10,11,12 such interdependencies were found, which adds to hypothesis 4.2.

It could furthermore be seen, that certainly different tasks have to be fulfilled within a process and accordingly the contents in knowledge elements differ. Anyhow, since the observed processes were not similar to one another, the concrete influence in operation could not be observed and therefore hypothesis 1 could not be proven. With regard to the influencing factors, the experience level in general and with the process seem to have a stronger influence on the occurring knowledge demand, especially when considering "learning on the job". In general the hypotheses that the process determines the contents hence may apply, as does hypotheses 2 that the demand depends on the actors skill set.

The overall amount of competencies applied during observation was 133, which addresses hypothesis 6. Of those 52 were professional skills, personal competencies were 6, social competencies 17 and 58 occurrences were method competencies. Accordingly, the professional skills and method competencies sum up to over 80 %. These can be supplied as contents in the KMS, whereas the other request for special addressing by education or personnel development strategies. Nevertheless, under observation the nature of the object can hardly be explored and consequently, the assignment to the competency classes remains difficult.

Considering the mentioned definition of information demand the question should be answered, whether the knowledge demand behaves in a similar way. Lundqvist [Lun07] for instance says, that information demand is constantly changing. However, does the knowledge demand do this as well? From the first observation made, it became clear, that knowledge in the process primarily is the knowledge needed to find and process the information necessary to fulfill the process. Accordingly, the knowledge demand from that regard changes with the process and the required skills. Consequently, the frequency of demanding new knowledge is lower than the one asking for new information. This however could not be proven with this observation series. It would demand an observation on the same process with various as well as the same processors for several times. Furthermore, the overall observation lacks differentiation between information and knowledge since this can hardly be estimated by the observer, but must be requested from the participant. Summing this up it could be seen that the knowledge demand differs from the information demand but by now not every difference can be described in detail.

7.1.3. Conclusions for the Framework

Considering the suitability of observations for the determination of the knowledge demand as necessary for the framework, it could be shown that they provide a good impression of what is currently used to satisfy both demands and which volume it has. In addition, general habits on IS use can be recorded as well as the communication channels in use. Nonetheless, the differentiation between knowledge and information in use is critical as is the time to be invested to gain the results. Furthermore, questioning the employees cannot be avoided and as such observations can work only as complement of general questionnaires. What could be categorized is the search results for knowledge, since most it is method and professional skill support, whereas social and personal competencies experience less support in being learned from knowledge objects. As for the when of requesting knowledge the processes and their demands, as well as the skill set of the actor, have to be regarded as vital. In addition, knowledge is demanded as fewer objects which in themselves are more complex.

Regarding the observations, the knowledge demand to be observed can only be the individual knowledge demand, since the organizational demand should be gathered from the knowledge objectives of the organization, whereas the individual knowledge demand has to be described and captured within the organization and may differ strongly depending on the process to be supported. The consolidated individual knowledge demands lead to usage patterns for satisfying them when being observed. By this demand, the channels are retrieved through which the contents referred from the organizational strategy on the knowledge development should be transported to the employee. Consequently, these channels or their lack of are supposed to be addressed with the knowledge services as suggested in the architecture of Maier through which the organizational demands should satisfy. Nevertheless, it has to be considered that contents have to be available as well. Hence, the organizational knowledge demand is involved in the decision as well, since only channels can be strived for which can be supported and supplied by the organizations. Yet, though mainly the individual knowledge demand determines the demand which can be satisfied towards a benefit achieved with a KMS, the organizational demand has to be gathered.

The indications for the knowledge demand side by the observations certainly allow for some recommendation, when taken as a gap analysis. What is critical is the differentiation to be done between knowledge and information, which hardly can be achieved within an observation but needs more interaction with the concerned persons e.g. an interview or a questionnaire. Taking for example the lookup frequency externally it can be stated that this motivates building up an internal knowledge base. The competency type observed however, allows for recommendation on the support of collaboration (in case of high social competency requests), as does the frequency of contacts to others, may it be coworkers or customers. Interesting in this part was also the remark on the wish for someone to talk about the work within during observations. This wish indicates a strong wish for more

collaboration. Accordingly, for the establishment of knowledge services the following table 7.3 provides an idea on how the observation criteria indicate services.

Knowledge service	Observation criteria
Publication	search for external documents, keeping own knowledge documents, contents requested, high amount of local storage
Search	long search times, missing links between documents, questions to colleagues on where to find things
Collaboration	communication with colleagues, use of shared documents, collaboration applications with colleagues and customers
Communication	communication with colleagues and customers, use of communication applications
Learning	use of e-learning, skill development within the processes, frequency of processes (e-learning as refresher)

Table 7.3.: Observation criteria to services

When assuming these criteria connected to the knowledge demand useful for the recommendation on the knowledge service the question arises, whether they can be determined before starting actual introduction processes. Consequently, general characteristics could be categorized as demonstrated with the table 7.3. This should be considered for the initialization phase since observations are a rather long lasting procedure and observing all processes within an organization will hardly be possible. This addresses not only requirement 4, but also 7, by putting more emphasis on the initialization phase.

As mentioned before, it is easier to recheck on the processes or gain an impression on the actual use of applications and habits gained from a questionnaire beforehand. The observation as a method hence offers aa possibility to check, whether the conclusions drawn from a questionnaire apply and consequently are a useful addition. Moreover, for the knowledge demand to be considered for the recommendation within the framework, a look at the personnel development from the viewpoint of skill development might be useful to be able to put forward the right contents, e.g. as a push system. This would also be based on the architecture of a centralized KMS as suggested by Maier [Mai07], filling the personalization layer as well as the publication contents to be provided. However, this part is not essential to the framework since it form the contents, which vary highly between organizations and work tasks.

Concluding this section, it can be seen that the knowledge demand in this framework serves as the concepts central for integration for the concept of knowledge services as well, as well as the perceived benefit represented by the KMS Success model. It has to gather and analyze by the means of the KMS Success, presenting on the one hand the expressed demand for technical support and on the other hand involve the dimensions of quality, use

and benefit to weigh them. This is especially of interest with regard to existing systems, which might not be recognized as KMS support yet. In the end these knowledge demands are categorized with regard to the knowledge service to provide a recommendation for the implementation.

7.2. Enhancements on the Initial Framework

Besides the preliminary discussion on the knowledge demand or knowledge service demand, the case studies revealed the demand for enhancements within the framework. The ones perceived as most urgent were the requirement 1 and 6, demanding more details on the process steps of the framework.

One major major enhancement made also refers to the mentioned requirements, yet interprets them from the practitioners point of view. To provide better applicability of the framework is was decided to integrate a method manual, supplying the desired explanations. The composition of the method manual is described in section 7.2.1.

Moreover, the detail of detail important for the determination of the knowledge service recommendation to shown how the different concepts for are applied together. Consequently, the enhancements necessary to satisfy these requirements are provided in section 7.2.2.

7.2.1. The Manual: Focusing the Benefits

The second important point of critique arising with the first application as described with the cases of BTL (section 6.2) and the use of social media for KM (section 6.3), was the demand for a more practical oriented solution. The feedback gained by report on the experiences in the case studies was, that the framework as such was “inconcrete” or “difficult to be interpreted” and provides “too few rules for application”. Hence, the representation of the relations of the concepts in the framework was considered relevant, yet not feasible under the actual decision making process. This issue in particular refers to research question 4 demanding operationalization for practical application.

To address this issue, the decision was made that the existing conceptual framework as shown in 5.2 should be accompanied by a guideline providing further information for the potential user on how to put the framework into use for the respective organization. The conceptual framework itself can only provide an insight into the concepts of relevance, but hardly any direct explanations on the practical application. However, this is necessary for concrete operationalization for applying SMEs. The experiences of the participants in the case studies revealed, that little guidance on, how to interpret and apply the parts of conceptual framework was given. Hence, this property of the artifact so far did not align with the desired problem solution in the decision making and implementation of such systemic support, the actual problem leading to the development of the framework.

To support an actual application of the framework and the transfer of the presented

concepts into practice, the decision was made in favor to develop a method addressing this issue. A method generally describing the "a set of steps (an algorithm or guideline) to perform a task" [Mar06] consequently was to be constructed. With this step to integrate a method manual also the property of a framework "that expands the structure into something useful"[SOG16] was addressed. The scientific approach used for accomplishment was done according to the approach of method engineering as suggested in [GLS98] for IS development. To transport and illustrate the method, as well as to provide a means of publication to the target audience, it was compiled as a method manual. Within the manual an SME finds the description of the method components and further explanations on the steps to be conducted. Consequently, the method manual is the channel for publication towards the target audience. The developed method nevertheless, completes the framework, which is the central artifact of this PhD thesis.

Working according to the approach of [GLS98], a method is considered to consist of several method components, which themselves should be reusable. Each method component consists of concepts, a procedure and notation relevant for this component. The procedure explains the rules and recommendations on the actual development of the IS system, which for this work can be narrowed down to a KMS. The notation thus describes the results gained in the procedure of the individual method components. Hence, the outcome of each method component is to be clearly defined, also ensuring when one component ends and the next one begins. The overall frame in which the method is settled is described with the help of the interrelated concepts.

The method engineering in this case had to be conducted for an already existing conceptual framework. The concepts describing the frame consequently were: knowledge and KM, KMS architecture with the knowledge services, as well as the KMS Success Model, the knowledge demand and the TOI model. As a consequence, the method was designed as an enhancement of the already existing conceptual framework which was oriented to the decision making process from chapter 5. The run through the framework in adjustment was converted to a method as shown in figure 7.2.1. The method components determined under method engineering at large resemble the steps as already chosen for the case study of BTL (see 6.2). The method under construction therewith followed its specific scope namely the provision of a benefit-oriented decision support on KMS in SME. with the development of the method the decision was made to name the entire framework KinS, short for "KMS support in SME"

The construction of the KinS method led to the individual steps embodied as the method components. The actual visualization of the method developed underlying the manual can be seen in figure 7.2.1.

Although the method components listed below, appear to be rather general by the provision of their details concrete references to actions to be conducted are provided to the target audience of SMEs.

- Initialization Phase

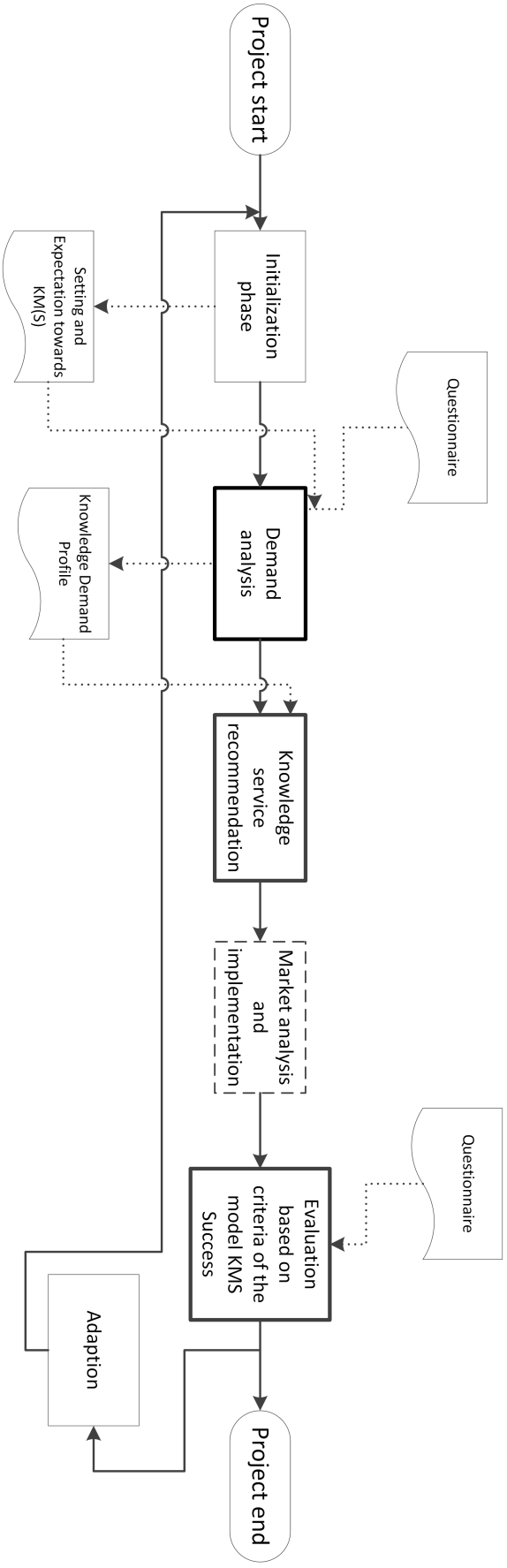


Figure 7.5.: The transfer of the framework into a working process

- Demand Analysis
- Knowledge Service recommendation
- Market analysis and Implementation
- Evaluation based on the criteria of the KMS success model
- Adaption

With the general structure resembling the introduction of software the KinS method puts a strong focus on the integration of the benefits in decision making process within the scope of KM. Consequently, the first phase appears to be rather general, but strongly relates to the general project management initiating the project and raising awareness for the issues under discussion, e.g. by indicating the importance of knowledge for the organization. The necessity of this method component became especially evident through the BTL case study, where no such initialization was communicated. It hence refers to requirement 7. The method component furthermore reflects the recommendation of [PRR06] to relate the knowledge management activities to the organizational goals. The focus of this method component lies on the overall demand clarification within the organization to settle the frame for a possible KMS support. With this integration requirement 3 is addressed by the development of this method component. Furthermore, the initialization phase is intended to relate to the holistic approach of KM rising organizations awareness of the fact, that a KMS depends on more than a mere working system set up. Consequently, this method component is supposed to introduce the concept of the TOI model with its dimensions to be considered. Though KinS is directed at providing decision support on KMS support, it has to be clarified that additional actions have to be taken to successfully implement a KMS which, should be part of a larger KM initiative. This step hence addresses the process integration.

However, the actual determination of the demands, expectations and organizational specifics are the center of the second and third method component. With the help of social empirical approaches, it is the goal to clarify the possible areas of relevance to be supported by KMS. The emphasis of this component lies on the knowledge services as e.g. introduced by Maier [Mai07]. With the help of several questions the recent situation in the organization is to be analyzed with the focus on the possible support by knowledge services. This is achieved relating the demand to the benefits to be expected of such a system. The demand therefore is designated to find the field where the highest usefulness can be generated, as indicated by the discussion of value and benefits. Subsequently, within this method component the demands with regard to the knowledge services are determined. The approach heads for the tangible benefits and by the utility for the concept of value as known from macroeconomics. As a consequence, the emphasis of a system support will be experienced more intense in a positive way, leading to higher benefits experienced by the employees.

Beside the focus on the knowledge services the demand analysis is also concerned with the general embedding of KM and KMS in the organization, and by this reflecting the

demands of [Pro98, BWP98]. The case study of BTL [Rec12] also raised the awareness for the difference between uttered need by the management and existing demand among the employees. In that case the management was willing to introduce a system, however, the demands among the employees were completely unclear. Furthermore, the necessity of systemic support is to be clarified within this component, since especially the organizational culture and general business processes determine the possible niche to establish a new system. With these questions the knowledge demand as discussed in section 7.1 is integrated. It is hence not the pure knowledge demand of a single individual but the knowledge service demand indicating what is needed to satisfy the knowledge demand within the work scope of the employees. Thus, the method does not register demands with regard to their contents but the channel for their satisfaction. To be able to gather the according demands the description within the method manual provides predefined sets of questions.

Based on the demand analysis and the settlement in the TOI dimensions the following method component provides the actual recommendation as an application class. The illustration of this choice on knowledge services was demanded by both case studies (BTL and social software for KM) since this is the actual point where the decision for a certain support is made. To achieve this, the demands derived from the surveys among the employees are condensed to a knowledge service demand profile. By the identification of the knowledge service demands through statistical means (means, variances) and the weighing of their relations to one another (e.g. it is not sufficient to support the search service when the publication is not adequate to have something to find), the knowledge service to be supported can be named. Based on a tabular catalog and combined with the organization culture issues the application class is determined. The decision was made in favor to recommend an application class as explained before and therewith confront the organization with the individual choice since the market and the amount of products available change permanently and fast. The abstraction hence was chosen as the framework otherwise would have been outdated soon. At the end of this method component the SME receives a recommendation on an application class namely the one having the highest demands for and thus promising the most benefits also from the viewpoints of the KMS Success Model. Both method components are refined in the next section 7.2.2.

The following method component “Market analysis and implementation” refers to procedures already known and is only enriched with adjustments to be taken into consideration integrating the dimensions known from the KMS Success model, and consequently addressing the possible perceived benefit of the solution to be implemented. Hence the market analysis can be considered to be known and the implementation is referring back to the models known from software and project management as e.g. the waterfall model [Bal10]. This method component also refers to the principle of reuse in method engineering [BJP07]: it does not have to be reinvented or changed in comparison to other software product and thus is simply referred to as implementation in the method engineered here.

The reuse is consequently regarded in the method manual by providing details only on the KMS Success factors from the KMS Success model [JO06]. The service and system quality both have to be addressed within the market analysis and the information/knowledge quality should be at least partially addressed within the implementation. This was not only recommended in literature [JO06, Mai07] but also by reflection upon the BTL case study showing that an empty system gets paid less attention.

Having introduced the chosen product the evaluation of its benefits should consequently accompany the necessary maintenance of the support. With this application of the KMS Success model also the long term character of KM is addressed, since it demands regular repetition. The evaluation is referring back to the dimensions of the KMS success model and the demand determination since the surveys to be answered, strongly resemble one another. As for the other questionnaires, the general questions to be adapted for the individual enterprise are provided in the method manual. The results provide an impression of the perception within the organization, as well as adaptations in the system to provide a better support. Interpreting the revised demands and perceived benefits as a circular model, this component is representing the connector to the next cycle. In addition, this method component can serve as an entry point for SME already employing a KMS support but looking for alignment and evaluation of the existing solution. By following this method after the initial evaluation, an IT-initiated approach common as e.g. described in [Nor16], can be enriched towards the benefit. Consequently, an adaption or extension of the already existing solution can be achieved.

Using the method components given above the manual as to be found in appendix A denotes for each method component, what should be done (procedure) and what is the outcome (notation). This method as described in the method manual provides the concrete description and formulation as demanded under evaluation, it is considered the operationalization of the conceptual framework. Thus, the concepts are explained in the preceding chapters of the method manual, which are explaining the general setting of the framework. Nevertheless, it is a general overview which is provided since that method manual cannot cover all aspects of KM. Moreover, the interaction with the research consultant is still wanted and the method manual as such not self-explaining for the realization of the method.

With the help of the individual method components and their combination into a process, it could be shown at which point the benefit-orientation is created within the decision process on KMS. Especially the integration of the KMS Success dimensions in the method components of the decision making process support the benefit-orientation. In the first version of the framework, the evaluation appeared as a subsequent activity after the actual decision on the systemic support. With the integration of the method and the method manual, the framework was enhanced above the conceptual status and is stronger oriented towards the problem solution for the target audience of SME. Hence, the enhancement of the framework also enhances the contribution of the PhD research work.

7.2.2. Knowledge Service Recommendation

Being aware of what knowledge is needed or at least which knowledge demands with regard to the knowledge services, the decision on the KMS recommendation has to be made. As systematic literature analysis 4.4 has shown, method support is hardly available on this decision, usually rules of thumb are applied. However, for this thesis we base the knowledge demand on an orientation towards knowledge services in need as could be concluded from the preceding section. These demands have to be gathered as the starting point for the recommendation determination. Consequently, the support by the means of the knowledge services can be implemented. Thus, the knowledge services also interact with and rely upon each other and accordingly a recommendation on a single, stand alone service to be implemented can hardly be provided. The recommendation on a possible systemic support is focused on the things needed most from the spectrum a KMS can offer, and therewith offering the most benefits if implemented quickly.

