Determining and Evaluating the Benefits of KM Tool Support for SME

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Abstract: Though knowledge management (KM) and knowledge management systems (KMS) have been well established in organizations the question on how to evaluate the benefits to be gained from the use of such systems is still not finally resolved. Based on a complete case study showing how a KMS was introduced in a knowledge-intensive small enterprise in Germany this paper illustrates the operationalization of the KMS success model of (Jennex, Olfman, 2006) for its use in a SME. It shows the difficulties arising from the use of the model as well as the shortcomings during the implementation process which further was directed at determining a suitable KMS by addressing the knowledge services as introduced in the KMS architecture by Maier (Maier, 2007). Therewith two complex models generated in the field of KMS are transferred into practical application and discussed in the context of a SME which is part of our framework for the value-oriented decision support on KMS support for SME.

1 MOTIVATION

Knowledge Management (KM) and Knowledge Management Systems (KMS) have been in the focus of research for several years now and have reached the state of practical relevance and application. In (Borchardt, 2010) we presented a survey showing, that the concepts and possibilities of KM and KMS for SME are not realized by the ones answering the survey, indicating that the concept of KM is only vaguely known to SME, as well as it is constantly confused with the scopes and tasks of information management. The result was that the application of tools or KMS in the participating SME is still based on rumours, in the best case on success stories if implemented at all. During the survey the main question put forward by the participating SME was the one on the benefits to be expected from the application of a KMS. Though several benefits as e.g. knowledge preservation under employee fluctuation, shortened times for searching documents or stronger innovation through reflection on the field of expertise (Mertins, Seidel, 2009), can be named in general this was not what the SMEs expected. Most SME still liked to speak of benefits in terms of monetary units or at least more specific for their organization instead of general expectations. The

rather imprecise and timewise undetermined benefits named are too vague to convince SME to invest into the effort necessary.

To address this problem and offer a systematic value-oriented method we designed a framework based on the concepts of knowledge demand, knowledge services and the operationalization of the KMS Success model (Borchardt, 2010) which was applied within the case study described in the following paper. We therefore used a case study and applied it as a means of practical evaluation as demanded in the design science approach (Hevner, 2010). Regarding the already exiting results within the field of KM, KMS and benefit determination for IS we determined the following research questions:

1. How can a model for measuring the benefits of KMS be operated towards the use in SME?

2. How can a recommendation on which tools to use for KM in SME be given based on the knowledge services and the organizations requirements towards KM?

3. Where does the introduced software lead to benefits?

This paper illustrates our approach to provide answers to these questions using a case study of a biotech SME introducing a KMS. The general

presentation of our framework is done in section 2. The actual case study including methodology, conduction of the case study and results is presented in section 3. Finally, section 4 relates the work of the case study to our general work in the field of value orientation of KMS in SME.

2 THE FRAMEWORK FOR VALUE-ORIENTED DECISION SUPPORT ON KMS

The general objective of our framework is the recommendation on usage of KM supporting applications which support mostly one of the knowledge services, instead of building a holistic system at once as suggested by Maier (Maier, 2007). This decision is based upon the characteristics of SME, having a smaller budget and a stronger orientation towards the operative business (Mertins, Seidel, 2009).

The decision upon the knowledge service to implement is to be made based on the possible perceived benefit of such implementation. Consequently the decision making process includes a questioning of the employees for their needs. These uttered demands then build the base for a benefit to be perceived, which can be valued as useful by the employees if fulfilled and will not be perceived as "yet another system" to be filled. A general depiction of the framework showing the interrelations between the different components of the framework can be seen in Figure 1.

The decision upon the technical support must not only consider the knowledge service but also the interdependencies between them, e.g. knowledge items cannot be found if they were not published properly. Having made a recommendation on the service to be implemented this recommendation is refined into a recommendation on the application class to be implemented, which is based on the general strategy of the SME under consideration. Using this recommendation the SME has to conduct a market research to actually find their product implementing the recommended application class. During market research and implementation already the awareness for the KMS success dimensions (Jennex, 2006) is requested, since the dimensions should be considered from the very beginning, to be able to successfully satisfy the demands retrieved from the employees with a well-balanced technical support.

