

The state of SME knowledge management

a multiple case study analysis

Full Research Paper

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Abstract

Small and medium-sized companies (SME) account for more than 50% of the added value throughout the EU-28. Organizational learning has been found to be a powerful tool to maintain flexibility and support sustainable competitive advantage. As of today not much is known about the methods, practices and tools SME employ to establish knowledge management (KM). Within our paper we present our findings of a case study analysis conducted within six German SME. Even if all investigated companies had a rather clear, yet not coherent understanding of the terms and the potential impact of knowledge and knowledge management, we could not identify any commonly applied KM methodology. Furthermore our cases suggest that technology companies tend to use broad tool support to store and access knowledge, whereas non-white collar businesses rather focus on interpersonal knowledge transfer.

Keywords

Knowledge, Knowledge Management, SME, Case Study Research

Introduction

Small and medium-sized companies (SMEs) are the powerhouse of contemporary western economies. They represent 99,8% of the companies in the EU-28, employ as much as 66,9% of the total workforce and provide 57,8% of the added value [Commission 2015]. SME according to the European Commissions' definition have an annual turnover of less than 50 Mio. € and less than 250 employees¹. The flexibility of SME has often been regarded as one of their relative advantages in comparison with large enterprises [Naisbitt 1994]. As a consequence of constantly decreasing costs of information dissemination, constant change occurs everywhere in today's economies. Flexibility is commonly refereed to, as the ability to cope with unforeseen change [Evans 1991]. There are several ways to prepare for

¹ Numbers of employees are calculated as full-time equivalents (FTE).

change. Amongst them are structural flexibility such as building and maintaining flat / matrix structures but also dynamic capabilities such as organizational learning [Englehardt & Simmons 2002]. In that regard knowledge has been recognized as one of the predominant source of lasting competitive advantage or as Nonaka [1991] stated: "In an economy where the only certainty is uncertainty the sure source of lasting competitive advantage is knowledge". The impact of knowledge and knowledge management (KM) on the competitiveness of companies has not changed as of today and also applies to SME [Cerchione et al. 2015]. The general role of knowledge and KM in contemporary economies is well understood and equivocally shared amongst scientist as well as practitioners [Nonaka & Takeuchi 1995; Dyer & Hatch 2006; Cerchione et al. 2015]. A profound scientific body of knowledge on the general concepts of knowledge acquisition, creation and utilization does exist [Nonaka 1994]. Moreover, strategy and leadership have been identified as key facilitating factors to KM and business performance [Cerchione et al. 2015]. SME significantly differ in terms of organizational structure, demand for flexibility, access to capital, availability of workforce and the role of the owner-managers from large enterprises. Whereas a vast body of literature on KM in large enterprises is available, tools, methods and practices that enable KM within SME as well as the special role of the owner manager with regard to KM are not well understood [Cerchione et al. 2015].

Research scope and method

Our long-term research objective is to build a well usable and rather easily applicable prototype of an SME knowledge management toolkit. In order to reach this higher-level research goal, normative input (i.e. building blocks) for later implementation steps has to be derived. A solid understanding of the current role, tools, applied methods / practices on KM in SME is therefore preparatory to guide the later requirements engineering and implementation steps. This paper - though self-contained - presents the first step towards our main research objective. We applied the case study research (CSR) method [Eisenhardt 1989; Yin 2003] to better understand and sharpen the conceptual understanding of the actual vision, challenges and applied practices of German SME with regard to KM. Within this work we would like to answer the following major research questions: **RQ1:** Are the terms and definitions of knowledge and KM clearly understood amongst SME top managers and owners? **RQ2:** Are common patterns, tools and practices identifiable with regard to KM in SME? **RQ3:** To what extent are the fundamental process steps of KM represented in SME practice and management vision? **RQ4:** Are there identifiable barriers and hurdles that limit SME from doing proper KM and how might they be overcome? **RQ5:** What is the relation of technology and methodology with regard to day to day KM practice in SME?

