

Knowledge creation in small construction firms

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Abstract. Studies on knowledge creation are limited in general, and there is a particular shortage of research on the topic in small and medium-sized enterprises (SMEs). Given the importance of SMEs for the economy and the vital role of knowledge creation in innovation, this situation is unsatisfactory. Accordingly, the purpose of our study is to increase our understanding of how SMEs create new knowledge. Data are obtained through semi-structured interviews with ten managing directors of German SMEs operating in the construction industry. The findings demonstrate the influence of external knowledge sources on knowledge creation activities. Even though the managing directors take advantage of different external knowledge sources, they seem to put an emphasis on informed knowledge sources. The study's findings advance the limited body of knowledge regarding knowledge creation in SMEs.

Keywords. Knowledge creation, small and medium-sized enterprises (SMEs), knowledge management, knowledge, construction industry.

1 Introduction

"...management scholars today consider knowledge and the capability to create and utilize knowledge to be the most important source of a firm's sustainable competitive advantage" (Nonaka et al., 2002, p. 41).

As the opening citation indicates, knowledge has become an essential source of value generation and competitive advantage in post-industrial society (Barney, 1991; Spender, 1996). In order to survive in an ever-changing business environment, companies have to constantly create knowledge that is both similar and different from that of competitors (Tolstoy, 2009). Allard (2003) stresses that "knowledge creation plays a vital role in innovation, a process that is important because it facilitates an organization's ability to keep pace with a dynamic environment" (p. 368). According to Du Plessis (2007), innovation is "the creation of new knowledge and ideas to facilitate new business outcomes, aimed at improving internal business processes and structures and to create market driven products and services" (p. 21). Therefore, a firm's capacity to continuously create new knowledge can be regarded as determining factor for its competitiveness.

While knowledge is considered the most important source of a firm's competitive advantage, the study of knowledge creation in general is lacking, particularly with regard to definitions and measures (Mitchell and Boyle, 2010). This refers to all organizations, regardless of size. If one addresses the study of knowledge creation in small and medium-sized enterprises (SMEs), however, there is a particular shortage of research. For example, Durst and Edvardsson (2012) who conducted a literature review on knowledge management (KM) in SMEs identified only five papers on the topic of knowledge creation. Against the prevalence of SMEs, this situation is unsatisfactory. Additionally, as continuous knowledge creation is viewed as a fundamental basis for innovation (Amalia and Nugroho, 2011), a better understanding of the actions undertaken by SMEs would be helpful.

Bearing this in mind, the purpose of our paper is to investigate knowledge creation in SMEs. More specifically, we analyze which knowledge creation activities/actions are undertaken in small German firms operating in the construction industry. Since the construction industry plays a vital role in Germany and is mainly represented by SMEs we consider it to be useful for our research.

The present paper is organized as follows. In section 2, the literature related to the research aim is briefly reviewed. Section 3 then describes the method employed to come close to the research problem. Following this, the findings are outlined, and in the final section, the conclusion and study's implications are presented.

2 Theoretical background

2.1 Knowledge creation

Knowledge creation refers to ways through which the construction of new knowledge is concerned. It refers to activities related to the determination of required knowledge and activities that are implemented to acquire the needed knowledge (Amalia and Nugroho, 2011). Knowledge creation in companies can be supported by, for instance, giving organizational members time to experiment (Gupta and Govindarajan, 2000). Additionally, knowledge sharing can enable organization members to create new knowledge as well (Amalia and Nugroho, 2011). Thereby, knowledge is not only internally produced; external knowledge sources need to be considered as well.

The most influential theory of knowledge creation belongs to Nonaka and associates (Nonaka and Takeuchi, 1995; Nonaka and Konno 1998; Nonaka et al., 2002), who argue that the interaction between tacit and explicit knowledge via socialization, externalization, combination and internalization (summarized under the term SECI), leads to the creation of new knowledge. A shared place is also considered important for knowledge creation, whether it is physical, such as an office, virtual e.g. email or teleconference or mental, such as shared experiences or ideals. Ba provides a platform for advancing individual and/or collective knowledge. Knowledge resides in Ba and is intangible. There are four groups of Ba: originating Ba, dialoguing Ba, systematizing Ba and exercising Ba. Each one of these supports a particular mode of knowledge conversion in the stages of the SECI process.