After implementation the framework includes a regular evaluation of the solution to find the points of dissatisfaction or be able to detect necessary changes in time, before the system is neglected by the possible users.
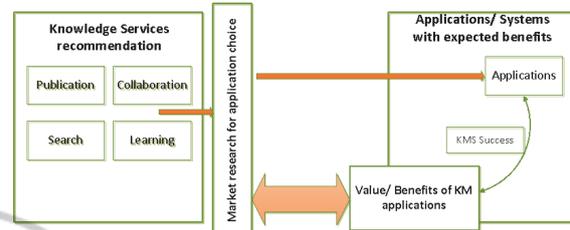

Figure 1: The initial framework for KMS recommendation.

The general method accompanying the framework and operationalizing it is shown with the help of the case study in the next section.

The framework and the method are directed at SME or small-scale business units, since these usually do not have the resources for a strong focus on KM, but can benefit from a systematical support as well (Mertins, Seidel 2009). The actual framework was composed by the combination of components retrieved from the scientific knowledge base (Knowledge services by Maier, social empirical methods, KMS Success), since we found no direct support for this issue in literature. As such the framework represents our artefact gained using the design-science research approach (Hevner, 2010). With the application of method and framework to the case of BTL we were looking for the transfer of our work to IS practice, as well as conducting a cycle of evaluation for the created artefact. This does not mean that the framework is finalized, but the presented case study shows the practical application and possible points for further adaptions.

3 CASE STUDY

This section shows the application of the framework for value-oriented decision support for KMS support using the case of BTL and transferring the theoretical artefact to practical application.

3.1 Methodology of the Case Study

The case study took place between May and September 2012 in Mecklenburg-Hither Pomerania, Germany. During accessing the organization we used the following approach:

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. Determination of the requirements catalogue on the knowledge services as proposed by Maier and

4. Installation of the 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

7. Success evaluation using the KMS Success approach by (Jennex, 2006) to determine the perceived benefit and the user satisfaction using our own operationalization of the model.

3.2 The Enterprise

The enterprise within the conducted case study is BTL, a biologic 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 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 behavioural studies are developed. Moreover, 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 having an annual turnover less than 2 million €. Consequently, it can be classified a small enterprise. The working reality is that there are two managers owning the company. 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 deliberately running a systematic KM.

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 supported. On all systems different versions of the Microsoft Windows operating system are running (from XP to Windows 7). Additional software in use is: Microsoft 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 equipment. 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, running as a file server only.

The availability of information and knowledge sources onsite is mainly reduced to working hours, a remote access to the enterprise network is not provided. This includes that remote work is not supported which on the one hand side is 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 we found most items concentrated on the main site's file server. Even the available paper literature is concentrated at the main site. 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, the sources named most often 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 enterprise processes mostly being experiments 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. invoices, 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, 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 holds 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 2; this indicates that computer based search is hardly of any support.

Having a closer look at the gained results and 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 rest can be assumed unaware of the functionalities. However, the result (see figure 3) confirms the general assumptions on colleagueship in SME: asking a fellow worker is the most common choice to find something.
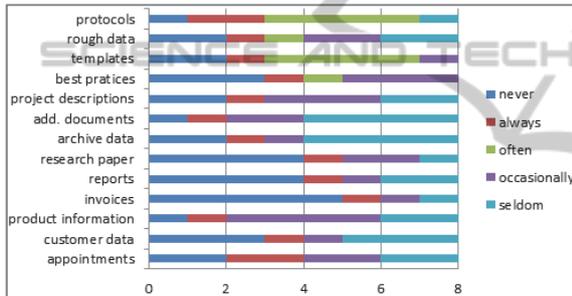

Figure 2: Information sources.

Representation of information is mostly done via common formats as there are Word or Excel files, as well as picture formats. There is no hint 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 automatically stored one. 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.

3.3 Results in the Implementation

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.
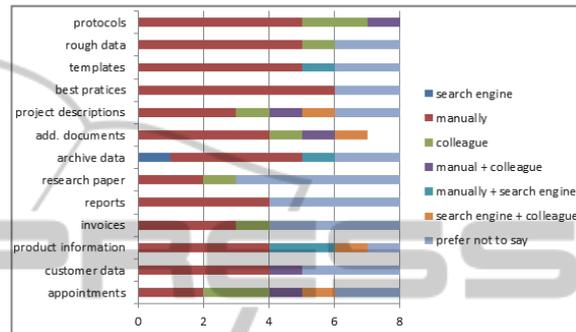

Figure 3: How is information obtained.

3.3.1 Determine Knowledge Service Needs

The determination of the knowledge needs was part of the questionnaire, showing that knowledge is considered of high importance in the SME. 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. The other 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 a KMS.