Data gathering and case sampling

Related literature has shown that the opinion and leadership practices of owner-managers / top-management are key facilitating factors that shape strategy and structure amongst SMEs and ultimately delimit their performance [Mazzarol et al. 2009; Pushpakumari & Watanabe 2010]. For that purpose we decided to address this stakeholder group with a semi-structured questionnaire to first identify this stakeholder groups' definition on KM and the tools, methods and processes they impose to shape their understanding and vision of KM within their respective organizations. Our sample includes six German SME from the business network of all research project participants. Sample size and case types have been selected according to the suggestions of Eisenhardt and Graebner [2007]. Two of cases are participants in the underlying research project, two are associated partners and another two are non-technology companies that have been added from the business network of the participants to limit the bias implied by the technology companies. We selected this diverse set of SME cases from technology as well as non-technology related areas to obtain a broad picture of KM practices in SME. The sample includes small (Alpha, Gamma, Delta and Zeta) and medium companies (Beta and Epsilon) from the areas of

information technology (Alpha, Gamma), engineering (Beta), on-line retail (Delta), cleaning services (Epsilon) as well as agricultural production (Zeta). Their turnover ranged from less than 2 million € to less than 50 million €. We asked their owners / top management for their willingness to participate in our research and briefly outlined our research objectives. Consecutively we agreed on a scheduled interview date and conducted semi-structured interviews via telephone or vis-a-vis. For the sake of research efficiency we noted basic answers using Google Forms right as we conducted the interviews. To later allow an inter coder reliability analysis as well as cross comparison checks we recorded the interviews and stored them on a collaborative file sharing service. The interviews were carried out by two different teams each of them consisting of two persons.

Case Name	Alpha	Beta	Gamma	Delta	Epsilon	Zeta
Type of the interviewee	Owner-Manager	Leadership-Team	Owner-Manager	Manager	Owner-Manager	Owner-Manager
Main service / product	IT-Consulting and application development	Agricultural engineering services	IT-Consulting and application development	Special interest on-line retail	Cleaning services	Agricultural Production
NACE Code	62.01	71.12	62.01	47.91	81.21	01.50
Operations	EU-wide	EU-wide	EU-wide	EU-wide	Regional	Regional
Number of Employees	15	67	25	42	380 ²	17
Turnover	less than 2 Mio. €	less than 10 Mio. €	Less than 2 Mio. €	Less than 50 Mio. €	Less than 10 Mio. €	Less than 10 Mio. €

Table 1: Case demographics

Theoretical background

According to Senge [1990] a “*learning organization*” has to cope with five basic capabilities / challenges. These are *personal mastery*, *mental models*, *shared vision*, *team learning* and *systems thinking*. It is characterized by its ability to adapt for change and enforces systems thinking as well as empowerment of employees in order to overcome static and clumsy structures [Docherty et al. 2001]. According to Karadsheh et al. [2009] knowledge “... is the result of merging information with practice, perspective and expression, resulting in [...] plans on which decision is based on”. Knowledge creation, capturing and utilization are amongst the critical success factors to build learning organizations. According to Ngah et al. [2008] KM is understood as the set of all activities alongside two organizational dimensions. One being the organizational capability to share, create and store knowledge and the second being the ability to use explicitly documented knowledge. Even if the positive influence of KM on companies success [Nonaka 1991] also applies to SME, the role of knowledge and KM in SME only recently gained more attention in the scientific community [Hutchinson & Quintas 2008]. While investigating the state of research on knowledge, KM and knowledge management systems (KMS) in SME as well as SME networks, Cerchione et al. [2015] identified only 94 research papers. The majority identified contributions are related to operations research and management science (60) and only 10 are related to computer science and information systems. 28 articles are focusing on determining critical success factors (CSF) of KM in SME. Cerchione et al. [2015] clustered these CSF's into *human and cultural factors* (i.e. skill, motivation, training, education, trust and collaboration), *technical factors* (i.e. degree of IT applications, information system, infrastructure) and *managerial factors* (KM strategy, management style, management leadership, organizational infrastructure, rewarding and team-work).

² Even if the company has 380 employees there are less then 250 FTE. Thus the company is still counted as an SME.