The knowledge demand consequently can be determined as described in the preceding section, whereas the knowledge service demand is identified with the help of either workshops or surveys depending on the culture of the organization and arising demands e.g. for anonymity. In the conducted case study of public administration (see section 6.4), the legal situation demands the anonymity, which was not given with some forms of knowledge maps according to the employee representative participating in the workshops. The sources on the demands afterwards are combined into a profile. Using the data gathered and categorizing it according to the knowledge services and the determining factors, the core issues within the individual knowledge services are identified, as well as the service asking for the most support. Based on that profile the technological support by a KMS should be determined.

The actual recommendation consists of two steps: the knowledge service determination and based on that the application class recommendation. The necessity for the integration of this step arose during review activities on the framework, since the actual matching of the knowledge demand and the knowledge service recommendation needed more explanations to provide transparency on the decision process. The emerging process of finding the knowledge service to be implemented is represented in figure 7.6 and described in the following paragraph. This however, illustrates the process as it constitutes for the knowledge-intensive SME.

The central issue of the process is the determination of the perceived benefit, since the method itself is supposed to be benefit oriented but does not aim for a monetary return rate. Accordingly, the perception of the future user, the employee, is used to estimate the benefits of the according system. Consequently, the determination of the user needs is the center of the decision making process. The needs subsequently, are to be analyzed using the background of the knowledge services.

Analysis for demand and perceived benefit The starting point of the process is the determination of the knowledge service to be of the greatest utility to the SME. This is

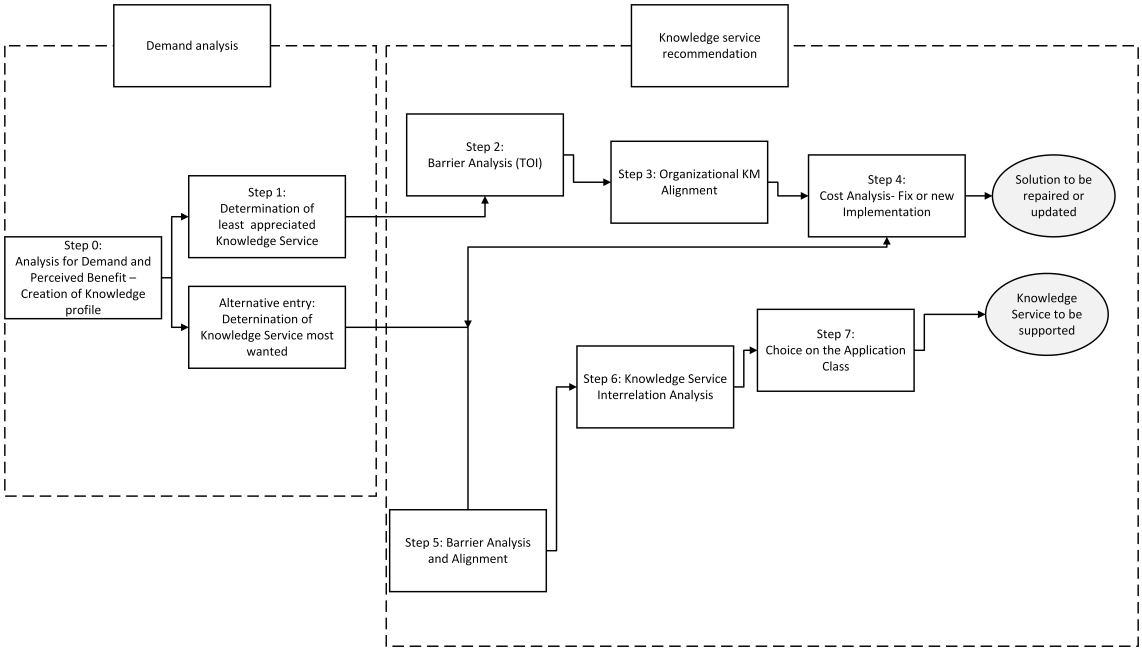


Figure 7.6.: Retrieving the knowledge service to be supported

considered to be the knowledge service demanding the most support. The straightforward approach would be, following the assumption that the knowledge service demanded most should be supported first and hence recommend an application class for this knowledge service. However, this cannot always be verified, since the interrelations between the services and general barriers in the organization have to be taken into consideration for a recommendation as well.

The entry point in the process as shown in figure 7.6 is the determination of the knowledge service with the lowest appreciation (Step 1) or the one which the employees name as the one most needed (Alternative entry). Therefore the knowledge demands as described in section 7.1 have to be determined. This can be done differently, according to the desired and the organizational culture of the SME.

For all SMEs, it is possible to use questionnaires, categorizing the gained data with regard to the knowledge services. Moreover, the case studies and the observations have shown, that we need a general description of the working environment, as well as the provision of the knowledge and competencies necessary for work. These three fields of interest form the basis of the knowledge demand. Whereas the questions on the knowledge service address the needs and the assumed benefits in the respective areas, the other data provides the information on contents to be supplied and the organizational setting of a KMS support. The later e.g. considers the access to a systems, which may not be provided due to the character of the workplace. To verify the statements in the questionnaire observations can be conducted. Otherwise also workshops can be used to gather the desired data, which might lead to faster results than a questionnaire. Anyhow, for the conduction

of workshops the influences of group dynamics on the results have to be regarded.

When having collected the results, the profile of the SME is build by summarizing the answers according to the knowledge services. Since these answers are not only provided as scales, the data analysis has to be done focusing on a) already existing system support, b) appreciation for the knowledge service support and c) the indication or need for knowledge service support. If the determined knowledge services equal each other, the recommendation can proceed with step A, if not two knowledge services as fields of action have to be considered under the recommendation process. The set of questions furthermore do not only reflect the knowledge demand, but also the dimensions of the KMS Success Model in case systemic support is already available. The success dimensions of system, service and knowledge quality also refer to step 2 of the process, the barrier analysis.

Barrier analyis (TOI) For the actual recommendation, it has to be analyzed whether the low appreciation of a service is due to technical support or if the other two dimensions of the TOI model are responsible for the occurring problems. This could e.g. be the case if the organization does not provide time to actually fill a system or if the individual employee's fears prevent them from entering relevant knowledge into the system at hand. By the integration of the results the existing solution, hence can be optimized with regard to its perceived benefit, if it is still the knowledge service in demand. In case the individual and organizational problems outweigh the technical ones these have to be resolved within the organizational culture and alignment of the KM strategy (Step 3).

Cost Analysis If the technical problems outweigh, this indicates, that either a fix of the existing solution or new system support is needed. With this step the system quality from the KMS Success Model is addressed. In case the decision is made for a new implementation, the demands of the employees should be considered, if they do not mention that the knowledge service that the system supports most needs enhancements fixing the existing solution should be sufficient. By continuing with a known system also the remaining effort is minimized, however, it has to be considered whether an update in the software is worth fellow efforts (licenses, interfaces, maintenance). Hence a cost analysis has to be conducted. Otherwise this is the knowledge service of choice for a new KMS solution to be implemented. Technological problems also indicate that a technical solution perceived as KM support exists and therefore should be considered for further enhancements. This was demonstrated for instance with the case study of BTL (see section 6.2), where the choice was made in favor of reworking the existing fileserver and provide it with a well defined structure as well as a naming policy to be of constant utility for the search service. A permanent issue is for instance the existence of folders named "MISC", "other", "leftovers". Avoiding these names in the naming scheme and providing clear instructions on what to expect from the contents of the folders and collected documents increases the value of the document collection constantly. Consequently, these actions to be settled in the publication knowledge service resolved the issues recording for the search knowledge service.

Barrier analysis and alignment If the appreciation of the knowledge services is good for all services or no technological support can be named, the demand profile part on the knowledge service most wanted can be considered directly as a recommendation (Step A - as alternative entry point). The satisfaction of expressed demands in this case promises the highest benefit generation. At this point, being without systemic support, the expressed demands are the basis for the benefits to be perceived. In addition, the questionnaires to gather the demand, also include the "intention to use" (from the KMS Success Model) is prompted to indicate the associated benefits of the use of a systemic support. Combining the uttered demand for support with the possible benefits leads to the first appropriate recommendation. Although a first recommendation could be given at this time, for the success the holistic approach of KM has to be regarded. Therefore both, knowledge services and the resulting system recommendation, have to be compared against the organization's strategy whether further support in this field is possible and can be encouraged. In case the organizational strategy e.g. does not support exchange via unofficial channels as there are messengers, but the employees demand such possibility an alignment process has to be accomplished, which has to be done outside the KMS implementation. Further alignment is also necessary with regard to the organizational and individual barriers since the implementation of a technical solution cannot solve these without the organization providing the time by e.g. integrating the task as a permanent compulsory part in a process (Step 5).

Knowledge service interrelation analysis Finally, the provided recommendation also has to be related to its surrounding/supporting knowledge services. A general depiction of the knowledge services and their interrelations can be seen in figure 7.7, which is also used for illustration in the method manual.

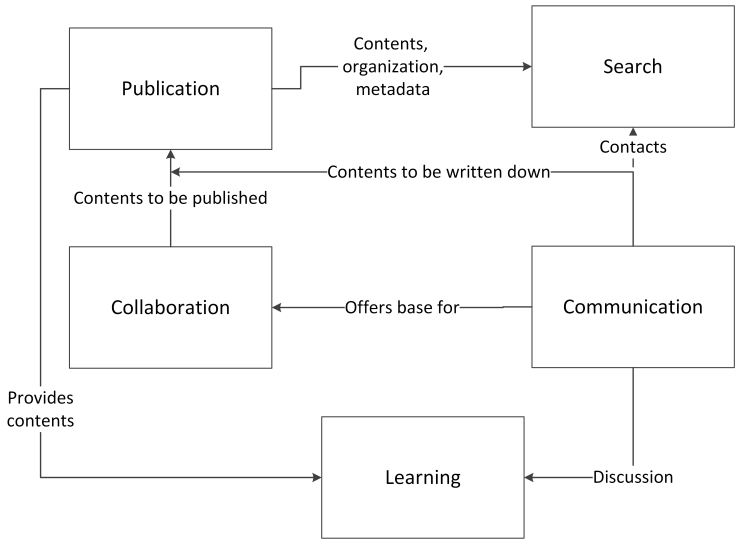


Figure 7.7.: The interrelation of services

The interrelation of the knowledge service indicates, whether or when a certain knowl-

edge service is to be supported, though it is not the center of demand. Communication is e.g. the base for a successful collaboration. This indicates that even if the results from the analysis phase reveal a strong demand for collaboration only it has to be secured, that the level of communication is sufficient to support successful collaboration. Already in the 3K model by [Teu96] the dependency of these two services was illustrated. In general communication is the base for successful collaboration as the later describes the work on a shared artifact and hence depends on the communication on what to do to be successful. At this point, it has to be noticed, that for the framework the knowledge services as proposed by Maier [Mai07] are refined. By the observations it was recognized, that communication and collaboration may be dependent upon one another, yet, collaboration with systemic support is applied less often, whereas communication should have a stronger focus. Therefore the two were included individually, to be able to address the social issues associated to communication. The communication service for once has to be included in the organizational culture of the SME and is reflected by the level of satisfaction with the communication service, since if the communication service is sufficient, the employees have established the right amount of exchange between them. In addition the individual issues arising with the service of collaboration have to be resolved which e.g. means clarifying the importance of the collaboration for the organization and addressing the individual issues like fear of loss of importance at the employee level. Here the alignment to the KM strategy and the organizations subjectives is to be accomplished, in addition the usage of incentives should be integrated. However, it has to be noted, that this not only refers to the electronically supported communication. This holds since especially communication in its informal aspect is accomplished without technological support. Another part of interrelated knowledge services are search and publication, which strongly depend on one another since results in search cannot be retrieved if there are no publications on the topic available. Consequently, if there are issues with finding certain information the solution is not always a better search machine, but often the mechanisms of publication should be taken into account for rework. For these knowledge service accordingly two reasons for unavailability should be kept in mind: first, the desired information is in the system but the place is unknown and consequently it cannot be found. And second, the information is not yet available in the system.

For the service of learning, which is especially challenging with regards to the contents, it has to be noted that learning is often not done via an official e-learning channel but by informal contacts or mere documents provided, these can be supported with the help of a KMS. Consequently, the knowledge service learning strongly relies on publication to provide the desired contents and on search to find the contents as well as the co workers to communicate with. Nevertheless, it should be recognized that learning with systemic support is considered less important in SME [BG10].

Choice on the application class After the identification of the knowledge service to be supported the choice on the application class (Step 7) has to be made. In general a large

amount of application classes can be named to support KM, consequently these are to be categorized with regard to the knowledge services, as shown in the table 7.4. The table cannot be considered completed since new application classes emerge continuously.

Knowledge Service	Application Class
Search	Search Engines
	Visualisation components
	Expert Systems
Publication	Document Management Systems
	Content Management Systems
	Social Media: Blogs, Wikis
Learning	Learning Management Systems
	Authoring Systems
	Digital Libraries
Collaboration	Group Editors
	Annotation Systems
	Electronic Meeting Systems
Communication	E-Mail
	Messenger Systems
	Conferencing Systems

Table 7.4.: Application classes for knowledge services

Using this table a choice can be made on an application class taking into consideration the organizations IT development strategy.

With this choice, the actual integration and market research has to be done. The general budgets for a potential system should have been clarified in the initialization phase, at last with the demand gathering, whereas here the concrete sums including the maintenance costs and the responsibilities for a running system have to be determined during market analysis. Based on the recommendation and the according choice of the application class a market research should be conducted as the step to determine the concrete product to be implemented in the organization. However, it should be kept in mind that this method directs towards a benefit-oriented choice and that the benefits within are generated by the users perception and acceptance. Consequently, the success dimensions of service, system and knowledge quality should be included as known from the KMS success model.

7.3. Introducing the KinS Framework

The creation of the method manual as a visible artifact has brought forward a new, more detailed version of the conceptual framework. The new version containing the accompanying method is described this section. The full method manual however, can be found in the

appendices (see appendix A). A visualized overview on the framework and the included concepts is shown in figure 7.3. The version of the framework was already discussed and published with [Bor14b].

Starting point within the KinS framework is the enhancement towards the knowledge demand which can clearly be seen by the integration of the demand, organizational as well as individual, determining the actual knowledge service demand shown in the left part of the figure 7.3. This part is new compared to the first version of the framework, which started with the actual knowledge service recommendation. Although the idea of recommendation was already articulated it was not clearly integrated in the older version of the framework.

The frame representing the knowledge demand also represents the organizational background, which is supposed to motivate and implement the dimensions influencing KM in general. Regarding the actual determination of the knowledge demand the organizational knowledge demand determines the field in which the knowledge is necessary for the accomplishment of the working tasks. Consequently, it provides the frame for the individual knowledge demands of the employees. The individual demand is the one to be observed and inquired, since individual employees are the ones experiencing benefits from fulfilling their knowledge needs by the usage of corresponding knowledge services implemented. Moreover, the individual employees provide the usage patterns and habits in the application of IS support, thus they provide the basic routines indicating that the implementation of a certain knowledge service is useful. Analyzing employees needs in groups reveals the patterns leading to stronger recommendations and also supports feasibility of a technical implementation. Through observation of their behavior also tendencies in the support towards e.g. Social Media or informal channels can be determined. In addition, under observation especially current media for the satisfaction of knowledge needs is of interest, since they provide a general idea on the informal social structure of the organization. Consequently by the usage of the according observation criteria the current integration of knowledge and KM with the TOI model is analyzed. In the framework these demands clearly form the background for the knowledge service recommendation representing the assumption that without a demand on a knowledge service hardly any benefit can be gained (see section 3.4.1) or proven. Nevertheless, the demand analysis includes the consideration of the perceived benefit, hence for existing solutions the success dimensions are to be included, in case of nonexistence at least the intention to use.

Within the revised version of the framework, a refinement for the actual knowledge service recommendation was integrated. The decision was made towards the separate handling of the services communication and collaboration. This decision was made during the evaluation of the method manual as described in section 8. This differentiation holds with the statement of Maier [Mai07] that the knowledge services effortlessly can be enhanced or adjusted. The decision within this framework on the separation of these

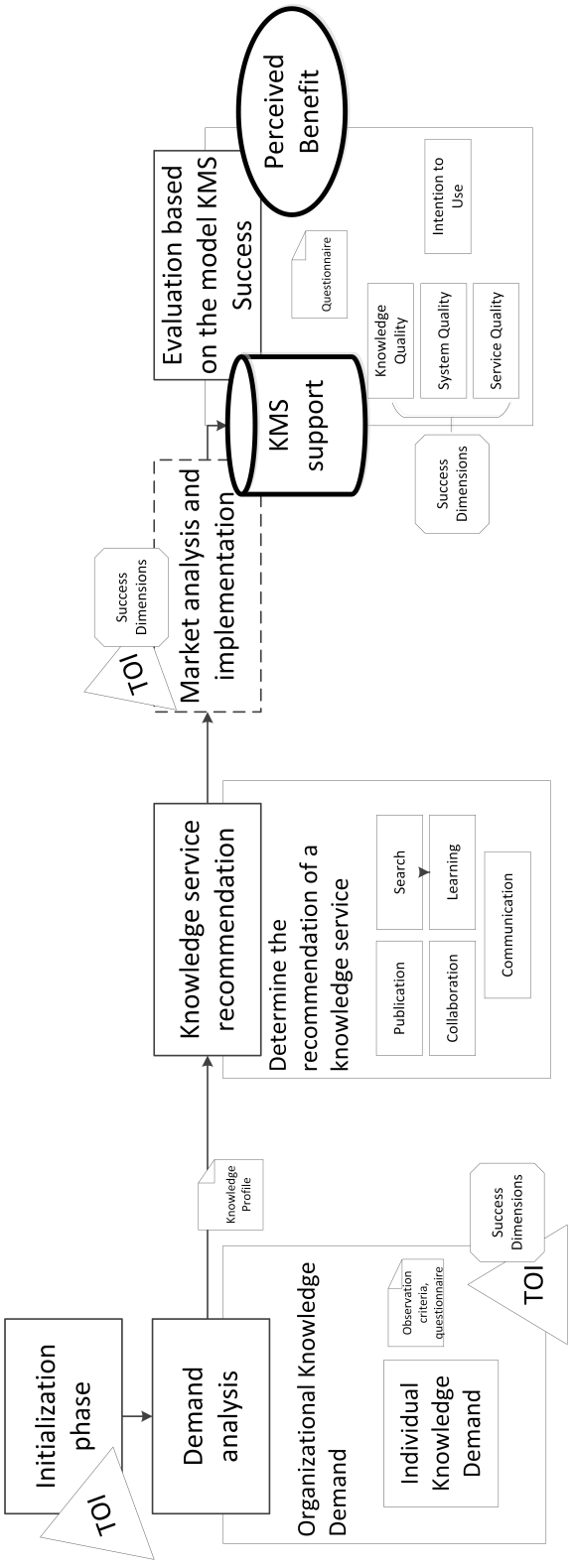


Figure 7.8.: Framework design for the demand - and value-oriented KMS implementation in SME

knowledge services was made based on the experience, that communication usually has a high significance for an SME however is not necessarily formal [FLM+07, MS09]. Furthermore, other architectures (see section 3.3) name different services and hence an adaptation seems reasonable. Collaboration, however, aims at a shared working artifact which is not always essential for the work to be conducted. Consequently, a differentiation for the two services has been accomplished leaving communication as a separate knowledge service to support. Furthermore, the significance of e-learning for SME has to be discussed. Though a full knowledge service is addressing everything connected to the issues of learning, this is hardly accomplished on an electronic base in SME, since the customized production of the according contents is rather time-consuming and has high demands towards the pedagogical abilities of the producing employee [BG10]. Especially, if this profile is not part of the general work knowledge necessary, the skill set of the employees might not be sufficient for the preparation of e-learning contents. As a consequence the importance of this knowledge service is reduced for the recommendation within SME. However, based on the knowledge demand and the profile created on the knowledge service demand a recommendation on the application class/ knowledge service is provided within the framework. Based on the recommended application class, which is e.g wikis, the market research as an external method component is to provide the actual solution to be implemented.