The third 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 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, however 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. The strongest demand could be identified on the field of publication indicating the need for more information to be published. However, published information should be found and for this reason some improvements for the search are desirable. Since the work is not constantly done at a PC workspace the demand for collaboration via PC is relatively low.

Summing this up a central system storing process knowledge and experiences is suitable to address the enterprise knowledge needs. This however leads to the use of a document management system which might be complemented by groupware functions e.g. contacts and collaborative working on documents. The software should cover standard office formats.

3.3.2 Software Choice

Based on the demands described above and economic aspects (investment and maintenance cost, training effort) a systemic support was chosen.

The concrete criteria for this choice were: user friendliness, integration with the existing Microsoft office environment, license costs, 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 is according to Jennex/Olfman KMS Success (Jennex and Olfman, 2006) a significant indicator for a system's success. The final decision was made in favour for Microsoft SharePoint as a system for collaboration and document management, which also provides a centralized calendar and contact management. Aspects supporting this choice were the opportunity to adapt the interface and the 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.

3.3.3 Implementing the Knowledge Services using Sharepoint

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.

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. 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 artefacts. 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. Finally the system should gather information from team meetings. This information should be published as an intranet blog. This 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 by 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. This addition allows for more sophisticated search support in the Foundation version. There it is integrated and displayed as an extra website, which supports searching the old file server as well as the newly established intranet. It supports crawling more document types and especially pdf's, which is highly important for the enterprise. Finally, 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, allowing parallel work on documents. 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.

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.

3.3.4 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 part of the KMS Success of Jennex/ Olfman (Jennex, 2004) as introduced before. 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 during observation time. Moreover, usage as well as user satisfaction were assumed the focal points for successful adaption. For the evaluation 9 of the 12 employees could be asked, the others were not available due to summer holidays.

In the general questions it was asked what the precise working field of the employee was and whether he is using a permanent PC workspace. On this 4 of 9 answers denied using a designated workspace. 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/difficult.

The actual working time showed that 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 by then usage was not depending on external reasons. The overall results appear rather disappointing but for the actual result the working conditions and number of employees have to be taken into account. Some employees use the system for sharing their experiences though not being permanent PC workers.

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. This is again also due to the fact that not all employees have permanent PC access, whereas a paper notebook can be easily carried around. Asking the employees for the precise reason why they did not use the SharePoint system 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. No KM specific support by the management was given. Consequently it is noted that the problem is not the system itself but its process integration. It gives evidence 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 4. It can be seen that only one negative aspect was mentioned, namely information being incomplete.

This is remarkable and should be changed yet by that time can be easily explained: after 2 months it could not be expected that everything was transferred completely into the new system.
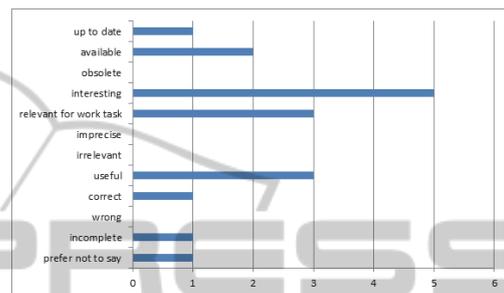

Figure 4: Quality of information.

Moreover, the employees should be encouraged to fill found gaps, to enlarge the knowledge base.

Finally, the motivation of the employees was analysed. 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 we also asked whether they see a positive influence on their colleagues work. Here we gained 6 positive answers and 3 times "prefer not to say".

3.3.5 Resume

Considering we evaluated a knowledge- intensive SME with little knowledge on the topic of KM it 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 we sum up the following: 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; and employees feel support for their work, especially considering the group exchange.

Based on the individual 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 and the installed meta search integrates old assets from the fileserver with the new ones in the intranet.

As for critical remarks on the KMS and KM we found the following: 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.

3.3.6 Discussion

In general the small sample of 12, respectively 9, employees can be argued to be too small for showing or proving effects of the work conducted. Yet working in the field of SME this enterprise size represents a typical example for a small enterprise.

With regard to the critical remarks a stronger focus on the TOI components (Bullinger et.al., 1997) is desirable and should be addressed by the management. Though SME are said to have a knowledge supporting structure it is still a problem that time has to be spared for these tasks. The management should provide more concrete goals to be accomplished, to provide a stronger context for the KMS in the SME as suggested before. In addition, in the beginning integration and adaption time for the employees is needed to adjust.