The authors identified *cultural factors* and *financial issues* as potential barriers to KM success in SME (4 papers). Nine of the identified papers investigate *contingency factors* (i.e. environmental influence and change). 29 papers focus on KMS within SME. Amongst those 29 papers 18 papers deal with methods on knowledge creation, storing, transfer and application. As few as 11 paper focus on the used IT-systems. Cerchione et al. [2015] contribute to the body of knowledge in that they identify the recently raising, yet not well-developed interest in SME related KM research. They state a “clear need for a more thorough investigation of KM-Tools and KM-Practices employed by SMEs”. Even if it seems rather obvious, that information processing and information systems play a crucial role to master KM, not much has been written or understood about the link between the tools that are being used and the management practices that govern them. Our research contributes to this very research gap.

Data analysis

In the following section we present our case findings. We make use of tabular views since we believe this gives the readers the best opportunity to review our case findings vice-versa the conclusions we draw from them [Eisenhardt & Graebner 2007]. The data analysis part consists of two sections, the first addressing the terms knowledge, KM and the role of knowledge and the second section addressing the experience our interviewees made throughout their KM journeys applying certain methods, practices and tools.

Knowledge, knowledge management and the role of knowledge

Case	Knowledge	Knowledge Management
Alpha	<ul style="list-style-type: none"> - is correlated with work effectiveness - is expensive to loose because it has to be re-gathered - frames a competitive advantage - result of tasks - things that have been researched - documents of any type - know how of the employees, (technology, tooling, processes) - literature, libraries, e-mails, chats 	<ul style="list-style-type: none"> - quality control - effective explication - safe storage - is the asset of the company
Beta	<ul style="list-style-type: none"> - action-oriented association of information - important production factor - needs to be homogeneously distributed across the workforce - knowledge is context-specific - utilized know-how for the daily business 	<ul style="list-style-type: none"> - structured storage - structured transmission - incentives to use a KM-tool - mechanism to distribute knowledge based on need - easy access and to the right knowledge
Gamma	<ul style="list-style-type: none"> - is continuously deprecating (is actual 2-3 years) - children do attract new knowledge faster - base knowledge are facts - meta knowledge is structure - hard to identify if you need it - has a huge influence on groups - is correlated with propensity 	<ul style="list-style-type: none"> - how to attain knowledge - adults must be focused on the knowledge process - use meta-knowledge to find relevant knowledge artifacts - how to exploit knowledge - enforce curiosity - unlearning bad customs - shyness to share is problematic and needs to be handled
Delta	<ul style="list-style-type: none"> - cognitive visualization of experience and associations thereof that guide future action - contain experience, associations, conclusions 	<ul style="list-style-type: none"> - demand-actuated access to structured categories of knowledge - focus on utilization - enrichment with external sources
Epsilon	<ul style="list-style-type: none"> - know-how 	<ul style="list-style-type: none"> - knowledge sharing - inter-personal transfer
Zeta	<ul style="list-style-type: none"> - acquired information (i.e. viewing, reading, practicing), - trained know-how through different communication channels 	<ul style="list-style-type: none"> - management, administration and structuring of knowledge - organizing and explicating

Table 2: Knowledge / Knowledge Management

The managers and owner-managers we have interviewed, provided as very diverse picture on the terms knowledge and KM. The owner-manager of Alpha for instance found that knowledge is correlated with work effectiveness and expensive to loose. He named it "the asset of the company". The owner-manager of Gamma added that knowledge is depreciating over time and has a certain operating life in which it is valuable for the company. He further added that young people (especially children) learn fast and due to sheer unbreakable curiosity. As humans grow up, unlearning bad customs, overcoming shyness to share and enforcing curiosity become very important aspects in managing knowledge as the owner-manger of Gamma states. The interviewees of cases Alpha, Beta, Epsilon and Zeta all used the term "know-how" in their definitions of knowledge. We therefore assume that the practical understanding of the term knowledge prevails. As mentioned by the interviewees of cases Alpha and Beta, knowledge is also a production factor that might provide competitive advantage. We have additionally asked the interviewees whether there is knowledge that is hard if not impossible to explicate. The owner-manager of Alpha claimed that practical knowledge is hard to explicate. In all cases, challenges concerning the explication of know-how were mentioned. That is not limited to a specific type of activities but covers a broad range. For example, case Epsilon expressed difficulties to explicate knowledge about how to clean windows correctly and efficiently, since this requires practical experience. On the other end, case Gamma articulated challenges concerning explication of knowledge about complex image processing algorithms, since this both requires knowledge about the underlying research papers as well as process knowledge of the implementation phase. Altogether our interviewees provided a quite broad coverage of KM aspects. For instance the interviewees of cases Alpha, Beta, Delta and Zeta are very much concerned about effective and structured / organized storage of knowledge that allows easy access. Transmission / sharing of knowledge was on the definitions of cases Beta and Epsilon. Use / utilization of knowledge was mentioned amongst the top priorities of KM by the interviewees of cases Beta, Gamma and Delta. The owner-manager of case Alpha pointed out that quality control is a very important aspect of KM. Besides their definitions of quality management we have also asked our interviewees on the role that knowledge has in their businesses. All our interviewees agree that knowledge plays a crucial role in their organizations, be it to get a special task done as the owner-manager of Zeta mentions or as a general production factor (Beta), for company growth (Delta) or as a competitive edge (Gamma). See table 3 for details.