For the recommendation as well as the market research the dimensions relevant for KMS Success are to be included: knowledge quality, service quality and system quality. The aspects of system quality are especially relevant within the market research. Though the general recommendations on user friendly systems [Shn03] should always be considered, they are to be remembered to ensure their integration in the process. In addition, market research is to include the service quality aspects, as there are training or maintenance of the system. Both have to be taken care of and demand attention as well as resources, which in the end results in money assigned to the project. Here requirements and expectations gathered in the initialization phase should be taken into account. These issues are displayed in the framework by the introduction of the organizational requirements in the central framework depiction, however, they are also immanent through the establishment of the method as provided in the manual.

The result of the market research and the following implementation (which are both external components not described in this work) are supposed to deliver a working application. This application is to be controlled by the dimensions of the KMS Success model ensuring the benefit delivery by the use of the system. Within this part of the framework also the knowledge quality integration has to be accomplished, though in it is not the primal focus of this work. Hence, without appropriate contents provided by the system, no benefit can be perceived. At this point also the vicious cycle of an electronic data base [MA96] as seen in figure 3.5 applies. Moreover, without an initial knowledge base included during implementation the entry obstacles are set, since the expected users have to deliver contents in advance, which remains difficult and hardly provides a positive

experience with the system. The demand for the initial knowledge base to be delivered can already be gained by the analysis in the initialization phase and the determination of the organizational knowledge demand. Furthermore most frequently used objects as observed should be transferred into the system to provide the incentive for the KMS to be used. Nevertheless, the case study of BTL has shown (see section 6.2) that the provision of a filled system is not sufficient for a successful system, but demands for the organizational integration in the work processes to ensure respective usage. This fact is also be addressed within the implementation and the according strategy, following the idea of a process-oriented implementation [Nor16].

The framework as shown in figure 7.3 is highly integrated with the method and the method manual as described in section 7.2.1. With the refinement of the framework described in this section the method manual becomes an essential part for the practical application providing the method and the necessary artifacts for the method conduction within the SME. Consequently, they are to be treated as complements for following cycles in the evaluation. Anyhow, it should be taken into account that the artifact demands for adaptation to the individual applying SME. This process certainly needs for consultation by experts since the individual application of the framework demands for sophisticated knowledge in many areas connected to KM and KMS, which can hardly be expected from average SME. Hence, the KinS method manual is not to be applied by the SME on its own, though it provides a general access to the topic, but is designed for application with the researcher.

With the framework the requirements as presented in section 6.6 were addressed and integrated to provide a more profound solution for practical application. Following the process determining the framework, the initialization phase as an extra phase addresses the requirements 3 and 8. Within this method component with the support of the TOI the process awareness is raised, as the organizational embedding of the KMS support is regarded (R8), as is the concrete definition of goals to be achieved with KMS support (R3). Following the demand analysis as such refers to requirement 4, which could be found in three of the case studies and as a consequence was discussed in the beginning of the chapter. The result thus is, that the knowledge demand in the context of this framework has two facets. First, the knowledge demand indicating which system support will be used, and second, the demand signalizing the context to be included. The focus lies on the first facet. Within the demand analysis R5 is addressed, as the demands are also analyzed with regard to the organizational culture. This allows conclusions on the support to be implemented, since the organizational culture determines e.g. communication channels. With the discussion of the TOI model in the different components, in general R2 and R9 addressed, as e.g. in the market analysis and implementation these dimensions describe the references for the integration of the support in the organization. Especially, in market analysis and implementation this is also done by the usage of the KMS Success dimensions, these refer to the integration of the system relevant for benefits to be created.

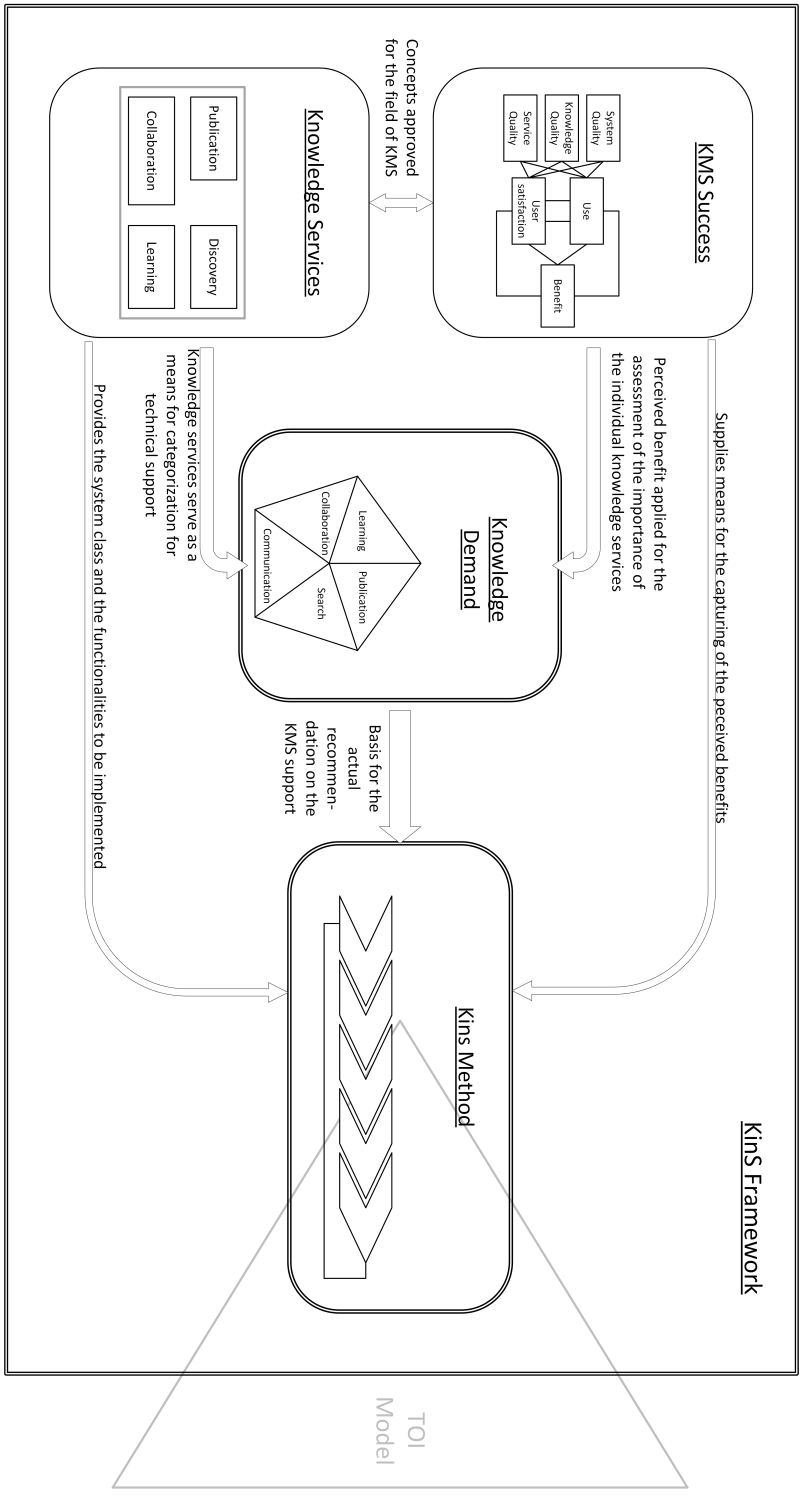


Figure 7.9.: The conceptual KinS framework

The requirements gained from the fourth case study are integrated with the KMS Success dimensions as well. This is done by the integration of predefined sets of questions in the method manual to be used for the analysis with regard to the perceived benefit. The missing requirements R1 and R6 were the reason for the creation of the method and the method manual in general, providing the desired degree of detail.

In addition to the reflection on the process level, the KinS framework can be discussed on the conceptual layer presenting the contributions achieved by the framework. The conceptual representation is shown in 7.3.

The figure visualizes the parts of the framework on the conceptual layer indication by doubly lines, which of the concepts were newly developed for this thesis and which were used from the existing knowledge base. It can hence be seen the the knowledge demand as discussed in the beginning of this chapter is of central importance. It is the integrating concept central to this thesis aligning the systemic support as shown with the knowledge services and the perceived benefits to support benefit-oriented decision making on the issue. The figure consequently represents the central artifact, which is instantiated for individual application. Within the figure it can also be seen that the TOI model represents a significant concepts influencing the KinS framework especially in practical application. The TOI model illustrates that the systemic support is to be further integrated within the organization. Especially the organizational culture is decisive for the usage of the system support. This is somehow reflected by the “intention to use” in the KMS Success model, however the feedback from the case studies and practice partners has shown that also the discussion of non-systemic solutions or at least measure for KM support should be considered for integration in the framework. Though this is not the scope of the thesis, the TOI refers to that alignment. By the conceptual framework it can also be seen that the practical application with the KinS method manual is only a part of the artifact considered relevant for this thesis.

Chapter 8

Reviewing the Framework: Systematical Evaluation

Following the approach of DSR, it is essential to provide evidence for the practical validity of the result of the research conducted presented by the produced artifact [PRTV12]. Consequently, a systematic validation is to follow the introduction of the artifact, the KinS framework including the method manual. The developed method manual as presented for practical application in the method manual introduced in the preliminary chapter, therefore were validated systematically as described in this chapter.

Validation and evaluation are essential in the research process to justify and improve the work conducted under research. Furthermore, validation in practical application is also supposed to ensure the validity of the results retrieved by research methods. Scientific publication as demanded by the DSR approach (see section 2.1) partially ensures validation through the review of the results in the publications by fellow researchers. This step in the research process validates through the review process connected with the scientific publication and the according discussion of the gained results among researchers. The publication however, can only represent the relevance and acceptance among the research community. For this work, this is shown with the published work as presented in section 1.3. Consequently, this chapter focuses on the validation with regard to the "application of the artifact in the appropriate environment", which is supposed to lead to further refinements or alterations in the created artifact [HC10].

As already discussed in chapter 2.3, this work utilizes the approach of Lincoln and Guba on naturalistic inquiry [LG85] for the evaluation of the artifact as presented with the method manual of KinS in the first version. Accordingly, the individual validation steps conducted are described in detail and their results presented in the following sections. Besides the systematical evaluation of the method manual it has to be considered that the method manual does not equal the framework. As a consequence, this chapter discusses the general threats to validity of the results gained in this thesis. The discussion is based on the four criteria of trustworthiness by [LG85].

8.1. Method Manual: Validation

Validation as the process of verifying results "by authoritative affirmation or by factual proof "[webb], can be accomplished on different stages. For planning the validation steps for the validation of the method manual based on the work of Lincoln and Guba [LG85] following stages were to be considered in the process of evaluation of validation:

1. The internal theoretical validation should allow an assessment of the applicability of the method manual from the perspective of a potential user covering the terms of comprehensibility of the produced text and the included concepts. Consequently this step contains the review of the method manual with regard to wording, used explanations, train of thought and comprehensibility. To cover all areas a systematic approach using several analysis steps was used, which are described in detail in the following.

2. For the internal practical validation, a possible application of the KinS method manual introduced in the method manual is simulated. This stage focuses on proving, whether usage of the method manual is possible or it contains severe barriers in the method design preventing the successful application. For this validation part, the application of a fictional case study was used, which allowed for the accomplishment of the steps as demanded by the method without the timewise elaborated and complex demands of a real case study.

3. The external theoretical validation is supposed to prove, whether the artifact could be used in the practical environment and by practitioners as it was created for. In the case of the KinS method manual, this means that an existing organization or practical expert as an external actor is supposed to review the manual, however, does not have to apply it in the organization to develop a solution to the problem.

4. For the external practical validation a complete thorough practical application within an SME would be necessary, including the long term observation of the impacts created by the application. That this is possible with the created artifact was already shown with the help of the case study on BTL (see chapter 6.2) for validation purposes, and was not fully repeated with the finished KinS method manual. Nevertheless, the most critical part on the knowledge demand determination was repeated to prove external validity.

The external validation stages can be further divided, for once regarding the validation context and on the other side the application context [LG85]. The execution of the manual by external actors within the validation purpose as it is done for the progress of this thesis, can be considered peer-review. The usage of a case study for validation purposes would also imply the usage in validation context. Accordingly an external theoretical validation within the application context would aim for extension of the artifact, in this case the

KinS manual, by external actors. An external practical validation for usage with the purpose of implementing a KMS for an SME without the focus on the validation feedback, consequently would be the external practical application.

8.1.1. Results of the Systematical Artifact Validation

The different stages of validation delivered results to be taken into consideration for the refinement of the KinS method manual. However, not all validation steps possible were conducted and documented completely and in detail at all stages of the work in progress. Figure 8.1 depicts the validation process conducted for the KinS method manual and names the different validation steps to be further described. E.g. the comprehensibility review for the method manual was done systematically as described in section 8.1.1, yet more than one person read the manual and added comments to improve the text quality. The steps presented in the following were part of the students thesis [Kle14] and therefore only described here partially. The complete data can be found within that thesis.

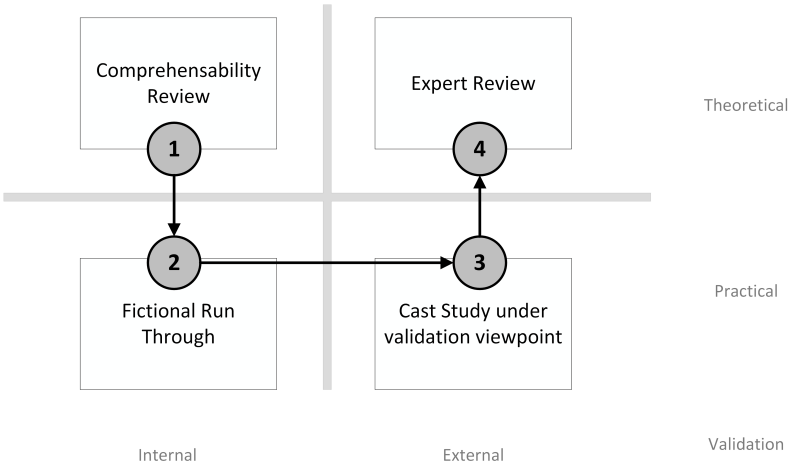


Figure 8.1.: Steps in the validation process

Internal Theoretical Validation

Though especially this part of the validation process is prone to the problems of inductive procedures and intersubjectivity, a review by individuals is recommendable for the KinS method manual to ensure comprehensibility among practitioners. However, since the ability to comprehend certain procedures depends upon the individual abilities of the reviewer, triangulation is necessary to accomplish a reliable result. Hence, the review should be conducted several times. Nevertheless the general terms of the review had to be settled. For this purpose the "Hamburger Verständlichkeitsmodell" [LSvTMT73, Lan79] was employed in this validation step. This model subsumes criteria for the general comprehensibility of a text, besides the legibility of it. It focuses on the possibility to extract information about certain facts and circumstances from a text instead of simply analyzing the mere style the

text is written in. The model was developed at the University of Hamburg and names 18 evaluation criteria which can be summarized to 4 attributes: simplicity, structure and alignment, brevity and conciseness as well as inspiring additions. Texts optimizing these attributes are according to [LSvTMT73] easier to read and understand by well, as well as less educated readers. In case of the present KinS method manual a reader would be considered less educated if he or she had little education/ experience in the topic of KM and thus is not acquainted with the terms and concepts in use. For the subsequent evaluation legibility, completeness as well as the validation of the used theories should be regarded. The attributes within this model can be described as shown in table 8.1. According to

Simplicity	
simple description	complicated description
short, concise sentences	long, nested sentences
common wording	uncommon wording
concrete	abstract
explained terms	unexplained use of terms
Structure and alignment	
Structure	unstructured
logical	illogical
clear	unclear
substantial aspects contained	unsubstantial aspects
train of thought visible	confused
brevity and conciseness	
too short	too long
restricted to substantial	unsubstantial aspects
compendious	wide
concentrated	discursive
concise	lengthy
Inspiring additions	
inspiring	dry
interesting	bland
varying	neutral

Table 8.1.: Characteristics used for internal theoretical validation: positive and negative forms according to [Lan79]

[Lan79] the criteria named can be evaluated using the following schema: property clearly developed (++), property partially developed (+), properties equally strong, neutral (0), properties opposite partially developed (-), properties opposite clearly developed(–). A comprehensible text should have the characterization of (simplicity, structure and alignment, brevity and conciseness, inspiring additions) denoted with (++, ++, 0 or +, 0 or

+).

The present evaluation based on the Hamburg model was done for each of the chapters of the method manual v.0.5 individually, and resulted in an overall characterization of the dimensions of (+, ++, +, 0). The full description of the evaluation listing all characterizations according to the model can be found in [Kle14]. Since this overall result gave the impression of the manual almost being optimal, the individual chapters were reviewed providing a more profound impression on necessary rework besides improving simplicity and adding inspiring additions. The remark allowed for a thorough rework of the handbook for a new version 1.0.

The main issues were questions and remarks on the realization of the method, especially for the individual components of the method. In addition, considering the audience employees or managers of SMEs, that the technical terms should be accompanied by a glossary to provide deeper insights into the used concepts. Furthermore, stronger guidance for the reader was indicated to be of interest to support the focus of the underlying technical method components in practical realization.

Internal Practical Validation

Though a text might be easy to comprehend, its contents applicability is not necessarily guaranteed. The same applies for the created artifact, the framework and the KinS the manual, and consequently the next focus in validation is the applicability. Though practical validation is demanded and usually of highest value [GL+94, MBM+02], to start with this validation step proves applicability internally with the help of a fictional model. In the case of the KinS method manual this would be the model of an SME demanding help in the implementation of KMS support. As before, the validation was done for each of the process steps separately which were described in individual chapters of the method manual. It is the intention of this validation step to clarify whether the descriptions provided in the method manual were sufficient to put them into practice. Furthermore, it should be elucidated, which preliminary knowledge had to be available for the execution of the method. This was addressing the issue of how much consultancy by the researcher is necessary besides the provided descriptions in the method manual.