As for the method it was recognized, that the success evaluation may be repeated after a longer period of time. Moreover, we had to recognize, that a knowledge demand analysis is the starting point for the introduction of a KMS however, the means are various and hardly standardized and therewith demand a high expertise on the field which cannot be expected to exist within a SME. Therefore this analysis seems to be rather rough in our case study and is to be refined for further cases. Anyhow the embedding in the dimension for KM Success in general can be considered insufficient, since the management support and knowledge content could be seen lacking a certain level, whereas the other

dimensions were not considered at all. Using of interviews for the demand analysis, allowed a deeper insight into the general settings of the enterprise. Regarding the questionnaires to determine how the employees satisfy their need for information: it certainly needs introduction to ensure, that the questions are understood by the employees. Nevertheless, it proved useful, since it ensured that all employees were confronted with the same questions. In addition it can be repeated easily without further support from the outside, which was considered a positive side effect of it by the manager. The latter also holds for the use of a questionnaire for success evaluation, considering that the results of further evaluations can be compared more easily.

4 CONCLUSIONS

Within this paper we presented the operationalization of our framework showing the operationalization of the KMS Success model (Jennex and Olfman, 2004) and the knowledge services (Maier, 2007) and consequently showed the answer to the first research question on the operationalization. We showed the retrieval of the KMS recommendation using questionnaires filled in by the employees to determine their demands, which then were prioritized as demands on support of individual knowledge services, resulting in a recommendation on a knowledge service to be supported. This is the general answer to research question 2: using social empirical methods to retrieve the demands of the employees, which can be questionnaires, but also interviews and observations. With regard to research question 3 the results were presented in 3.3.5.

The case study showed that the framework as such needs further refinements to allow for a better application. In general considering the usage of the model of KMS Success of Jennex/Olfman (Jennex, 2006) it would be of interest to be able to compare the gained results with other enterprises. Yet the concrete operationalization of the model is left open by the authors of the model. However, this approach does not support the exchange and comparison of precise experiences between individual enterprises as it might be of interest for SME (Borchardt, 2010).

Especially for the use within SME KMS/ KM tools as well as their indicators for success have to be quick at hand. This leads to the question whether the KMS success model can be operationalized into

a method addressing SME and allowing them in the end to see the benefits to be expected from certain KMS solutions to be able to make their decisions for a KMS support based on that method, in the context of their individual situation. For this part this included an easy to handle questionnaire pointing out the facts of interest to pay special attention to under the phase of implementation.
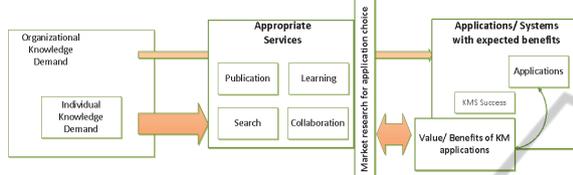

Figure 5: Revised version of the framework.

By the research work presented concrete adjustments in the framework are demanded. Especially for the demand specification it became obvious that two kinds of demands have to be distinguished. By now we concentrated on the individual demand for the support with knowledge by the means of the knowledge services. However, also focusing on the embedding in the organization the organizational demand should be considered as well, since it provides the frame in which the individual demands arise and should be satisfied. The inclusion of the organizational demand in the framework also addresses the lack of a KM strategy which became evident within this case. Yet for a goal oriented application of a KMS support this should be clarified first. Consequently, the adaption of the framework should look like shown in Figure 5. At the current point of research we are working on the refinement of the part knowledge demand as a prerequisite for the choice to be made on the knowledge services. Anyhow putting these components together should allow us to establish a value-oriented framework on the choice of KMS for SME, and is to result in a multi case study, allowing for comparisons based on the repeated use of the same approach. As such the framework was already outlined in (Borchardt, 2010).

While putting this framework into practice we had to recognize, that before being able to start into picking suitable services and applications it is necessary to determine the knowledge demands of the SME. As was shown with the case study presented in this paper, the knowledge demands determine the necessary knowledge services. Yet, this topic is rarely covered systematically in scientific literature other than by the statement that manifold empirical methods are available to address

this problem, as e.g. in (Probst et.al., 1999) where knowledge goals and identification are important building blocks, but no recommendation is given on how to address them systematically.

Besides the already existing questions which are discussed as e.g. done with the presented case study, the questionnaires also ask for further validation, as e.g. presented in (Ong, Lai, 2007). However, the mere statistical validation is rather difficult due to the small numbers of users in SME. Moreover, the validation has to be done more generally, and should not be done for the questionnaires, but for framework and method only. A possible approach for such validation is by (Lincoln, Guba, 1985).

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