Case	Quote on the role of knowledge
Alpha	"i think knowledge plays a very important role for us [...] however, in terms of communication, we are still to flabby, imprecise, personal and not fact-based enough"
Beta	"knowledge is one of the most important production factors in the company"
Gamma	"it [the knowledge] plays the central role. We sell [...] either complex or recent knowledge as consultancy [...] and] bundle special knowledge"
Delta	"there is no single answer on that because of the different [employee] roles [...] The role [of knowledge] is huge everywhere [...] [Knowledge is] crucial for growth"
Epsilon	"branch-specifically a huge role"
Zeta	"knowledge is crucial to get things done [...] there are special tasks, that require special knowledge"

Table 3: The role of knowledge

Finally we've been asking our interviewees to value the current and future importance of knowledge on a five point Likert scale (1 = strongly disagree, 5 = strongly agree). The

interviewees of the technology companies (Alpha, Beta, Gamma) all assert knowledge the highest possible value currently as well as in the future. For the on-line retailer as well as the agricultural company the interviewees not only in the Likert evaluation but also orally expressed their opinion that knowledge will become more important as time passes by. Only the interviewee of the cleaning company asserts knowledge a decreasing importance.

Practices, methods and tools

In this section we aimed for identifying *practices, applied methods* and *used tools*. For that purpose we have been asking where and how knowledge is actually *stored* and what *tools* are being used. Further we have asked how actuality of knowledge is being ensured and about the experience the interviewees made with regard to tooling and applied methods. In that regard we further asked about the practices of *transferring / transmission* of knowledge when certain events (i.e. new employee, new product / service) occurred. Finally we asked about the applied practices and methods to *maintain* and *create* new knowledge.

Storing knowledge

Knowledge storing according to our case findings is an astonishingly unstructured and weakly defined procedure, that is scattered across a diverse tooling landscape. As the owner-manager of case Zeta states “knowledge is often stored in the brain of the employees”. In the opinion of the owner-manager the ISO 9000 handbook in case Epsilon fulfills at least part of this companies' knowledge storage requirements. All technology companies use a multitude of different systems to store knowledge. Case Gamma for instance uses self controlled servers to store explicated knowledge as files, documents or image data. The manager of case Delta claimed that they store knowledge in systems reaching from classical relational databases to special desktop applications of single users. This systems use provisioning modes like software as a service (e.g. Google, Facebook) or reside on top of a cloud infrastructure as self-managed systems (i.e. Magento, Odoo). The manager further mentions that this means, data is not always secured or accessible (e.g. in case of outages) and not 100 percent controllable. This is a huge strategic threat to the company. The interviewee of case Beta names the isolated systems his company uses “knowledge silos”. The companies of cases Alpha, Beta and Gamma use open source bug trackers to store operational knowledge but the owner-manager of Alpha claims that actually searching for relevant knowledge is not easy due to the heterogeneous documentation quality and distribution across different tasks.

Knowledge creation and maintenance

Ensuring actuality of knowledge, maintaining existing knowledge and creating new knowledge are weakly specified as well as relatively unstructured processes across all analyzed cases. Table 4 shows the results of our interviews. The technology companies Alpha and Gamma create knowledge “on the fly” as they perform software development based on a project setup, that is supported by bug tracking systems. Case Beta, also a technology company, creates new knowledge within their research and development departments and through their support. In case of Delta knowledge creation is very much depended on the specific role of the employee. In case of the primarily non white collar businesses Epsilon and Zeta, interpersonal and non system-oriented knowledge exchange and development prevails.