For the conduction of this validation step a fictional SME managed by its owner having 10 employees was used. The model assumed further, that the SME is IT - related, providing software solution for hospitals and care facilities. The SME is an abstraction of an existing SME, from which also the structures of the employees could be used, as well as the general description of the organizational culture. Using the SME description a run through the method manual was simulated following the individual steps described in it. The results gained by this validation step of using a fictional SME being positive were:

- in general the efforts to be taken for the conduction of the method were sufficiently described

- by executing individual method components, it is possible to create the necessary questionnaires with the help of the manual
- the adoptions in the social empirical methods necessary are only minor, depending on the individual SME and its already existing system architecture
- the technical realization of the gathering of the demands and benefits determination could be easily prepared using text editors

The results signalizing need for improvement were:

- the knowledge service determination has to be described in more detail, which is also important for the system class recommendation, since by the current status the description is insufficient and untransparent for the applicant
- the knowledge service interrelations and their implications for the recommendation need to be described more detailed, since they appear incomplete
- the embedding of the KMS solution in the TOI dimensions of the enterprise demands further explanation to strengthen the assumption of possibly unnecessary technical KMS support

External Practical Validation

Though the application for a fictional model of an SME provided already valuable input on the applicability of the method manual in general, further input on the overall validity was needed. This for once should establish a full systematical evaluation of the model. Validity was especially of interest for the core method component containing the social empirical assessment of the knowledge demand. Besides gathering these data, also the interpretation and the deferral of the system class recommendation, as well as the benefits to be expected, is assumed central to the method. Only by this validation step the actual use of the method analysis of "real" data could be shown.

For general practical validation the full conduction of the method would have been desirable, yet since the results from the case study of BTL were already available from the first cycle of the evaluation and validation a reduction could be tolerated. This decision was also made with regard to the time necessary for a full application which was estimated for a full first cycle to 6-9 month based on the experiences from the case studies. This decision was based on the experience from the case studies since the case study of BTL had shown how time intensive the evaluation method steps were. Furthermore, with the case studies of public administration and Tweedback single instruments were successfully tested and refined to gain the necessary expertise on those method components in use. Nevertheless, the instruments in use in the method manual needed further validation. As a consequence, an organizational unit of the University of Rostock which recently had introduced a modeling support for process modeling related to KM issues, was asked to

take part in the validation step. Clearly an organizational unit of the University of Rostock is not a separate SME, yet the central administration is in employee numbers below the numbers of an SME and as an organizational unit from public administration underlies the same sparseness in resources that can be assumed for SMEs. Since the decision on the KMS support had already been made, the focus lay on the determination of the benefits of the solution implemented. The actual setting within the central administration was, that the organization development agreed to support the research project with a possibility to do the survey to gather the data for the perceived benefit in June 2014, after the introduction of Picture [1]. Picture actually is a tool support addressing the process management and consequently was used to enrich the process models with the knowledge from the employees. Thus, Picture offers support for the "publication" and "search" knowledge services, while offering also "collaboration" possibilities.

With the help of the manual general questions on the dimensions of the KMS Success model were combined, which should be answered by the employees in the central administration. Though officially 21 employees were designated to work with Picture at that time, only 3 completed questionnaires could be gained. The results indicated that though the systems was considered use-friendly (system quality), some functionalities (e.g. document upload) were missing and the communication within the user community (service quality) was not working. Thus, the publication of the process descriptions as shared documents was not used as much as they could. With regard to the collaboration aspect, hence no positive benefit was perceived. With regard to the contents provided (knowledge quality) the users were satisfied, yet the integration with the work tasks still had to be improved (service quality). The perceived benefits hence only were determined with regard to the provided contents and their storage. The results gained with regard to the validation of the method were:

- the questionnaires as introduced in the method manual provide a profound foundation for the value determination in terms of the perceived benefit approach, they need strong adaptations
- the method manual emphasized the consideration of the critical success factors for such a system in use sufficiently, yet they are not reflected in the questionnaires or in according descriptions on the interpretation of the gathered data
- the return rate problem of questionnaires has to be addressed for the execution of the method as introduced in the method manual

The last point clearly reflects the insufficient result gained by this practical external validation step. The data gathered are meager only due to the very low return rate in the validation period. The validation was done during holiday periods and therewith created only low return. Furthermore, the validation was not motivated by the project responsible, which created only minor visibility and therewith was not considered of relevance.

[1] www.picture-gmbh.de

Hence, it should be noted that participation in the follow up evaluation should be motivated stronger by the management of the SME or organizational unit to produce reliable results. Reflecting this back to the method in use a strong embedding of the inquiry in the procedure of KMS introduction is needed. Considering the result achieved, it could also be related to the fact that KinS was not applied completely and consequently some phases were missing. The results to be gathered are supposed to be the foundation for further decisions on the topic and consequently, the employees should be integrated with this follow up process with respect to the integration of the individual dimension for KM. The individual integration also aims for the benefits to be realized with the choice of a suiting support.

External theoretical validation

Since this validation step has not been part of the students thesis as the other validation steps, it is presented last. Nevertheless, the contact to experts assessing the applicability of the method manual so far has been made, to provide external sources for validation. The difficulty of this step was the determination of when a person could be considered an expert. Hence, the review of the method manual was done on the one hand by a practitioner for the introduction of IT-support for public-administration acquainted with the field of KM, and on the other hand an employee of an SME striving for KM support due to its quality management initiative. Both experts have been provided with the KinS method manual and were asked to answer the following questions in an interview:

- Where you able to understand the method manual?
- Would you (with support of the researcher) be able to apply the introduced method?
- Do you consider the used concepts relevant for KMS support for SMEs?
- What is missing in the method manual/framework?

The experts were interviewed after having read the method manual using the questions in an open form, refining them asking for the reasons or further remarks/ suggestions. regarding question 1, the answers indicated general comprehensibility. The interview partners reported language remarks, as well as complicated writing style, but consider the method manual as generally suitable. However, both experts recommended a translation to German. With regard to the application, one of the experts answered, that she would need massive support, especially since the demand determination was rather imprecise. Also the other expert stated the need for support. Moreover, the time for the accomplishment and the effort necessary was questioned.

Regarding the concepts used the experts did not see a need for change from their perspective, yet they were demanding details as e.g. the benefits of meta-data. both expert welcomed the approach to integrate the benefits, yet regretted the lack of being able to name the benefits concretely from the beginning. With the answers also the missing issues with regard to the method manual, namely the translation, degree of detail and the concrete benefits, can be summarized. With this validation step hence the contribution

as suggested by [Dav05, p.18] could be proven, providing "proof of acceptance and use".

8.1.2. Method Manual Enhancement

The results as presented in the preliminary section were supposed to lead to an alteration of the method manual providing improved applicability. This is the consequence of fulfilling a complete design-validation cycle as intended by the DSR approach. The key issue addressed after validation was the focus on the target audience of SMEs, which demands for other descriptions and explanation than the general scientific audience as known from scientific publication. Subsequently, a redesign of the KinS method manual was necessary. The steps accomplished to achieve this are listed below documenting the changes within the chapters of the manual (for the result see the complete manual version 1.0 see appendix A). The preceding version of the method manual evaluated is available at the author. The changes partially wwere done promptly in the revision of the framework as described in chapter 7.3, especially with regard to the refinement of the method components.

1. Method enhancement: the validation showed that a more detailed description of the knowledge service determination and analysis is necessary. To provide improved transparency and easier access to the decision making process, the process step of the knowledge service determination was split into demand determination and analysis. Furthermore, the descriptions provided were further refined, representing the results as shown here in section 7.2.2.

2. Language rework: during validation the theoretical validations revealed too many long sentences and complicated formulations, thus these were reviewed and changed. This was done improving the train of thought and the general comprehensibility. This process was repeated to integrate the remarks of the reviewer.

3. Illustrations: the "Hamburger Verständlichkeitsmodell" demands inspiring additions to provide improved quality for the reader. Since under validation this was referred to as demanding improvements, further illustrations and examples were integrated to provide an improved train of thought and clearness.

4. TOI integration: under evaluation it became clear, that though the manual emphasizes integration of the KMS solution according to the TOI model, it does not provide satisfactory explanations on this point. Consequently the KinS method manual needed further refinements on that point, discussing the issues arising with the organization and the individuals involved more deeply in the method components. For this reason, the TOI dimensions were integrated for more method components.

Following these validation steps further refinements in the manual would always demand further validation since a new design-validation cycle was started. Yet, with the improvement of the according method manual the created artifact of the PhD thesis has reached

the desired maturity status. It shows that the efforts conducted under the research process are externalized by the means of the KinS method manual can be transferred into practical application and respectively can create benefits for the users with the usage on further case studies ongoing the suitability of the method manual could be proven, even if further improvements follow.

8.2. Threats to Validity

Up to this point this chapter mostly refers to the ex-post validation of the method manual created within the scope of this research work. However, with regard to the validation of the conducted research more issues have to be considered to ensure the trustworthiness as demanded by Lincoln and Guba. Especially the enhancement of the validation so far to the entire framework instead of the method manual only is necessary in order to provide general trustworthiness. Hence, this section is dedicated to the discussion of the threats to validity in general, presenting how the four criteria of trustworthiness: credibility, transferability, dependability and confirmability were achieved for this work. Since the discussion in the preceding sections focuses the method manual and therewith the ex-post perspective of this thesis remarks on the ex-ante evaluation are to be included here as well.

Since the ex-ante evaluation usually is supposed to address the threats to validity before the actual research process [PHPH12]. Hence planning research activities beforehand is demanded for ex ante validation, however, it has to be denied, that this was done for the research process as described in section 2.4. This is due to the exploratory nature of the research conducted, which could not precisely define all steps at the design stage of the research process. The problem of ex-ante validation also holds for the evaluation design process outcome, the KinS manual, as presented in this chapter. However, referring to the classification as used in [PHPH12] and the according examples parts of the work conducted can be labeled ex-post, since the design process for the actual artifact took more than one iteration. Referring to the in between conducted case studies, parts of the process accordingly can be described ex-post. In the following the individual parts to be addressed for the establishment of trustworthiness [LG85, GL$^+$94], are to be discussed for the outcome of this thesis accompanied by the measures taken to accomplish them.

Credibility

The first aspect of credibility is supposed to accomplish believable results, assuring that the conclusions drawn and interpretations made by the researcher are representing the actual problem. According to [LG85] this involves two parts, first, ensuring that the research activities are conducted allowing for credibility and second, presenting the results back to the research objects for verification. To support credibility, activities as persistent observation, peer debriefing, triangulation, use of referential adequacy materials and member

checks [LG85, GL+94] are suggested. Hence, the credibility is intended to guarantee that false interpretation or interrelation is avoided.

For the presented work this can be discussed regarding two aspects: first, the conduction of the individual research steps and second, for the conclusion drawn from the results transferred back to the design artifact of the framework. As for the individual research steps represented with the case studies it has to be noted, that these mostly were conducted involving students theses. Hence, a triangulation involving more than the opinion of the initial researcher was at all times provided. Though it could be argued, that these works were accomplished under supervision and hence refer to the author of this research work, validation was also provided by the assessment process for the individual works. With all of the conducted and documented activities a peer debriefing and member check was established presenting the results back to the participants in the research process demanding their comments. However, the aspect of prolonged engagement with the research partner could not always be established, e.g. for BTL it was possible, since the student had already conducted his internship in the enterprise, whereas in the case of "Social Media for KM" the student was not part of the organization. With the follow up case of the public administration this aspect was addressed by the observation of processes and departments and the interviews as well as meetings to gain the respective insight in the organization. Yet, since the entry barriers in that case were nonetheless high, the prolonged engagement can only be considered partially successful. Finally, for the Tweedback application the researcher joint the team for some time and hence gained an impression of the demands within the project. Since the individual steps in the Tweedback evaluation focused different aspects also the referential material and its quality differs. It is only partially involved within this thesis and the original sources are attached to the student theses. However, since parts of the theses bear a restriction note, only parts of the material are accessible.

The assurance of credibility for the overall outcome of this thesis is more difficult to establish. The most delicate point for certain is the choice of theoretical constructs to be included within the framework, as well as their interrelation and composition used in the framework. This interrelation could not be proved statistically and hence, could be considered assumed. The credibility of this construct accordingly relies on the chosen research method demanding regular publication and therewith verification of the gained reasoning and results by the research community, as well as the feedback collected within the practical application from the practitioners reflecting upon the suitability of the artifact presenting the concepts to them. E.g. the expert review for the method manual which includes a general description of the framework, and thus bases on the assessment of the concepts, did not reveal serious criticism on the composition. For the research process conducted, credibility was not planned beforehand in detail, but by the usage of the DSR paradigm the general process was already verified. Nevertheless, with the determination of the actual research problem to be addressed, also the naturalistic tendency of the activities was decided. Thus the usage of case studies was considered the most valuable feedback on

the designed artifact, as the intention was to support a practical application as expressed with the research questions.

Transferability

The second issue to be regarded for trustworthiness of the achieved results is transferability. The transferability refers to the generalizability of the gathered results, questioning how far a generalizability can be done without neglecting the context found relevant to the results e.g. in the case studies. The first step already done within the scoping as presented by the research questions, was the restriction of the solution to knowledge-intensive SMEs. With the integration of this aspect the discussion is restricted to the organizations fulfilling the criteria as described in section 3.1 and further generalization is not within the scope of this thesis. This choice was made reflecting the diverse characteristics of SMEs including craft enterprises which are not related to the use of IT support in their activities.

[GL+94] suggest the provision of theoretical and purposeful sampling as well as a "thick description" to support transferability of results. According to [MBM+02] also negative results are supposed to be included showing the limitations and difficulties within the process. The purposeful sampling for the presented case studies had to be done finding a tradeoff between available and desired partners in practice. Hence, the initial requirements were for the organization to be a SME and knowledge-intensive. In addition, for testing the artifact, it was of interest for the SME to be close to the researcher to provide for regular and flexible contact. Already with the second enterprise in the "Social Media for KM" case study this became an issue, since it is situated in Berlin. The established contact accordingly was sparse and could not provide the prolonged engagement as demanded for credibility. Moreover, the sampling is rather difficult, since SMEs in particular signalized interest in the topic however, do not prioritize the topic of KM with additional funding or resources. KM being long-term oriented also demanded a long term orientation within the case studies, so a full application or even repetition of the cycle would need approximately 9 month providing valuable results on the benefits and at least as much for the second cycle. Nevertheless, all case studies are provided with the thickest description possible also with regard to the necessary anonymization. Consequently, the adaptations made within the case studies are first put into practice within the case study only, reflecting the working surroundings of the individual organizations. Nevertheless, a certain generalization had to be done for the changes and extension in the artifact. These were always on an abstract level, and the degree of detail for the e.g. method within the KinS method manual was chosen. This decision comes at the price of experienced accuracy in the description provided with the manual. To further extend the transferability more case studies would be desirable; however, this was not realizable within the scope of this thesis. Hence the results also are restricted to German SMEs, and as such difficulties possibly arising in other countries could not be reflected in the design of the artifact. The generalization furthermore is focused on aspects concerning the actual recommendation;

a generalization with regard to the enterprise character was not included due to the low amount of case studies.

Dependability

The third aspect referring to trustworthiness of the achieved result is the dependability, as a matter of reliability of the conducted research steps. Since dependability can be summarized to ensure, that a repetition is possible, these issues have to be addressed in the research process [GL+94] being the parallel to quantitative reliability. However, applying the DSR approach, the design of the used artifact changes constantly, as does the organization in which the application took place. Consequently, the results have to be freed of the factors influencing the gained results. To achieve this, the use of overlap methods, stepwise replication, as well as an dependability audit is recommended in [GL+94]. Transferred to this thesis, this is represented with the multiple case studies on the framework within the first evaluation cycle of the framework, showing similar results to be included in further design phases. Yet, being aware of the diverse environment of SMEs it cannot be assured, that all influences are found. As for the stepwise replication this could not be accomplished as recommended, as the work was not part of a larger research project and hence only one team of researchers were available. Nevertheless the triangulation provided in the students' work reflects this fact. As for the dependability of the results in general the quality of the research process was not addressed in particular but is part of the supervision and publication process accompanying the research process collecting feedback on suitability of the applied methods and discussion of the results with fellow researchers. And in addition, already the nature of the artifact, the method manual, providing decision support reflects the fact, that dependability is core to the research conducted for the thesis consequently providing the degree of generalization and amount of description to be applied to the target group of knowledge-intensive SMEs.

Confirmability

Finally, the aspect of confirmability is to be addressed to assure validity or "trustworthiness" of the research results. This aspect refers to the objectivity as known from rationalist approaches to validity [MBM+02], and is intended to ensure that the decisions made, are done due to the results and are not based on the preferences of the researcher or implicit assumptions. With this criterion it is to be shown, that logic and consistency in the work are appropriate regarding the choice on the methods, consequently the "chain of evidence" is to be regarded. Hence, it is intended to show that the data and drawn conclusions are coherent. According to [GL+94] triangulation, practicing reflexivity and an confirmability audit support ensure this aspect. Especially, the confirmability was tried to be achieved by a regular transfer of gained results to the research audience. For the individual case studies this was addressed by making use of the fact that these were conducted within student's theses and hence always at least two persons were reflecting on the results. Consequently,

a decent triangulation could be achieved for those. For the overall thesis as presented here a triangulation could not be achieved. Moreover, the decision for the inclusion of concepts to the framework usually was not based on data, but on the common use and suitability for usage within the framework. However, with this approach it cannot be ruled out, that concepts exist which might fit better within the approach of providing decision support on KMS support for SMEs. Nevertheless, the degree of "better" has to be verified since by the systematic evaluation of the method manual as provided in section 8 a general effectiveness could be proven. Furthermore, in the evaluation of the final artifact more participants would have been desirable to achieve a higher degree of objectivity.

Chapter 9

Resumee

Having completed all necessary research steps and described them in detail with the thesis so far, this chapter summarizes the conducted work with regard to its achievements, the possible points of critique and further developments for the KinS framework, including the method manual as well as the research work.

9.1. Summary

The thesis at hand presents the design of KinS as a framework providing support for the decision making process on technical support as a KMS in SMEs. The according result is achieved through research following the DSR approach. The outcome of the process, the artifact, is the KinS framework, which according to the research approach was validated to mature to a state being suitable for practical application. KinS shows how an individual SME can, based on its organizational and individual knowledge demands (related to individual employees), determine the knowledge service requiring the most support and consequently promising the highest perceivable benefit. With the help of the determined knowledge service to support and using the background of the TOI model (technology, organization and individual) KinS provides the necessary decision rules on KMS support to facilitate an improved decision for a possible KMS solution. This decision is based on the perceived benefit to be gained and consequently addresses the benefit to be gained from the application of such a solution in a suitable manner. By the permanent integration of the perceived benefit in the framework and the according method manual, constant benefit and value-orientation is supported in the KM integration and for the technical support. The necessary process steps in the method are based on social empirical methods in a generalized manner, supporting an application with restricted resources as can be found in SMEs. Implementing the developed method as a permanent process in the organization, in addition supports the integration of KM in the organizations processes, which is an essential requirement for successful KM.

The objectives of the work as expressed with the help of the research questions (see section 1.2) were addressed as follows.

RQ 1: What are the specific demands of SMEs towards KMS?

Using surveys and literature research, the specifics of knowledge-intensive SMEs with regard to KM and SMEs were inquired. The focus hence lay on the application of KMS support and KM in general revealing, that many organizations are using informal approaches to KM due to their size. Moreover, formal approaches for KM in SME could be found, yet the approach to the manifold, often theoretically discussed, concepts available remains difficult for the organizations as the benefits of the application remains undissolved for the organizations. Hence, the sparse resources and the focus on the value addition is central to this work. In addition, the case studies conducted have shown the desire for fast results in SMEs, which conflicts with the long-termed character of KM in general.

RQ 2: How can the value and the benefits of a possible KMS in an SME be determined?