Case	Means of actuality, maintenance and creation of knowledge
Alpha	no specified processes in place, action-oriented checks against external data sources, company uses a ticket-system for day to day work, Internet search, training and education, through decisions of the owner-managers, self-motivated learning
Beta	different, not standardized processes, only one system is updated regularly and with a standardized process, responsibility shared across different end-user roles (e.g. head of sales, product manager), research and (product) development and support department create new knowledge
Gamma	company uses a ticket-system for day to day work. Actual knowledge is stored there. No process to invalidate old / outdated knowledge in place. Use team presentations to induce discussions
Delta	critical knowledge categories are frequently challenged by the top-management and external stakeholder (e.g. equity provider), less critical knowledge through demand-driven invalidation, knowledge creation is department specific and influenced by external consultants
Epsilon	on-site trainings and interpersonal knowledge exchange mediated through foreman, regular, quarterly employee trainings
Zeta	The office is frequently screened, documents and notes older than five years are mucked out. Statutory requirements are stored in paper-based format. Direct discussion between manager and employee based on facts (e.g. machine data, work time)

Table 4: Means of actuality, maintenance and creation of knowledge

Tooling

Across the cases we have investigated, a wide range of different tools are used (see table 5). All these systems have specifically been mentioned by our interviewees, when we asked them about the systems that are used to capture knowledge in their organizations. Again the technology companies use the most diverse tool landscape. For instance they all use bug / task trackers, ERP systems, Wiki, E-Mail and conventional file storage systems. In the latter system class we joined everything that is document oriented in a classical sense. However, we didn't further differentiate between modern cloud file applications such as Sharepoint, Owncloud, Seafile, Dropbox and classical on-premise file storages (e.g. Network Attached Storage, Fileserver). We have also asked our interviewees what they missed most on their actual tools and what their suggestions to improve the tools were. Good search algorithms and search indexes were mentioned in cases Alpha, Gamma and Zeta. The ability to tag certain information was mentioned by the owner-manager of case Gamma and manager in case Beta. The manager of Zeta emphasizes the need of an intuitively usable system. In case of Beta a reputation and incentive system alongside with a clearly documented methodology and processes would be desirable. The manager of Gamma further added that the system should be open (ideally Open Source), standardized and flexibly extensible. The manager of Delta would like to have easy visualization across different sources of data with a drag and drop functionality. The manager of case Beta also requested for offline availability of the knowledge stored in the system.

Practices and methods

Through all our interviews we found scarcity of specific methodological backgrounds to do KM. Managers of cases Alpha and Beta claimed they had no specific methods in place. The manager of case Beta said "all happens intuitively" or "implicitly" as the manager of case Delta put it. This manager just as the owner-manager in case Alpha further said, that he does not know any textbook method and that the methodology would definitely be person, capability and education depended. As the interviewers further asked this manager on methods such as brainstorming / brain writing he replied that, although they make frequent use of brainstorming, he does not conceive it as a KM method. For him KM methods should enable actual decision making. The owner-managers of Alpha and Gamma enforce compulsory documentation on task level. Cases Epsilon and Zeta transfer knowledge on an inter-personal and not system integrated level. The manager of Zeta said,

they ensure that knowledge is at least distributed on two persons. The owner manager of case Gamma said he enforces knowledge creation for example through frequent discussion initiatives and lightning presentations. For that purpose he specially and intentionally asks the newest employees / trainees to share their recent university knowledge by means of presentation. The manager of case Delta said they use a “creative hour on Fridays” where every employee is asked to improve his / her task specific knowledge. This hour shall not be spent on the daily business, hence.