The center of research and practical attention for the value creation within the method is defined by the fact, that by the immaterial character of knowledge a concrete monetary value can hardly be determined. Within this thesis the terms of value and benefits have been discussed to document the preference of the term benefit. To overcome the issue concerning monetary evaluation and allow for a benefit to be also communicated the decision was made to integrate the perceived benefit approach. The construct in use, the perceived benefit as described with the KMS Success model [JO06] provides a means for the visualization of the benefits perceived by the employees. The integration of the perceived benefit approach facilitates the focus on the support provided by a KMS solution in knowledge transfer and reuse. Consequently, the concrete support is emphasized with the help of this approach. By the integration of the KMS success dimensions: system, service and knowledge quality as benefit determining dimensions in the decision making process upon the the application class to recommend, the benefit are furthermore transferred to the requirements phase.

RQ 3: Which parts are needed for a framework to address the issue of the holistic approach of KM/KMS for SMEs?

In detail the KinS framework supports the holistic view of KM in the organization, integrating the technical component as a support means for KM in general by the use of the TOI background. Integrating the two other dimensions of organization and individuals as known from Bullinger [BWP98] the KinS framework, in particular the method manual,

provides questionnaires for the demand and requirements analysis. This addresses the needed technical support as part of a holistic KM, where the knowledge services derived from KMS architectures as e.g found in [Mai07] allow for categorization. Furthermore, the focus on the knowledge services (publication, communication, search, collaboration and learning) supports a narrowed down field of interest instead of a complex KMS addressing the limited resources and narrowed scopes of SMEs compared to larger organizations. This way of integration dissipates the complexity of a holistic KMS, nevertheless considers services for integration and further support within the SME if necessary. The artifact as such therewith supports the integration of several applications among one specified purpose, KM, depending on the concrete demand specification within the organization. Consequently, the KMS support can be integrated like a portal system, however aims for the reduction of media disruption and close integration with working processes.

RQ 4: How can a framework be operationalized to support practical application?

After the first design phase of the framework, the consequent validation revealed, that the first intention of keeping the framework as a standalone version could not be realized, since it did not offer enough information to support practical application. By that time the decision was made in favor of a method manual being integrated in the framework for practical application. Nevertheless, it had to be decided, which support the manual was supposed to provide. Since the intention was to provide decision support the method manual was dedicated to provide a method leading through the decision and implementation of a KMS solution. Therewith it provided more than the originally intended concept descriptions and was oriented towards the provision of further information on the decision making process. Nevertheless, an abstract level had be kept for the KinS framework to facilitate applicability though more details up to the explicit solution to implement would be desirable for individual organizations. This was avoided since the emergence of ever new applications would make such an artifact obsolete very fast. This decision furthermore was made in order to facilitate generalization and consideration of individual resources of an SME.

With the results gained on these refining research questions an answer to the overall research question could be provided:

Central Research Question: How can knowledge-intensive SMEs be appropriately supported in their decision and implementation on a KMS/ KM application support?

With the provision of the KinS method manual containing and operationalizing the designed KinS framework a possibility was created to support SMEs in the successful

implementation of a KMS. The term of "successful" for SMEs however, does not only refer only to a working solution (as e.g. a fully implemented system), but to a value addition by the introduction of the technical solution. The research therefore contributed a practical means considering the special requirements of SMEs, particularly the ones of the potentially interested knowlede-intensive SMEs. The method as such is designed to be lightweight and fast considering mainly small amounts of employees as can be found in SMEs and having sparse resources at hand. Nevertheless, each SME is different in its organizational culture and expectations towards KM and a KMS. This issue was addressed with the introduction of a profile summarizing all issues and characteristics necessary for the individual knowledge service recommendation base for the actual KMS implementation.

Besides the creation of the KinS framework the research conducted for this thesis delivered several scientific contributions. The main contribution certainly can be found in the process of the KinS method manual design. Nevertheless, the work also contributed by the operationalization of the KMS Success model for this purpose and it thorough testing in this scope [BVC14]. Furthermore, the work needed further clarification of the relations between knowledge demand on the organizational and on the individual side. Even the capturing of the knowledge demand was addressed within the research work. The work therewith fills the gap for demand-oriented support by IT systems, which are focused towards the benefits they can deliver for the applying organization. Moreover, case studies published within the evaluation phases rise the visibility of the topic within the scientific community.

The research presented within this thesis finished with the provision of KinS as a method for benefit-oriented KMS decision support focusing SMEs through the research process using the DSR approach. Accomplishing all activities along the DSR approach the KinS method manual satisfies the first guideline of DS (see section 2.1) being a viable artifact. Following [GH13] it can be classified a level 2 artifact, offering the gained knowledge as operational principles. At the same time the KinS method manual available for application as also embodies the way to communicate the conducted research back to the practitioners, and consequently being published in the research community through scientific publication. This step applies to the seventh guideline of DS, demanding the communication of research.

Within this work, it was also shown that the created method manual addresses a problem not yet covered by research so far (as shown with the systematic literature research in section 4.4) but of high interest for the target group of SMEs (as shown with the surveys in section 4.1). The combination of both proves problem relevance within the DS, hence accomplishing the second guideline on problem releveance. The research conducted furthermore shows that the artifact was not plainly put together but was designed and subsequently validated using the means of case studies as a form of naturalistic inquiry and furthermore systematically evaluated by the means of Lincoln and Guba [LG85]. These

activities and the provided results satisfy the third guideline of DS of design evaluation. In addition this presents the design as a search guideline, only by several evaluation cycles the design could be refined to satisfy the intentions of it, as expressed by the research questions. The design process itself therefore is based on the common approach including analysis, requirements analysis, construction and evaluation. This approach combined the requirements and interests expressed in the survey with the concepts available in the knowledge base. Consequently, the DS guidelines number six (design as a search process) and four (research contributions) can be considered adequately addressed. This furthermore, using the evaluation as suggested by Lincoln and Guba and the standardized problem solving process as well as the method engineering for the creation of the manual, represents the necessary research rigor with regards to methodology and design addressing guideline five (ensuring research rigor). Summing this up the result of the research process as presented within this thesis is also considered valid with regard to research methodology.

9.2. Critical Remarks

Though having adopted a valid research methodology and fulfilling the requirements provided, the results gained should be reflected. This can be done from two viewpoints, first considering the chosen methods for research and second regarding the results.

The research work presented in this thesis as such is conducted oriented towards qualitative research. The focus consequently lay on the creation of profound qualitative results solving the problem at hand, namely the missing benefit-orientation for KMS decision making in SMEs. Though qualitative research methods have been applied e.g. by survey conduction in the problem specification, a confirmation of the result, the KinS method manual, was not in the scope of this PhD project. Consequently it can be argued, a quantitative study on the created artifact is still missing based on a wider sample of SMEs and the full application of the artifact as such.

Further critical consideration should be given to the validity of the research process. Though the general approach of DSR was used the focus lay on the generation of an artifact as a valuable outcome of the research process. However, the validity of the conducted research steps should be considered as well. The discussion on these threats to validity or in the case of this work “trustworthiness” was provided in section 8.2. as shown within that section an increase of the “trustworthiness” is still possible and desirable.

The motivation for this thesis partially relies on the assumptions on the demographic development [Cal08, Ste10], which predicts a lack of experts and skilled employees, as well as a high amount of retirements in the next years. The demographic development however does not discuss how much this holds for individual SME. This is especially of interest with regard to certain branches which are considered knowledge-intensive and attract younger employees, e.g. IT related businesses. On the other hand the case study

in public administration (see section 6.4) revealed, that other domains though not being SMEs, experience a massive retirement due to the age structure of their workforce.

Another relevant point of critique is the consideration of the interdependencies between the individual method components, as well as the framework components. This aspect addresses the internal theoretical validity. By now the entire framework is build around the central assumptions on the architecture of KMS to be described as services providing the desired functionalities. Anyhow, the proof of the validity of the knowledge services is missing and can be shown by arguments only. Furthermore, the correlations between the individual knowledge services leading to additional inclusions in the knowledge services to be addressed with the recommendation demands supplementary specification and investigation. This is especially interesting since the knowledge services vary in the different KMS architectures (see section 3.3) and Maier [Mai07] admits that these can be further enhanced and changed. Partially general acceptance of the categorization of the knowledge services could be shown, as this was of no concern for external experts under the external theoretical validation of the framework shown in 8.1.1. The choice of the concept of knowledge services there were confirmed as a possibility to structure the tasks to be provided by KMS and were confirmed reasonable.

The relevance of the problem of benefit-oriented decision support, as well as the solution was shown for SMEs only and concentrated on them. Within the target group the concentration was done towards German SMEs. The actual review of SMEs in Europe or world wide is still missing. This is of interest, since the TOI model integrated refers to the organizational culture, which is also related to the cultural background. The subsequent verification is still pending. At the same time, it was not verified by which degree the same assumptions hold for larger organizations. For further research, it could be possible to validate and enhance the KinS for such organizations as well. Regarding the generalizability of the framework for other organizations, also the application to small scale business units should be considered, as these show similar characteristics with regard to the qualitative characteristics of SME.

Besides, the method developed within this scope is by now not validated against other methods fulfilling a similar intention. Anyhow, since by the shown research (especially systematic literature research) no other frameworks or methods addressing this issue could be found such a desire is rather difficult to satisfy. This holds especially with regard to the research object of SMEs, which hardly allow for a repeated study. This aspects refers to the missing measurement of efficiency, as by the validation as shown so far only effectiveness could be proven.

9.3. Future Research

Following the DSR approach the work presented with this thesis can hardly be considered finally finished, since design can always be considered a search process. Nevertheless, this

section is dedicated to providing some general ideas on where to proceed.

Relating to the DSR approach and the threats to validity discussed, further case studies and evaluation steps would demand further refinements in the artifact, as does a progress in technology development. This e.g. affects the available application classes, as well as the knowledge services to be employed.

Regarding the current version of the method manual refinements of the questionnaires supporting further standardization would be desirable. Though for questionnaire design already tested construct like e.g. [OL07, BALOO09] were used, appropriate testing of the composition in the questionnaires would be desirable. With such an approach the data could be used more easily for comparative studies supporting a more quantitative approach in the conducted research. Using this result the relevance feedback according to DSR could be strengthened and the actual application of the artifact to practical application would support further cycles in the design process. The enhancement of the practical application could furthermore support the initial idea of linking the method manual to a catalog of solutions serving as a reference a guideline for implementation. However, this is strongly connected to the issue of quantitative research, which demands a high number of repetitions. These most certainly would also lead to changes in the actual method model. An enhancement and comparison with alternating structures in the method allowing for a higher agility between the method components would be desirable. Conducting more case studies also addresses the issue of generalization, proofing the validity for other countries, specific branches of SMEs or different organization types, as there are e.g. public administration or non-profit organizations. Moreover, the maturity of KM in SMEs should further be reflected upon. It is for instance of interest whether maturity in SMEs is the same as for larger organizations considering their informal culture.

With regard to the scientific implications further investigations on the knowledge demand and its determination within enterprises as well as dependencies between individual and organizational demands are promising fields to be pursued. Similar to the gathering of the information demand, the question of structure and reuse [Lun07] arises on this topic, and demands additional research activities. This is especially of relevance, when considering the difference between information and knowledge, being given as “context”. Yet, the representation of knowledge in various form remains of interest putting forward e.g. the question “When does the integration of semantic technologies provide additional benefits for the applying organization?”. Furthermore, the applicability for these technologies can be discussed, since the access to those technologies is not given for all organizations due to competencies and skill sets. This field of research would also benefit from the conduction of further case studies with the framework focusing on the knowledge demand. Using the appropriate context characteristics, it can be expected to develop knowledge demand patterns (similar to information demand patterns [San11]), which could be applied for the provision of knowledge within the SMEs. Following this idea, the framework can serve as a catalog for the pattern, and thus would also add the inspiring add-ons.

With regard to further usage of the framework, three dimension should be regarded. First, there is the KM viewpoint, which is interested in the justification of measurements taken in general, besides the application of IT. Hence, the transfer to non-IT measure of the approach could be used. Therefore, the knowledge services must be discussed from another perspective. This would also refer to the application of the KMS Success model, which is centered on technical support and hence, an adaption should be made for further application of non-IT related actions.

Second, for the management perspective, the benefit application was integrated in the decision making process on a KMS support for SMEs. Yet, the method manual of KinS and its creation in addition are concerned with the non monetary estimation of efforts connected to KM. Nevertheless, the question arises when precisely is the break even between used resources and benefits gained achieved. Since success of an organizational initiative is always connected to monetary terms, this point will remain of interest for KM and KMS.

And third, the IT perspective could adapt the framework for the implementation of sandbox systems to support the individual knowledge services. This addresses the findings of [MHBD16], that SME often are not of interest for software vendors in the KM field due to their seize and resources. Yet, the integration of different knowledge services by according interface would provide an easier approach and higher reusability of components. Hence, for future research a frame for the technical integration would be needed. The IT perspective also should be used to discuss the integration with the already existing IT infrastructure and existing processes in the organization. Hence, the framework could include an alignment to the enterprise architecture.

Finally, furthe research should address the generalization of the findings to SME networks. These suffer individually from the same restrictions on resources, but as a unit have to be regarded differently from the perspective of the knowledge demand. The concept consequently is expected need further enhancement.

Appendices

Chapter A

The KinS Method Manual version 1.0

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Date of Submission: 31st May 2016 Sate of Defense: 19th October 2016

Universität Rostock

Traditio et Innovatio

KinS - Knowledge Management System Introduction for Small and Medium Enterprises

A manual for the decision-making process

on systemic knowledge management

support based on demand and benefits

Contact: Ulrike Borchardt | e-mail: ulrike.borchardt@uni-rostock.de

UNIVERSITY OF ROSTOCK – FACULTY FOR COMPUTER SCIENCE AND ELECTRICAL ENGINEERING – CHAIR OF BUSINESS INFORMATION SYSTEMS

Contents

1 About this manual

Knowledge Management (KM) has been around for several years, and often is associated with the technical support by Knowledge Management Systems (KMS). This manual addresses the fact, that the choice for a specific knowledge management system should be made carefully with certain issues to be considered. The focus of the presented method in this manual, consequently is on the demand for KMS and the benefits such technical support can offer for an organization. However, before explaining the setting and the actual course of actions in the following chapters it is shortly described what to expect out of this manual and who should be using it.

Who should use this manual?

This manual addresses the introduction of KMS support for small and medium enterprises (SME) or organizations. These usually are organizations characterized by sparse resources and fewer number of employees involved when compared to larger organizations. Moreover, the employees have to cover a wider range of tasks within a small organization compared with the specialization of employees in larger organizations. Consequently, this manual provides a method for the choice of a technological support, to allow for a KM support adopted to these circumstances, instead of using broad or random support along all possibilities of KM. This might be of interest for larger organizations as well, especially when running several small business units and for the interactions between these units. Yet, the holistic support of KM for the overall enterprise should then be further analyzed separately from this manual. In the further course of this manual only the term organization is used referring to organizations and organizational units alike, but focusing on SME.

Furthermore, this manual's primary is the initial introduction of technical support for KM. Yet this does not mean that it cannot provide valuable information for the rework of an existing system, especially for decision upon its maintenance and extension.

Nevertheless, it is not the intention of this manual to analyze existing technical systems with regard to their support possibilities. Consequently, the addressed reader groups are:

1. Individuals planning the introduction or rework of KMS in the context of knowledge-intensive SME or small-scale-business units.
2. Individuals with the objective to further develop or adapt the method presented within this manual.

What to expect?

This manual provides a method guiding through the process of decision making on KMS support and the according evaluation of the implemented solution with regard to its benefits. Nevertheless, the method described does not contain the detailed explanations of every step taken, since it combines external method components known from other fields. For example it is not guiding through the market analysis and implementation process of the system itself, since suitable methods already exist, even for SME (see e.g. "European Guide to Good Practice in Knowledge Management" or "Wissensmanagement im Mittelstand"). Consequently, this manual is to support the decision for the suiting KMS within an SME. It is revealing the benefits to be expected from it and visualizing them for an evaluation of the KMS' success.

What should be done before starting?

This manual regarding technical support for KM is settled in the field of KMS as a holistic approach. This results in the demand for measures for organizational culture and integration within the business processes of the organization, since KMS demand integration and cannot provide their benefits working isolated. Consequently, the decision upon the introduction of KM as a concept should already have been made. This includes a fundamental understanding of the principles of KM.
Before starting to work on the introduction of a KMS support, it should be clarified which are the reasons for the introduction. In addition, the awareness for KM as a concept should be created. KM is not successful by the mere introduction of a system

to support it, but needs support from the management to address its several dimensions (technology, organization, individuals).

The concept of KM in the organization is closely related to the strategy of the organization and the according KM goals should be derived from and aligned to the organizational goals. The reasons for a KMS implementation and the expectations towards the introduction of a such a system should be visualized. Furthermore, it should be clarified, that KM consumes a serious amount of time and resources, which results in KM being a task to be taken seriously for justifying the necessary efforts. It involves networking, exchange and documentation activities, which usually are done on top of the general workload. Even if there is freeware or open source systemic support for KM, it does not come for free. The time necessary for installation and maintenance, as well as hardware support for keeping the system running on the one hand and on the other hand the cost for the employees filling the system with contents have to be taken into account.

Moreover, the "individual" component should not be underestimated: when an employee is supposed to explicate all he or she knows, this is usually not done without a proper motivation and a stable environment, securing him of his job or motivating him to take over additional or new tasks to come. The provision of an appropriate incentive scheme is not within the scope of this manual, though ideas on the integration are provided. In addition, it is supportive to be aware of ones process structure, to be aware of the enterprise resources and knowledge localization. It can also be helpful to clarify the processes within the organization first, in order to be aware of the problem field and resource allocation for the planning of KM.

For the success of the introduction of KM/KMS it is also advisable to set a concrete timeline. Otherwise KM projects are easily the ones to be postponed due to issues in the regular business operation, which always seem more important.

Preliminaries for Manual Usage

- ✓ **Planning KMS support for an SME**
- ✓ **Familiar with the general principles of KM**
- ✓ **Goals of KM usage are clarified**
- ✓ **Possible resources are allocated and responsibilities are clarified**

This manual is part of the research work for my PhD Thesis upon the support through KMS for SME conducted at the University of Rostock, Germany. In case of questions, need for help or obscurities, as well as further remarks on the work presented in this method manual please contact me for discussion (email: ulrike.borchardt@uni-rostock.de).

2 General Background

This section presents the general background relevant to a decision upon a technical KMS support for a SME. It provides details on the involved concepts and their relations to one another. However, it cannot provide a complete and comprehensive description on the field of KM but points out the issues of importance for the decision on the method KMS support. This manual contains two parts which combined provide instruction in the decision process upon the use and implementation of a technical KMS support. On the one hand there is the conceptual KinS framework holding the terms and concepts relevant for the decision support. On the other hand there is the method putting the concepts into practice and guiding through the process of implementation. Following sections provide information on the individual method components. The steps in the process, which are described in KinS are detailed in the following chapter.

2.1 The Concept Framework

The KinS framework provides the conceptual fundamentals for the decision making process, and is displayed in figure 2.1.