System type	Alpha	Beta	Gamma	Delta	Epsilon	Zeta
Bug Tracker (Mantis, Redmine)	x	x	x			
ERP system	x	x	(x)	x		
Wiki	(x)	x	x			
E-Mail	x	x	x	x	x	
Sharepoint, Owncloud, Seafile, Dropbox, file storage	x	(x)	x	x	x	x
Other Software			HG, Git	Facebook, Google, Excel, Magento		Evernote, industry-specific software, banking program

(x) means that the system is either very rarely used or its use is discontinued

Table 5: Applied tooling

Discussion

Across the cases and by means of semi-structured interviews we were able to identify an astonishingly diverse picture of the aspects of knowledge and KM. Our cases show a variety of aspects that were also mentioned in extant literature [Cerchione et al. 2015]. For instance managerial (e. g. management vision and action), human and cultural (e.g. shyness, reluctance to share) as well as technical factors (e.g. employed tools) where also identified in our study. However, the concrete interpretation of the challenges, means of leadership, applied tooling as well as practices and methods are different across cases. In reply to research question 1, the terms knowledge and KM are well known by all investigated SME, yet no single manager was able to provide a complete and consistent picture on all involving KM challenges. All interviewees agree that the role of knowledge is crucial and proper management of the knowledge resources is relevant to the competitive position of the company. However, neither the different nature of tacit and explicit knowledge nor all process steps as suggested by Evans et al. [2014] were consistently mentioned across cases. As of research question 2 especially the technology companies provided a very tool dependent, yet not integrated, picture on applied patterns, tools and practices. As depicted in table 5 they all make heavy use of information technology (IT) but all lack an integrated view on the captured knowledge at the same time. Patterns seem to depend very much on business models. Cases Alpha, Gamma and partly Beta do software related project business and store knowledge in bug trackers. Cases Epsilon and Zeta do not do project business at all. In those cases interpersonal exchange of practical knowledge prevails. This finding puts further emphasize on the importance of contingency factors [Cerchione et al. 2015]. Fundamental steps of KM such as identify / create, store, share, use, learn and improve [Evans et al. 2014], are all somehow and to some extend identifiable throughout our cases. The most visible pattern is that knowledge storage and exchange is tidily coupled with the primary business processes and the tools used to support those

processes. Furthermore, not all those steps are equally well established in our cases. Whereas storing, especially in the technology companies is tool based, sharing, learning and improving knowledge is still rather underspecified and depends also on the KM vision of the management or personal motivation. For instance the manager of Delta claimed “sadly sometimes knowledge is never shared”. In that regard the owner-manager of Gamma stated that he often intentionally starts discussions amongst employees in order to enable knowledge sharing and to break the predominant focus on the daily business. The managers of Alpha and Delta both outlined personality of the employees as a key factor to share or retain knowledge. Defined or even controlled processes do usually not exist, though. With regard to the fourth research question, our cases suggest lack of time, the prevalence of the daily business, missing or not consistent management vision and personality of employees to be the major hurdles to effective KM. Finally as an answer on the fifth research question we found out that an effective methodology for KM would be necessary but is largely missing for SME. None of our cases had a KM strategy and consistent methods and processes in place. Even if tools are deemed important in almost all our cases, the interviewees mostly believe, that the importance of consistent and understandable methodology is more important. Only the top manager in case Delta believes that tools are more important than methodology, stating that this was because of the “breath of the knowledge necessary to capture in their special business”. As a consequence of mission KM methodology, quality improvement and identification of knowledge are hard and underspecified challenges even in the most technology oriented SME. Amongst technology oriented companies the present focus seems to be on the storage and using part of KM. Applied KM tools seem to be limited regarding identifying and sharing knowledge. Learning and improving are definitely the least standardized, visible and most probably highly individual steps. They seem to depend rather on industry best practice than on methodology. As of today it is clearly identifiable that even throughout the technology companies in our sample tools prevail methodology. A role named “knowledge manager” just like a project manager or other leadership roles does not seem to exist in SME practice, though.

Conclusion

Our study contributes to the body of knowledge in that it shows that knowledge and KM has been identified to be a driving force of competition and success amongst owners and top-managers in SME. Our study also shows that technology seems to prevail strategy since documented and followed methods do not largely exist. Together with the well spread, yet not coherent picture on knowledge and KM our findings call for further research. Our study has some limitations. First and by purpose we just asked the management on their perspective of knowledge and KM. Therefore, further research with ordinary employees is needed to complement our picture and guide the prototype definition as well as the development stages of design science research (DSR). Moreover we did not specifically take cultural differences into account, although this has already been found an influencing factor of KM effectiveness. Further research needs to be conducted with respect to an applicable, standardized methodology alongside with supporting tools. Single case studies should be conducted to deeply understand the knowledge artifacts of certain companies to potentially identify generic knowledge building blocks that can then be handled (i.e. stored, retrieved, combined, improved, transferred) with the help of prototypical instances of information systems. Such an information system prototype should therefore be open, well-standardized, integrated and yet flexible for specific extensions. Open Source Software such as the enterprise resource planning system Odoo, bug / task trackers such as Mantis or Redmine and file storage systems such as Owncloud or Seafile as well as various open Wiki systems as DocuWiki or Mediawiki might be a perfect ground for such a prototypical development. Especially since they seem to be in widespread use as data silos as of today already (see table 5).