The center of the framework is the knowledge demand, which is necessary to describe the field where benefits can be expected. This knowledge demand can be found on the one hand as an organizational demand, manifested in e.g. ideally the overall organizational strategy in KM and knowledge development. On the other hand the individual knowledge demand of the employee exists with his or her personal skill set, needing certain knowledge and skills to fulfill tasks/processes in the organization. For the concept of knowledge demand we consequently imply that the difference between mere data, information and knowledge has already been realized within the organization. The awareness for knowledge, being the information processed for a certain context to allow appropriate actions should already have been created. The individual knowl-

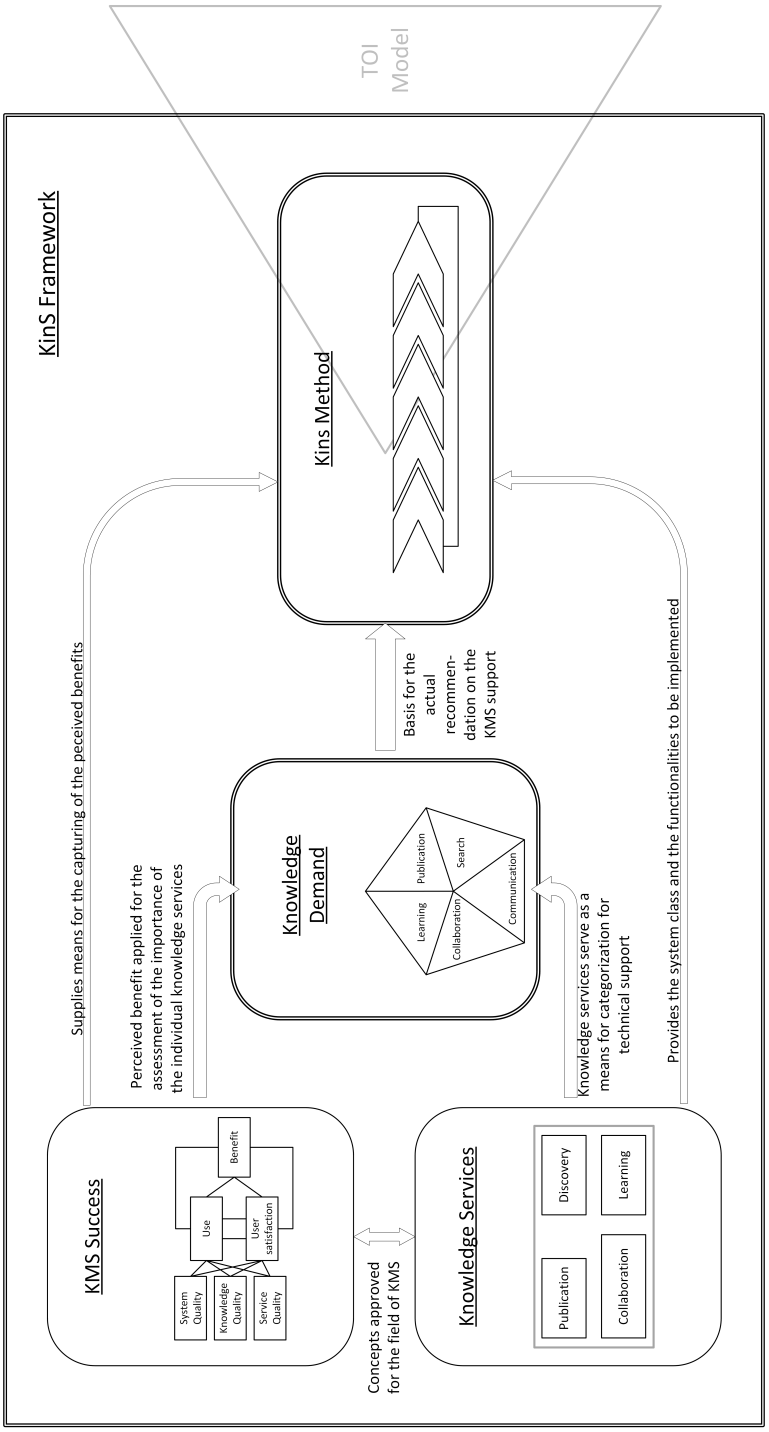

Figure 2.1: The framework for KMS decision support for SME

edge demand of the employees determines the contents to be included within a systemic support as well as the field in which a technological support should be situated. The organizational knowledge demand summarizes the overall knowledge necessary to fulfill all tasks arising within the SME, hence the individual knowledge demand is part of the organizational demand. Research on KMS has shown that the need of the employees to work on the necessary knowledge can be categorized in one or more of the following categories, named knowledge services:

- search
- publication
- learning
- collaboration
- communication

These knowledge services are to be provided with the implementation of a systematic technological support through a KMS. In general, all knowledge services are important for the implementation of KM, yet not all of them need further systemic support. However, the demand of the organization for knowledge and KM in the strategical perspective provide the frame in which the demand for the different knowledge services by the individual is settled. Consequently, the individual employees with their habits, work routine and media competency strongly influence the choice of the systemic support, since they are the potential users and therefore essential for the KMS' success.

The focus during demand analysis lies on the channel used to provide the necessary knowledge. To provide the appropriate knowledge services, the focus is not on the contents. Consequently, the findings gained on the content to be supplied are considered a by-product. They should be taken into consideration during implementation, but have only minor influence on the choice for the systemic support. The demand analysis including the questions leading to the recommendation of the different knowledge services is described in further detail in chapter 3.2. With the demand analysis a profile on the need for knowledge services can be gained, from which the recommendation on the knowledge services can be deferred as described in chapter 3.3. The recommendation is given on an application class, the actual software product has to be determined using known methods of market research. Yet, since this is already known methodology the

concept of this search will not be described in detail within the method. The same holds for the introduction of the actual chosen software product into the organization. Though the demand for knowledge services provide a strong argument for success in their fulfillment. Further success factors for KMS should be taken into consideration already during the introduction of a KMS in an SME.

Already under the profound introduction of KM/KMS into the organization the success dimensions taken from the model of KMS Success provide indications influencing the quality of the choice and implementation to be made. The success dimensions are depicted in detail in figure 2.2. In general for the explanation of the concept it should be recognized, that the KMS success dimensions relate to the perceived benefit and do not describe value in any monetary terms. The basic assumption of the KMS Success model consequently is that the realization of the value of a system by the individual employee can transfer benefits to the employing organization. The KinS framework and consequently the method hence are unable to name the amount of money to be saved, but aim for the acceptance of a KMS in the working process and its support for the employees.

The success dimensions of the first level represent the facets to be kept in mind already under the implementation phase:

1. Service quality
2. Knowledge quality
3. System quality.

The system quality as the direct reference to the system implemented, reflects its characteristics with regard to user-friendliness and the technologies included. This dimension would also be covered in the common implementation process. Yet, especially the service and the knowledge quality, which do not relate directly to the implementation process, should be considered under initialization and training of the KMS, as well as its integration into the organization's processes. Both dimensions cover the contents, their relevance and the support for the system in the organization. This has to be considered to avoid isolated KMS solutions. The knowledge demand already considered the contents can be reused with regard to the knowledge quality. Furthermore, the organizational knowledge demand is to be integrated since the knowledge strategy is already reflected in them. To ensure the consideration of the success of a KMS, we

strongly recommend that the dimensions can be evaluated on a regular basis showing the development of the system implemented. By comparison the values can also indicate the point in time for reworking the system, which leads to another cycle in method usage. This way the dimensions are showing the perceived benefits through which the success of a KMS application can be illustrated. The dimensions however, should already be considered during demand specification, since they refer to the already existing systems within the organization and indicate the intentions to use system support. The concepts

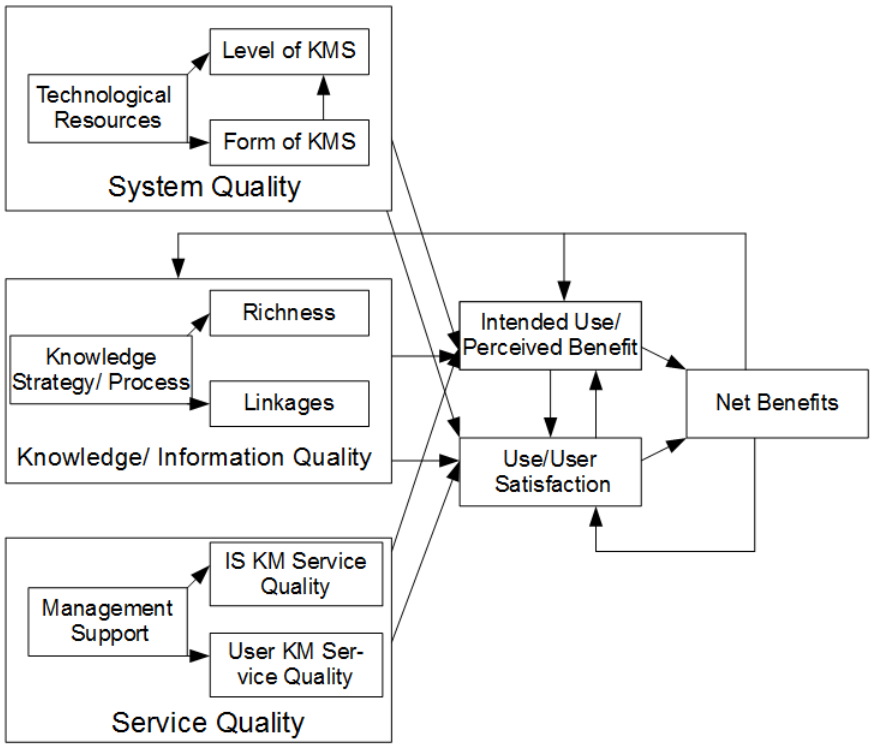

Figure 2.2: The KMS Success model

of knowledge demand, knowledge services and KMS success form a conceptual framework which is supposed to support the successful, demand-oriented implementation of a KMS in an SME. The method accompanying the framework and transferring it into practical application is consequently shown in the next chapter.

2.2 The Method

Using the concepts of the framework as introduced in the last section, a method is employed to put them in a practical operation mode. To determine the KMS support suiting the organization, different concepts from the framework are to be brought in order and be accompanied by a guideline on how to access and operate them. The actual order of the different steps operating the components of the framework can be seen in figure 2.2. With the help of the developed method, decision support in the introduction for KMS is provided. In the following, each step in the method is introduced as a component providing the scope, the procedure, the concept and the notation necessary for the component. The details on the deployment of the individual phases are provided in the next chapter.

Step 1: Initialisation phase

Scope The intention of this step is to prepare the organization for the upcoming KM project and clarify the measures already taken towards KM, as well as the resources and scope of the project. In addition, the alignment of the KM initiative to the organization's strategy should be made visible. When following the theory of Lewin(1951) this phase aims at unfreezing the organization before the change, showing the changes to come and to be implemented.

Procedure By interviews and brainstorming meetings the following questions are supposed to be answered:

1. What aspects/concepts of Knowledge Management are already known in the organization?
2. What does the organization expect from the introduction of Knowledge Management?
3. Which resources can the organization allocate for the implementation process?
4. Can the organization describe their business processes appropriately?
5. What general problems with regard to knowledge has the organization?

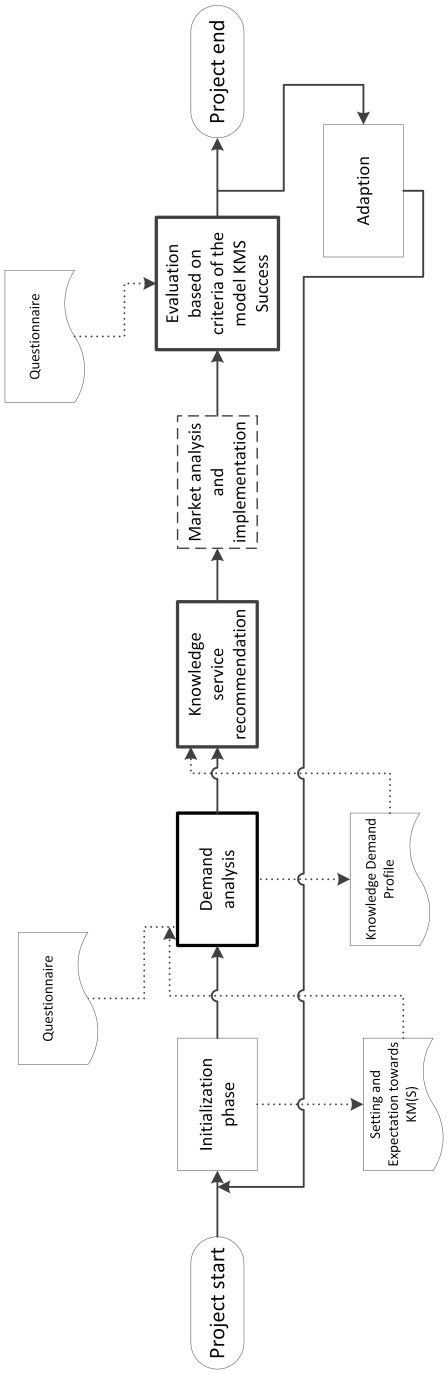

Figure 2.3: The method components for KMS recommendation

Concept From the implementation of software, as well as general project management an initial "Kick-Off" - Phase is known for clarifying the demands and matching them to the system to be implemented. This step consequently shows the demands towards a KM initiative and allocates the organizational resources.
Notation The answers to the questions should be documented in a protocol to be referred to in following phases. Furthermore, a business process model if available might be helpful. Of special interest to be written down are the names of persons in charge and their according responsibilities, as well as priorities and deadlines for the project.

Step 2: Demand analysis
Scope Now the collection of the organizational and individual demands with the help of socio-empirical methods should be focused. The purpose is to create a profile of the demands that provides a base for decision making on the application support for KM. The profile therefore considers two parts in the knowledge demand: the organizational and the individual knowledge demand. The organizational demand with the contents of relevance, the knowledge development goals and the IT strategy determines the setting in which the individual demands of employees are to be satisfied.
Procedure While this part mainly focuses on the individual demand, the organizational demands are to be deferred from the initialization phase results. With the help of interviews and questionnaires as provided in the following section 3.2, the employees are to be addressed on their demands in the field of KM in a user-centric manner. By analysis of the provided answers the knowledge demand characterization can be derived to be written down as a profile.
Concept The individual and organizational demands are verified with regard to the knowledge services and the employees satisfaction as well as their need for a technical support within the knowledge services.
Notation As a result the answers provided in the interviews and questionnaires should be captured and codified for further analysis. This analysis brings forward the desired knowledge demand profile.

Step 3: Knowledge Service recommendation
Scope A specific knowledge service is determined by analysis of the knowledge demand, the state of the art and the strategy of the organization. Here the results from the

scoping phase on the expectations and resources are to be combined with the demands determined from the employees to show the demands for support in certain knowledge services. These are to be supported by technology by recommending an application class as shown in section 3.3.
Procedure Taking the answers on the questions from the demand analysis, the data is analyzed with regard to: contents to be provided, application demands from the organization and the employees, knowledge service concentration and the support for the success dimensions. The result represents a recommendation as an application class, as well as remarks for a concept for integration in the business processes of the organization.
Concept Based on statistical and social empirical methods, clusters are build leading to recommendation foci.
Notation The result of the inquiries should be documented and explained, however through an explanation of the results in a meeting the same result can be achieved. Hence, the substantiation of the results and the rise of awareness for them in the organization are to be achieved.

Step 4: Market Research and Implementation
Scope Based on the recommendation of an application class the market research is supposed to lead the way to a concrete product. The implementation of the selected product into the existing technical infrastructure introduces the chosen solution to the organization.
Procedure It has to be noted for the procedure that these are two consecutive steps to be fulfilled, since the result of the market research provides the product to be implemented.

- Market research: choosing the actual software product or application for implementation in the organization. For this choice the resource description as retrieved in step 1 and the technical demands should be integrated. At this point the actual market has to be considered, what products e.g. are available for a certain application class and how do these fit the organizations demands towards IT, e.g. can the new solution be integrated with the already existing technical architecture.

- Software implementation: introducing the chosen software into the organization while considering the success dimensions, knowledge quality, service quality and system quality. The main focus here should be the business process orientation de-

termining in which the support is most urgent needed and in which the application should be contextualized.

Concept This component is an external method component and therefore summarizes two steps as one external method component, though both remain independent steps to be fulfilled in the overall method.
Notation The results of both steps should be documented, e.g. the criteria catalogue for the market analysis to be accessible and comprehensible within the organization. Especially with regard to the implementation part, a detailed schedule informing on the upcoming changes including a training on the system should be written down.

Step 5: Evaluation
Scope After introducing the KM application/KMS to the organization an evaluation with regard to KMS Success dimensions should be conducted, showing the satisfaction with the system as well as the perceived benefits, and in addition allowing for necessary adjustments. However, it should be considered that training times may postpone the time for the evaluation, since evaluation is only useful after the initial warm up in the organization.
Procedure Since applications related to KM are hardly to be evaluated in monetary terms, other indicators are to be used. This method component, as described in detail in section 3.5, keeps the user-centric focus and therefore uses a perceived benefit approach, which also refers to the expectations uttered towards the system in the initialization. This focus implies the use of methods like interviews or questionnaires among the employees. After their conduction the initial perceived benefits provide an indication on the satisfaction. However, the repeated questioning allows for comparison and the detection of changes over time.
Concept The concept of the perceived user benefit refers to the fact that satisfied users proceed using a system and therefore carry the individual benefits to the layer of the enterprise benefits since they become more efficient in their work.
Notation The results of the questionnaires and interviews can be codified and analyzed with the help of statistical means. The actual values to be retrieved mostly are scale values, depending on the scale used. In comparison with former survey trends the benefits and new topics to be addressed can be determined.

Remarks This method component is the entry point for organizations having already an implementation, but aim for the improvement of the existing system since the analysis of the different success dimensions also provides indicators for further needs and adjustments.

When combining the concepts shown in the KinS framework to visualize them in the process, the result looks like displayed in figure 2.2.

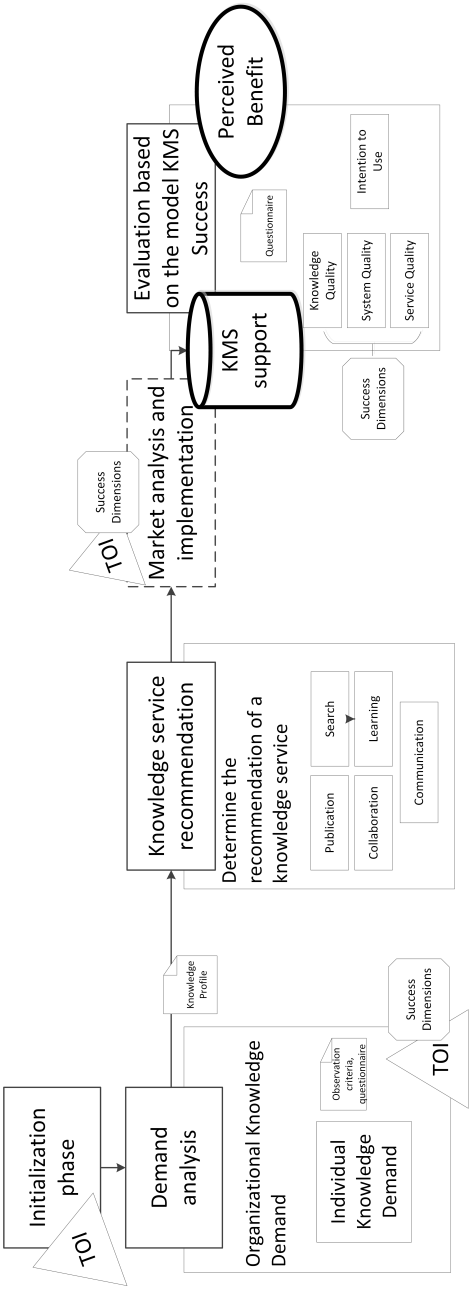

Figure 2.4: The method components for KMS recommendation

3 KinS - Determining the Recommendation

With this chapter the detailed version of the method components is provided for practical application.