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REFERENCES

- Cerchione, R.; Esposito, E. and Spadaro, M. R. 2015. "A literature review on knowledge management in SMEs," *Knowledge Management Research & Practice*, (2015:0) pp. 1-9.
- Docherty, J. R.; Surles, R. C. and Donovan, C. M. 2001, *Organizational Theory*, In: Talbott, J. & Hales, R. (Ed.), *Textbook of administrative psychiatry*, American Psychiatric Press.
- Dyer, J. H. and Hatch, N. W. 2006. "Relation-Specific Capabilities and Barriers to Knowledge Transfers: Creating Advantage through Network Relationships," *Strategic Management Journal*, (27:8) pp. 701-719.
- Eisenhardt, K. M. 1989. "Building Theories from Case Study Research," *The Academy of Management Review*, (14:4) pp. 532-550.
- Eisenhardt, K. M. and Graebner, M. E. 2007. "Theory Building from Cases: Opportunities and Challenges," *Academy of Management Journal*, (50:1) pp. 25-32.
- Englehardt, C. S. and Simmons, P. R. 2002. "Organizational flexibility for a changing world," *Leadership & Organization Development Journal*, (23:3) pp. 113-121.
- European Commission 2015, *2015 SBA Fact Sheet - Germany*, http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review/files/countries-sheets/2015/germany_en.pdf.
- Evans, J. S. 1991. "Strategic Flexibility for High Technology Maneuvers: A Conceptual Framework," *Journal of Management Studies*, (28:1) pp. 69-89.
- Evans, M.; Dalkir, K. and Bidian, C. 2014. "A holistic view of the knowledge life cycle: the knowledge management cycle (KMC) model," *The Electronic Journal of Knowledge Management*, (12:2) pp. 85-97.
- Hutchinson, V. and Quintas, P. 2008. "Do SMEs do Knowledge Management?: Or Simply Manage what they Know?," *International Small Business Journal*, (26:2) pp. 131-154.
- Karadsheh, L.; Mansour, E.; Alhawari, S.; Azar, G. and El-Bathy, N. 2009. "A Theoretical Framework for Knowledge Management Process: Towards Improving Knowledge Performance," *Communications of the IBIMA*, (7:7) pp. 67-79.
- Mazzarol, T.; Reboud, S. and Soutar, G. N. 2009. "Strategic planning in growth oriented small firms," *International Journal of Entrepreneurial Behavior & Research*, (15:4) pp. 320-345.
- Naisbitt, J., 1994. *Global Paradox: The Bigger the World Economy, the More Powerful Its Smallest Players*, New York, William Morrow & Co.
- Ngah, R.; Hoo, C. H. and Ibrahim, A. R. 2008. "The Relationship between Knowledge Management and Trust: Malaysian Perspective," *Communications of the IBIMA*, (4:14) pp. 113-119.
- Nonaka, I. 1991. "The Knowledge-Creating Company," *Harvard Business Review*, (69:6) pp. 96 - 104.
- Nonaka, I. 1994. "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science*, (5:1) pp. 14-37.
- Nonaka, I. and Takeuchi, H., 1995. *The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation*, New York, Oxford University Press.
- Pushpakumari, M. and Watanabe, T. 2010. "Do strategies improve SME performance? An empirical analysis of Japan and Sri Lanka," *Meijo Asian Research Journal*, (1:1) pp. 61-75.
- Senge, P., 1990. *The Fifth Discipline: The Art and Practice of the Learning Organization*, New York, Doubleday/Currency.
- Yin, R. K., 2003. *Case Study Research: Design and Methods*, Los Angeles, New York, SAGE Publications.