3.1 Preparing and Visualizing what to expect -Initialization

To start a profound KM initiative or the introduction of a KMS product, it should be externalized what the expectations towards the project are and what can be done to achieve them.

Within this step it is the goal to determine existing KMS support and the alignment of the initiative with the organizational strategy. Therefore, it is necessary to realize, that KM cannot be done "by the way" and needs commitment. Furthermore, it has to be noticed once more, that a KMS support might be helpful, yet KM affects three dimensions to be successful, these are: technology - organization and individual.

This manual is directed towards the component of technology, yet, the actual integration is done by the organization. Therefore following issues should be considered:

- What resources are at hand? This should consider time, money, as well as workforce. In addition, it should be realized that KM means permanent effort and hence also long term consideration should be made.
- How can the organizational culture be described? With this item we are aiming to the adaptation to new IT products, new technology in general, hierarchies and communication channels. It should be recognized, if these could be changed, and what could be done to do so.
- Is the management willing to "lead by example" or are there restrictions? By the answer to this question, it should be recognized, that employees usually follow the management, hence if the activities are not supported or regarded useless by the management, the efforts in KM usually do not pay off.

- Why is KM and KMS support needed? Usually a concrete problem at hand motivates an KM initiative, for otherwise strong incentives have to be created to provide necessity for actions to be taken. An example would be e.g. the QM demanding the securing of knowledge in the organization or the expected retirement of experts.
- Are the employees willing to take part or do they need special incentives? Employees hardly are willing to document their knowledge everyday, however there are motivations, which can support this process. However, also fears should be addressed and hence, the KM initiative should be carefully communicated to prepare the employees and be able to react to their uncertainties.

With the help of these questions the foundation for the KM initiative should be built. Furthermore, the schedule for the conduction of the individual steps should be coordinated here. Though KM usually does not have the highest priority in the organization, without a concrete schedule the project is most likely to be forgotten on the bottom of the priority list.

3.2 Demand Analysis

Based on the agreements made in the initialization phase, the recommendation on the KMS support is to be generated. Since this is based on the knowledge demand, this method component is designated to the gathering and analysis of the knowledge demand.

The demand analysis is the matching point between the demands of the organization, the individual employee and the KMS support needed.

This section introduces the method component to capture the knowledge demands of interest for the choice of the KMS support. This includes the choice on the means for accessing the knowledge demands, as well as the questions to be put forward to gain the necessary information. The block of questions is presented with an according explanation on their subjective and the indications they are about to provide. The knowledge demands addressed with this manual focus on the technical knowledge service support and neglect the contents to be provided, since these are highly individual to the

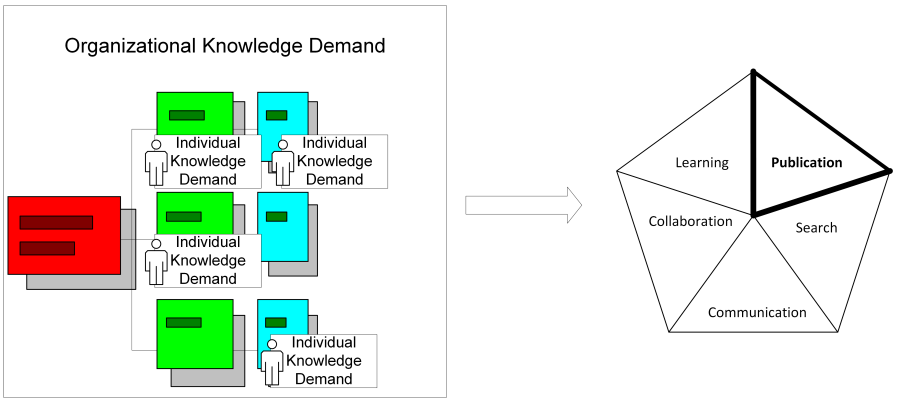

Figure 3.1: From the interrelation of organizational and individual knowledge demand to the recommendation

SME implementing a KMS.

3.2.1 Choosing the means

To capture the knowledge demands, the contact with the employees is essential. This can be accomplished by either interviewing them, using a questionnaire or discussing the knowledge demands groupwise. The decision upon the "channel" for the capturing of the demands has to be made by the organization based on issues of culture and time. Especially when being already acquainted with the method or when privacy issues (employees are unwilling to name their demands openly) arise in the organization, the anonymous printed or online questionnaire should be chosen. This way every employee can input his or her needs individually without having to face the direct confrontation. However, return rates of written surveys hardly reach 100% and therewith will always leave out some opinions and needs, leaving some individual demands unconsidered.
With an organization culture more open to discussion and exchange of opinions, sessions as groupwise meetings or at least individual interviews can be helpful. Using interviews is furthermore helpful when starting the method for the first time since an interview allows for reformulation of questions according to the target group. Furthermore, follow up or refinement questions can be put forward in direct contact. Nevertheless, it should be recognized that interviews are rather time consuming and often more information is

gained than actually necessary since employees might use the chance for explaining all issues involved in their work routines.

Further questions could refer to the dimensions of KM in general, the organization and the individuals. These questions do not necessarily have to be directly named in context with KM but should be kept in mind since technology support can only be successful if the organization and the individual employees are able to engage/work such a system and are not held back by any barriers. Yet, a wide range of interviews usually will show repeating results. This way new demands might be found very quickly when starting an interview series, but it should be proven carefully whether further interviews are necessary. Furthermore, the categorization of the answers in the interviews is more time-consuming than upon usage of a questionnaire.

In case the decision on written questionnaires cannot be made easily a test on using a questionnaire might prove whether this is a suitable method. Therefore a limited number of employees (ideally from different working environments) should provide answers and a short analysis is supposed to show whether suitable answers can be generated. A recommendation might be to combine the methods, since in the beginning interviews might be time consuming but provide a better insight into the problems and demands of the organization, whereas questionnaires provide a tool to address more people in a shorter period of time.

Putting the according questions into a practical interview or questionnaire is one part of the analysis, however the gathered results have to be interpreted. Therefore, it is necessary to come up with scales for the answers of the questions, that allow for crossing out the intended answers in the questionnaires. Or in the case of an interview provide suiting categories to gather the points of interest from the answers provided. A typical scale in use is a 5 Point scale, which might be complemented by an extra item allowing to skip the question. Adding the 6th point on the scale also addresses the fact, that individuals tend to choose the middle option.

3.2.2 Composing the questions on the demand

When putting together the questions, this can be done based on the structure of the knowledge services to be provided. The actual questions to determine the knowledge demands and support can be divided into several sets of questions. Whereas the first

set is directed at the demands and the required knowledge in general, the other ones aim at identifying the knowledge service support (summarized in figure 3.2). With the knowledge services also the perceived benefits are addressed to determine whether the employees perceive some already, and in case of existing support for services to estimate their success with regard to the success dimensions. As described before, this can either be done as an interview or as a questionnaire. Regarding the notation of the upcoming questions it should be noticed, that there are open questions whereas others require a scale. Open questions allow for free answers and are more common in interviews, however they can also result in no answer at all or ambiguous statements. When using scales the questions should be formulated accordingly and unambiguously.

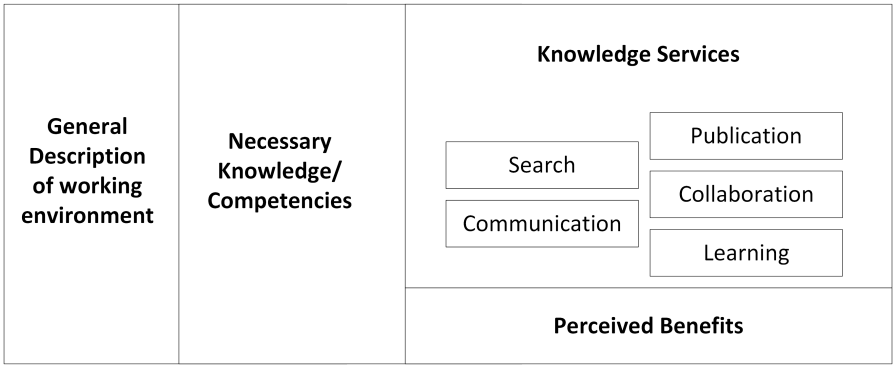

Figure 3.2: Fields of interest in the survey

Identifying and matching demands At this point two kinds of knowledge demands have to be captured. On the one hand there are organizational knowledge demands, and on the other hand individual ones, which arise in the context of the organization. These knowledge demands usually are uttered in a certain context, attached to an organizational objective or strategy. In a first step the organizational knowledge demand and the KM strategy should be discussed with the management in an interview since this builds the setting in which further demands are to be identified. An according interview should focus the strategy of the organization and the expectations towards the usage of KM. If the focus of the KM strategy is not instantaneously to be identified, the reference to problems occurring related to the handling of knowledge offers a point to start from. It should always be kept in mind, that KM is to support the general organization strategy.

Independent from the organizational layer to be questioned, individual answers to the following questions might be known in advance. However, for questionnaire development they should be considered, since they provide an idea on the individual context which forms the setting for the arising knowledge demands.

- Since when do you work for the organization?
- What is your profession?
- For which department/project are you working?
- What are your working tasks/relevant processes your are working in?
- Which working tasks do you work on in a team?
- What is your part in the process of consideration (to be replaced)?

Necessary knowledge/ competencies This part is directed at identifying the competencies and knowledge relevant for the individual employee. Here the focus should remain on the knowledge relevant for the special task accomplishment.

If the organization is already working with a competency related description of roles, or uses a detailed process description holding knowledge items in the description, this could be a good start to identify the knowledge needed. The latter also offers the possibility to identify gaps, since individuals might not have all necessary knowledge yet and consequently should be provided with it. This field of interest is usually not answered completely within a questionnaire by the concerned employee but by the superior, who relates the individual competencies to the organizations demand. The fields of interest consequently are:

- personal competencies
- social competencies
- factual competencies
- method competencies
- process-relevant knowledge (contents to be named) - How often is the individual piece of knowledge used? - Is the relevant knowledge explicated and available in the organization?

While questioning the competencies necessary it should be kept in mind, that the focus of this method does not lie on the contents to be provided but on the channels through which they can be gathered. Consequently, for all but the social competencies, it should be registered where they do come from. This provides hints on the channels already in use for satisfying the knowledge demands. E.g. it can be recognized whether facts are gained from a system or from a colleague (informal source). The according sources could be described in a questionnaire, but two problems should be kept in mind. First, sometimes it is difficult to name every source within the working process so consequently an observation could deliver valuable additions. And second, the sources of knowledge may differ depending on the expertise of the employee. With regard to the answer formats in questionnaires , it should be recognized that answering is easier with multiple choice questions or scales provided.

To sharpen the focus on the technical support of a KMS, the following section describes the questions necessary to retrieve information for the recommendation on a KMS. Therefore the individual knowledge services are explored for further information on their recent coverage within the organization. In addition, the questions should reveal the recent technical support for some of the services, e.g. the answers might also indicate that an already existing solution needs an update. When composing these questions it should be noted, that for the gathering of the perceived benefits and quality the questions on technical support are to be combined with the questions provided in section 3.5.

The knowledge services - Publication The knowledge service of publication covers the exchange of knowledge between employees within the organization. It addresses the identification of the point where relevant knowledge might be created, as well as the formal and informal point for the communication of knowledge and the systematic approach to secure relevant knowledge. Publication also covers the aspect of knowledge organization and availability (rights management) of the knowledge artifacts. In addition, publication promotes the externalization of knowledge, since this process is necessary to be able to provide contents.

- How are experiences captured and transferred? (digitalized, as well as oral)
- Are employees motivated to explicate and publish their experiences and best practices? How is this done?
- Are experiences from projects being collected and documented? Is this done systematically or with system support? How are the artifacts kept up to date?
- How does the exchange between colleagues take place? (oral, written)
- How is the transfer of knowledge organized? (transfer to all, transfer to chosen employees, informal)
- Which systems are used for storage of knowledge in the organization?

The knowledge services - Search The knowledge service of search indicates whether certain knowledge is available, which contains two facets: 1) is the knowledge documented and 2) can it be found? The latter includes the awareness on the knowledge structures of the organization, as this means to find the right person to talk to.

- How is information and experience exchange accomplished between departments/projects? (officially initiated, unofficially, through projects)
- Is awareness on colleagues and their tasks and skills given?
- How can contact persons be found? (knowing the internal organization, questioning colleagues, information services)
- Can resources be searched systematically? How?
- Is the structure of the existing resources within organization known? How is

it communicated?
- What role do access-limitations and hierarchies play in the organization?
- What is used for information search? (colleagues, experts, intranet, Internet, internal documents, literature)

The knowledge services - Cooperation and Communication Most knowledge within an organization does not come from the outside or through official exchange, but by using informal channels like contacting fellow employees. This knowledge service is supposed to support this process. The knowledge services of cooperation and communication aim at the systemic supported cooperation only, including the facets of joint editing and shared documents, as well as teamwork in the digital medium in general. For the part of communication the necessary frequencies (how often necessary), as well as channels and degree of formalization of the communication have to be clarified. Cooperation as such is depending on a functioning communication and is settled above the mere communication. In contrast to mere communication it includes the generation of shared artifacts as a working result and therefore demands more specific support. Though informal communication among employees always takes place, the communication of necessary contents only takes place if encouraged, therefore the organizational culture be regarded as well.

- Does the enterprise have several sites?
- Are the necessary contacts easy to be found?
- Does an exchange between colleagues take place? Is it necessary for work task accomplishment?
- Is there technological support for the process of collaboration?
- Are there any measures (technological and organizational) supporting communication?
- Do the work tasks enforce shared documents?

The knowledge services - Learning Finally, using the service of learning enables the systemic support of the learning process, in the form of e-learning. Besides the traditional

fully structured material provided in e-learning, this service also aims at mentoring programs or supervisions. However, it should be kept in mind that e-learning has high demands towards the quality of the provided contents. E-learning materials have a need for didactic integration and therefore should be created accordingly. Consequently, the use of e-learning is usually expensive: either because the contents have to be composed requiring a lot of time or they have to be bought. The usage of e-learning accordingly is rare, but parts like tutorials or videos in use besides standardized e-learning are also included in the knowledge service of learning.

- Which measures of knowledge transfer take place for a change in the staff?
- Is there further education on the workplace? How is it done? (literature, colleague exchange, e-learning, other measures)
- Do you wish for further support on learning?
- Do you use technical devices for learning?
- Do you use multi media contents for learning?

Based on the questions shown above the questionnaire should be designed as a written survey or interview guideline. Both require to capture the respective answers for the upcoming analysis and creation of the knowledge demand profile. Remember to plan an according amount of time for this step to be accomplished.

3.2.3 Creating the profile

Following the collection of the demands, the answers have to analyzed for clusters and common demands indicating a necessary concentration within the knowledge service. We therefore recommend to collect the answers according to the above described categories. The first step of ordering the statements according to the services they belong to already allows an estimation on what knowledge service the employees need most, or what knowledge service they are most dissatisfied with. This for instance can be done by a collection in a table, as e.g. show in table 3.1.

In case scales were used, the calculation of means provides a first idea on the general opinion on the question. Nevertheless statistical outliers should be regarded as well,

No.	Question	Gained Answers
1	Is awareness on colleagues and their tasks and skills given?	"I know only of the colleagues I have personal contact with", "Would be nice, but today it is more like good luck","The role profiles were meant to accomplish this, but are not updated."
2	Can resources be searched systematically? How?	"You can use the Windows search on the Team drive","I search by the structure of the drive","No, but I just know where I put the things"
3	Are you satisfied with the search support?	Average: 2.3 (1: completely to 6: not at all)
4	Do you wish for further support?	Average: 4.5 (1: yes to 6: not at all)
5	Is the search easy to apply?	Average: 2.0 (1: completely to 6: not at all)
5	Does the search provide the desired contents	Average: 4.6 (1: yes to 6: not at all)
5	Which systems are used for storage in the organization?	"Team Drive and Sharepoint","Sharepoint","I store everything on my PC"
6	What process-relevant knowledge is needed?	"Demands of the customer","legal restrictions","Cooperation agreements","SLA"
7	Where is the process relevant knowledge gained from?	System AB: 5 mentions, colleagues: 10 mentions, e-mail: 14 mentions

Table 3.1: Possible written results in a questionnaire for the knowledge profile

since they can have a significant influence on the calculated means. Anyhow, the use of scales for demands is only partially sufficient. The answers are more likely to be listings of possibilities, which are used or what the employees wish for. An example for such question is shown with question 3 in the table. However, the outliers are missing, as is the total number of answers provided on the question. Retrieving a 2.3 from 5 answers

can be achieved in different ways which can be of importance. E.g. 1 times 1, 3 times 2 and 1 times 5 or 3 times 1, 1 times 4, and 1 times 5. The later example is far more extreme and needs further analysis with regard to e.g. the knowledge needed.
In the next step, the answers on the contents should be separated from the answers on the actual technical demands. In the example table this concerns question 5. Regarding the technical implementation the answers should also be related to already running systems of the organization, e.g. file server, Sharepoint server etc. Here it is also of importance to note whether a system was named for several knowledge services. If the Sharepoint of the table example e.g. is named for search only but not for publication, this already indicates the first problem. Consequently for the profile it should be written down, how often which system was named for which service. The result of a questionnaire is illustrated in table 3.2.

system	publication	search	communication	collab	learning
Sharepoint		10			
e-mail			2	3	
fileserver	15				
satisfaction	2	2.5	4	5	-

Table 3.2: Profile table - documenting existing support

For the general profile creation count the critiques on the individual knowledge services first and order the knowledge service according to the most critical reception or lowest user satisfaction. In the example profile this would be the knowledge service of collaboration, together with the knowledge service of communication. In addition to the work on the existing systems, indicators for organizational and individual issues/barriers should be extracted. Here the two fields of organizational culture and individual issues have to be separated from the problems in the technical use. The most typical example indicating such issues besides the technical solution, is the statement that the time is not sufficient for extra tasks as KM demands. The same should be continued for the technical barriers in already existing systems. This can be accomplished as shown in table 3.3. However, it should be noted, that the problems are not written down but only

counted in the example. For analysis and consequent service recommendation the full problem reports should be available.

problems	publication	search	communication	collab	learning
organizational individual		10	13 2	 3	
technical		3			
wish for more support	5	4	4	1	-

Table 3.3: Profile table - barriers and support needed

Based on this categorization provided in the profile tables of already existing functionalities needing improvement and missing functionalities, the actual recommendation on the knowledge services can be retrieved as described in the next section.

3.3 KMS Recommendation

With the results gathered in the profile as described in section 3.2 the core issues within the individual knowledge services were identified, as well as the service asking for the most support. Based on that profile the technological support as a KMS should be now determined. The easiest approach would be, that the knowledge service demanded most should be supported first. However, this does not hold in all cases, since the interrelations between the services have to be taken into consideration as well.

A general depiction of the knowledge services and their interrelations can be seen in figure 3.3.

The interrelation of the knowledge services leads to the fact that when a certain knowledge service is to be chosen, its supporting knowledge services does not have to be neglected. Communication is e.g. the base for a successful collaboration. That means, even if the results from the analysis phase indicate a strong demand for collaboration it has to be secured, that the level of communication is sufficient to support successful collaboration.

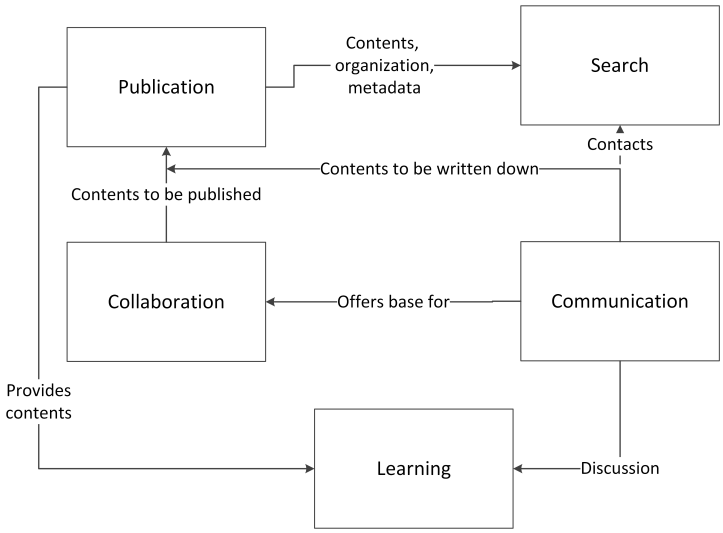

Figure 3.3: The interrelation of services

This example also illustrates, that not all support has to be provided in a technical solution. Especially communication in its informal aspect is done without technological support. This involves an organizational culture supporting an exchange between employees and the knowledge of the employees on whom to contact. Referring back to the example profile in the last section this means, that though collaboration is demanded the most the organizational barriers of the communication knowledge service should be resolved first to enable collaboration. In addition, the individual issues arising with the service of collaboration have to be resolved. This means clarifying the importance of the collaboration for the organization and addressing the individual issues like fear of loss of importance. Here the alignment to the KM strategy and to the organizations' subjectives is to be accomplished.

Another important interrelation is the dependency of search and publication services. If there are issues with finding certain information the solution is not always to come up with a better search machine, but often the mechanisms of publication should be questioned as well. This includes e.g. the metadata or the storage structure. Two reasons of unavailability should be kept in mind: first, the desired information is in the system but the place is unknown and second, the information is not yet available in the system.

In addition the importance of learning is usually neglected, since it is often not done via an official e-learning channel but by informal contacts or mere documents provided, these however can be supported as well. Consequently, learning strongly relies on publication to provide the desired contents, and on search to find the contents as well as the co workers to communicate with.

3.3.1 Knowledge service determination

The process of finding the knowledge service to be implemented is depicted in figure 3.4 and described in the following section.

Since this method aims at a benefit-oriented choice of a KMS, hence it wants to recom-

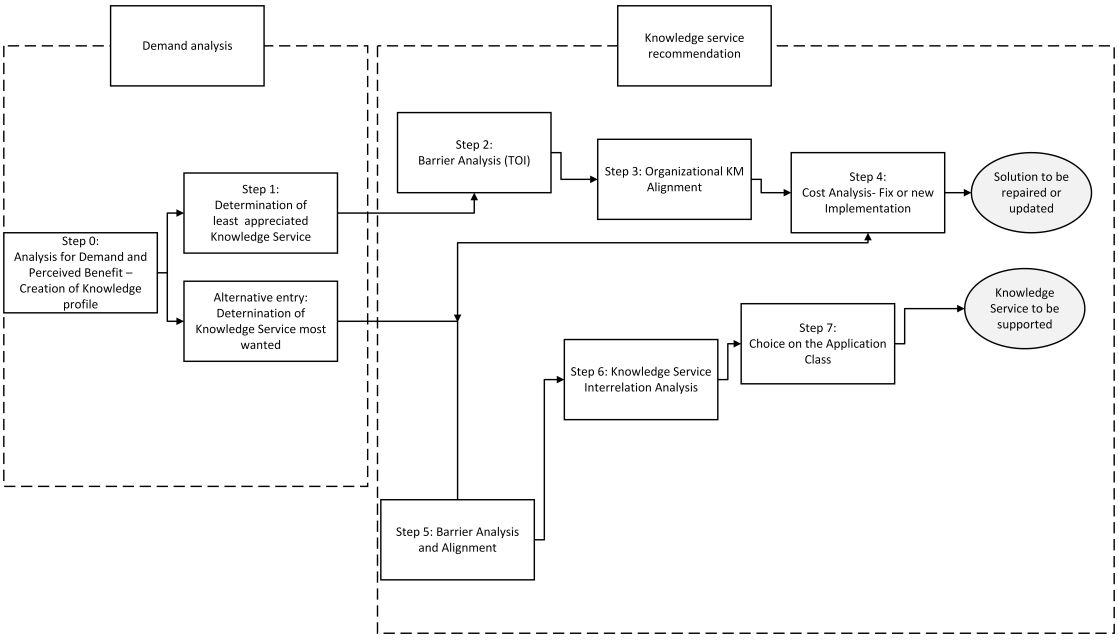

Figure 3.4: Retrieving the Knowledge Service to be supported

mend a system of value to the organization implementing it. However, since knowledge as such cannot be measured in monetary terms we do not aim at a return rate. Nevertheless, the perception of the future user, the employee, can be used to measure the value of the according system. Consequently, the user needs are the center of the decision

making process and are to be analyzed using the background of the knowledge services.

Before actually providing a recommendation of the KMS to implement, the knowledge service needing the most support has to be extracted. As a first step it should be compared whether the knowledge service with the worst reception corresponds with the one needed the most. If they correspond to each other the recommendation can proceed, if not two fields of action have to be considered for the recommendation. It should be analyzed what causes the bad reception, since the technical problems only can be addressed with the implementation of a new system. In case the individual and organizational problems outweigh the technical ones, these have to be resolved within the organizational culture and alignment of the KM strategy. In case the technical problems outweigh, either a fix of the existing solution or a new technological support is needed. Here the actual demand of the employees should be considered. If the employees do not mention that the knowledge service the existing system supports most, needs more support fixing the existing solution should be sufficient. Otherwise this is the service of choice for a new KMS solution to be implemented. Already the mentioning of technological problems indicates that a technical solution exists, which is perceived as support and therefore should be considered for rework. However, if the cost of repair are too high, a new implementation should be considered.

For the revision of existing channels a well-known example from the knowledge service of publication is e.g. the use of a fileserver, which as such is a common choice but needs a well defined structure and naming policy to be of constant value for the search service. A permanent issue is e.g. the existence of storage points named “MISC”, “other”, “leftovers”. These names do not provide clear instructions on what to expect from the contents of the folders and collected documents, which are most likely to be never found again. In addition, for storage being well maintained, metadata is is necessary to provide a means by which a document can be found.

In case the reception of the knowledge services is good for all services or no technological support can be named, the profile part on the knowledge service most wanted can be considered directly as a recommendation. Both knowledge services and the resulting system recommendation have to be compared against the organization’s strategy whether further support in this field is encouraged. E.g. if the organizational strat-

egy does not support exchange via unofficial channels as there are messengers, but the employees demand such possibility, an alignment process has to be accomplished. Further alignment is also necessary with regard to the organizational and individual barriers since the implementation of a technical solution cannot resolve these barriers without the organization by e.g. integrating the task as a permanent compulsory part in a process.

For the realization of the knowledge service needed, it should also be related to other knowledge services before establishing a system support. If the employees for example claim that they do not have a possibility to learn since there are no learning objects/documents available, the problem should be related to the knowledge services of "publication" as well as to the "communication" and "search". Communication supports finding the desired documents, as do suiting search mechanisms. Consequently, this answer emphasizes contents and demands clarification whether contents are missing or they cannot be found. Only the latter is a problem related to "publication" and respective "search" applications. Consequently, the knowledge service can be selected, but the remarks on the related knowledge services have to be taken into consideration for interrelations.

In addition the demand for a specific knowledge service and the satisfaction with the existing technical support are supposed to be balanced. When the answers to e.g. the service of "communication" indicate that employees only talk directly during meetings and are satisfied with that situation in general, an immediate change towards a system is not needed by the demands of the employees. Yet, for every organization the strategic goals should be taken into account as well. So if the organization demands more documentation on the conducted information sharing mere talking does not suffice. Other means from the field of "publication" are to be considered as a supporting strategy to achieve that.

3.3.2 Knowledge service application class

After the identification of the knowledge service to be supported the choice on the application class should be made. In general a large amount of application classes can be named to support KM. Consequently, these are to be categorized with regard to the knowledge services, as shown in the table 3.4. The table cannot be considered completed since new application classes emerge continuously.

Knowledge Service	Application Class
Search	Search Engines
	Visualisation Components
	Expert Systems
Publication	Document Management Systems
	Content Management Systems
	Social Media: Blogs, Wikis
Learning	Learning Management Systems
	Authoring Systems
	Digital Libraries
Collaboration	Group Editors
	Annotation Systems
	Electronic Meeting Systems
Communication	E-mail
	Messenger Systems
	Conferencing Systems

Table 3.4: Application classes for knowledge services

Using this table a choice can be made on an application class, taking into consideration the organizations IT development strategy. The general budgets for a potential system should have been clarified in the initialization phase, whereas here the concrete sums including the maintenance costs and the responsibilities for a running system have to be determined.

Besides the mere choice of the application class it should be noted that many of them are considered social media. For this reason and the notion that knowledge is social, the attitude towards social media should be discussed again, since these offer many applications to support publication and communication. Nevertheless, they certainly do not appeal to all kind of users. Here the organizational development strategy influences the choice, so it has to be taken into consideration if the organization is rather traditional and has always been using file server or if it deliberately aims at using new media. Consequently the dimensions of organizational culture and individual perception should be considered likewise upon decision making. This is essential since the inclusion of and in

the organizational culture is providing the necessary room for activities to take place. E.g. if the communication of an organization should be documented, a mere voice based support by a conference system cannot suffice that requirement.

Using the choice made based on the table and the accompanying discussion a market research is the next method component to determine the concrete product to be implemented in the organization. However, it should be kept in mind that this method directs towards a benefit-oriented choice and that the value is generated by the users' perception and acceptance. Consequently, the success dimensions of service, systems and knowledge quality are to be integrated in that method. Within this method component the system was determined and now the market analysis and implementation have to consider the success dimensions since the recommendation can only name the system with the highest potential. Furthermore, the implementation process has to take care of the contents provided and the service surrounding the system.

3.4 Market Analysis and Implementation Process - Integrating the Technical Solution into Your Organization

This part of the implementation process will not be covered in further detail, since we assume the methods for market research and implementation known to the users or organization. Nevertheless, the manual is supposed to provide some remarks which should be taken into account during market analysis and implementation of the KMS support to enable a successful introduction.

In general the market analysis is the point involving the financial demands of the organization. The market for IT based KM solutions contains many applications from the open source field but also manifold proprietary offers to be taken into consideration. Yet upon the decision for a certain product the technical infrastructure as well as the maintenance cost should be taken into account. Though a product might be low in acquisition costs, the maintenance costs can easily sum up. Especially when dealing with open source solutions maintenance might be difficult due to unresolved update possibilities and low documentation standards. Besides different forms of IT based solutions should be considered e.g. standalone software or web based services. A distributed application

for instance is not suitable if the connection between workplaces is instable or very slow. Furthermore, it has to be regarded, how secure the solution storing the knowledge and information valuable to your organization in the Internet, is.

Regarding the implementation of a solution we recommend to introduce it within an overall introduction of the KM approach in the organization or organizational unit. This creates a concrete purpose for the system to be used and a concrete integration of KM as such in the organization. Our recommendation allows for an easier integration of KM and KMS support into the actions to take place than merely providing it as an option besides other operative tasks. Within a certain project the operation of KM and KMS support becomes less abstract than by a detached introduction. For this purpose several implementation approaches exist, however if it is for the introduction of an application only, the focus on implementation approaches known from the field of software engineering is recommend. However, during the implementation it is essential to consider the application itself but all dimensions involved in KM. Without the support of the organizational management and the individuals the technology solution. The KMS support will not be fully integrated into the organization and is more likely to fail. Consequently, it is important to ensure the motivation for KM, the integration into processes, and the realization of the fact, that writing knowledge down needs time and feedback procedures. Here the three dimensions for classification in KM (technology, organization and individual) should be regarded. Even though from software engineering the introduction might be successful, this only comprises the technology part. Thus the organization has to provide a suiting environment to keep the technology running and the individuals motivated to work with it.

During the introduction of the KMS support your organization should also be aware of the success dimensions to allow for a valuable implementation, and serve them to allow for a successful implementation. The dimensions count for the technical support only: service, system and knowledge quality, however address the organizational support and the coverage by the individual as well. Further details and indicators to be considered on the success dimensions are provided in the table below.

Though it is not the focus of this manual, a short reminder. A part of the KMS support introduction should be the provision of contents. With this issue we also refer back to the organizational demand from the phase of demand analysis (see section 3.2). Filling the implemented system is of high importance for its acceptance. A system

Quality dimensions	Indicators
System	Stability, userfriendliness, integrated technical infrastructure, retrieval times, kind of supported knowledge sources, technical competencies of the staff
Service	support by management, integration in business processes, knowledge strategy, trust, transparency, competencies, fast failure recovery
Knowledge	Richness and linkages, amount, adequateness, up-to-dateness, comprehensibility, reliability, convenience, readability, layout

with contents can directly reveal its use, which is not left open to the imagination of a potential user if no contents are provided. Furthermore, the extraction of knowledge is not left to the potential user only. This also addresses the creation of quality standards for the knowledge elements, as well as it provides starting points for a possible extension by the employees.

In addition, the introduction of the KMS solution to the workforce including introduction is of special importance. Thorough training and awareness for the arising issues have to be accomplished to avoid the emergence of the feeling that the KMS solution has been simply imposed on the employees. The employees should be enabled to see the use and benefits of the system provided to them.

3.5 Evaluation and Comparison

Though a successful introduction of your KM support might be done a constant reconsideration of it should be done to secure the success and adapt to the changing demands of your organization. After implementing your KM solution it is about time to check for the its success. As explained before this evaluation should be done regarding the success dimensions as shown in figure 2.2. The evaluation can be accomplished based on a questionnaire, which should not be conducted once but in regular intervals to maintain the system and keep up to date on the changing demands towards a KMS implementa-

tion. The focus of the evaluation however is not on monetary issues but on the success provided to your work processes. Consequently, the evaluation is done with regard to the benefits perceived by the employees.

The questions to be put forward concentrate on the benefit of the individual employee as well as on capturing the factors influencing the success. The focus lies on the dimensions of service and knowledge quality. Furthermore, the value can be supplemented with values to be retrieved on the system, (if possible) documenting the actual usage of it. Questions supporting the acquisition to be used within the questionnaire can be found in table 3.8. The questions are categorized by the success dimension they focus on and hence can be used isolated as well. We recommended to apply these questions in a questionnaire for repetition issues. Furthermore, the questions shown below are all closed questions and therefore to be answered with scales.

Questions
The system provides correct contents
The system provides integral contents
The system provides logical contents
The contents provided are easy to read
The system provides practicable content
The knowledge classification of expertise in the KMS is clear and easy to understand
The classification of expertise in the KMS is consistent with my cognition
The branch structure of expertise in the KMS is clear and easy to understand
The branch structure of expertise in the KMS is consistent with my cognition

Table 3.5: Items on knowledge quality

Questions
The system is stable
The system comes with a sufficient training
Contact persons helping are available
The use of the system is integrated with my daily activities
The management support me sufficiently in the use of the KMS
Knowledge Management is lived beyond the use of the system

Table 3.6: Items on service quality/ integration

Questions
The KMS makes it easy for me to search/ retrieve knowledge documents
The KMS makes it easy for me to create knowledge documents
The KMS makes it easy for me to upload/download knowledge documents
The KMS makes it easy for me to transfer knowledge documents
The KMS makes it convenient for me to discuss issues with other people in the knowledge community
The KMS makes it convenient for me to input comments and feedback in the knowledge community
The KMS makes it convenient for me to share knowledge with other people in the knowledge community
The KMS makes it convenient for me to access the shared content in the knowledge community
The KMS enables me to control the settings of knowledge documents, e.g. timeliness
The KMS enables me to control the presentation of knowledge documents
The KMS enables me to define my favorite knowledge
The KMS can record my retrieval and reading history

Table 3.7: Items on user friendliness and system quality

Having conducted the survey, the analysis of the values is necessary. In general the averages of the results taking the extremes into account, suffice to deliver a general impression on the success of the system. Nevertheless, the first evaluation can provide a

Questions
Assuming that I had access to the KMS I intend to use it
Given that I had access to the KMS I predict tat I would use it
I recommended other people to use it after my interaction with the KMS
As a whole, I am satisfied with the KMS
As a whole the KMS is successful

Table 3.8: Items on user satisfaction and intention to use

tendency only, since comparison is not possible. It can occur, that the employees indicate generally only average satisfaction analyzing all of the questions. This does not necessarily prove that the system is not well perceived. If all values tend towards the average, this hints that the employees are either unable or unwilling to provide feedback. At this point an additional oral feedback as an interview with several employees regarding the why of their assessment can provide further insights.

Difficult results might also be too positive answers. The employees might provide a more positive perception to avoid further questioning. Therefore the numbers extracted from the system in use (hits, used contents, number of search strings) can provide an idea on the actual usage and reveal discrepancies between offered perception and actual use. The tendencies of the retrieved values can be found in the general evaluation behavior of the employees; a critical workforce will hardly evaluate the system enthusiastically whereas within a positive workforce even small changes in a seemingly positive evaluation should be rewarded more attention. The latter also indicates that this kind of evaluation is directed at detecting changes in the perception. For the assessment of the success, the time between implementation and evaluation has to be long enough. The process in which the system is supposed to work, has to settle and the first enthusiastic run or skepticism has to be over.

To provide input for the maintenance process the evaluation should also include a part on the satisfaction with the general knowledge service as presented in 3.2. This supports timely reactions on arising demands within the knowledge services, revealing changes in the knowledge demands. As soon as a new demand or unsatisfying values are

gained through evaluation, a new cycle of method execution should be started as shown in figure 2.2.

4 Summary

This manual has presented a framework and the according method for the introduction of KMS support within an SME. When following the method, the user should be aware that the focus lies on the value oriented introduction of such system (using the perceived value approach) and the background of an holistic KM approach. Hence, the inclusion of the organizational and individual factors is not optional. Consequently, the triangle of technology, organization and individual (TOI) at all times should be kept in mind as the frame for acting on the field of KM and thus the introduction of a technological KM support. This method manual focuses on the decision making process upon the employee, since he or she is the one perceiving the value which results from the system, service and knowledge quality provided by the KMS solution. Consequently, these tree dimensions are to be regarded for the systems success, as does the TOI for KM in general, to achieve a balanced technological solution within the holistic field of KM.

The method and the introduced components demand adoptions to the individual SME, and are as such specific to SME, that the underlying framework focuses on SME in terms of its complexity. It consequently can also be used for organizational business units of the respective size, but especially the use of socio-empirical methods aims for a certain number of employees. E.g. the use of questionnaires or interviews withholds a large amount of work with a rising number of employees involved.

Finally, it should be noted that the method is under constant development, thus remarks and questions are always welcome and may lead to the adaption of the method.

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Statement of authorship

I hereby confirm that this thesis has been composed by myself, and describes my own work, unless otherwise acknowledged in the text.

All references and verbatim extracts have been quoted, and all sources of information have been specifically acknowledged. It has not been accepted in any previous application for a degree.

Date and Place

Signature