Additionally, the link between learning and knowledge creation is quite common in the literature so that these are often used as synonyms. Theories of learning and knowledge creation have been developed in two different disciplines: (i) knowledge creation theory within KM, (ii) and learning theory within education and organizational studies (Jakubik, 2008). Argyris (1999) sees organizational learning as a process of detecting and correcting errors. This would comprise a proper diagnosis of the error's cause, along with its correction, so that organizations can learn from experience and implement suitable actions intended to prevent a repetition of these errors. In this context, Allard (2003, p. 375) says "often this leads to identifying a need that requires new knowledge to be created to answer the need". Nonaka and Takeuchi (1995) argue that knowledge creation involves interaction between two kinds of learning: obtaining know-how to solve specific problems based upon existing premises, and establishing new premises to override existing ones. Ueki et al. (2011) stress that providing employees with challenging initiatives, and systematically applying comprehensive human resources development (HRD) practices, such as cross-functional projects, job rotation, career development, group training and e-learning, can contribute to a stimulation of knowledge creation in organizations. An organization's success and ability to innovate and develop new routines is tied to its capacity for higher-order learning (double-loop), while lower-order learning (single-loop) potentially limits the creation of new knowledge and ways of working (Spicer and Sadler-Smith, 2006). Also, triple-loop learning may provide an opportunity for innovation, although it is rarely used in reality. This is about combining all local units of learning in one overall learning infrastructure, and developing the competences and skills to use this infrastructure (Romme and van Witteloostuijn, 1999).

Former research showed that new knowledge can emerge by accident (e.g. the discovery of penicillin) or by deliberate discovery following a gap in the literature and in corporate practice (Allard, 2003). Furthermore, new knowledge can generally emerge from new ideas or by emergent internal or external needs. New ideas are often transferred to the organizations via suppliers, professional bodies, consultants or research literature (external influences) or they stem from internal creativity and inventions. New knowledge also originates from needs and pressures from customers, competition, legislation and so on (external forces), or it may arise from perceived problems and opportunities identified by the staff and managers of organizations (Daft, 2007; Hughes et al., 2009; Sparrow, 2005). Improving brand value and attaching importance to customer satisfaction also fosters knowledge creation (Ueki et al., 2011).

KM tools can also assist knowledge discovery and knowledge creation through: (i) Data mining (i.e. data cleaning, data analysis, model interpretation and integration of results) (Jasahapara, 2011); (ii) KM-tools such as knowledge portals and groupware are said to contribute to knowledge creation (Ueki et al. 2011); (iii) Knowledge maps that can provide common context regarding ideas, concepts and mental models for organization members in an explicit visual model (Eppler, 2003); (iv) and KM 2.0 tools (e.g. blogging, wikis, video casting) that help firms improve their products. In this case, we may talk about "outside innovation", where customers and the "crowd" take on a substantive role in the innovation process by testing ideas and giving feedback at the developmental stage (Ribiere and Tuggle, 2010).

Organizational culture can either facilitate or strain knowledge creation (Migdadi, 2009). A company culture characterized by a high degree of change and flexibility will therefore have more positive effects on knowledge creation than cultures marked by stability and formalization (Kayworth and Leidner, 2003).

Mitchell and Boyle (2010) noted that former research has analyzed knowledge creation as a process, output and outcome. The process perspective assesses the steps or activities undertaken to create new knowledge, such as the use of metaphors to externalize knowledge. As an output, knowledge creation is measured in terms of an immediate product of the knowledge creation process, usually reflecting a significant enrichment of existing knowledge, such as a representation of a spoken idea. Knowledge creation as an outcome is measured in terms of a value-adding object, i.e. a new service, a changed routine or a product prototype. Here, the interactive process of knowledge creation, knowledge application and innovation is quite prevalent (Tödting et al., 2009). Consequently, systematic activities related to knowledge creation can enable firms to meet the need for continuous innovation (Popadiuk and Choo, 2006). Chen and Huang's (2009) study underlined the positive effect of knowledge creation on innovation performance.

2.2 Knowledge creation in SMEs

Many smaller firms have a flat structure and an organic, free-floating management style that encourages entrepreneurship and innovation. They tend to be informal, non-bureaucratic and with few rules. Control tends to be based on the owner's personal supervision and formal policies tend to be absent in SMEs (Daft, 2007). In addition, in many smaller firms the owner-managers take on a central position (Bridge et al., 2003). In such an environment, it is not uncommon for the processes of business planning and decision-making to be limited to only one person (Culkin and Smith, 2000). This centrality also signifies that these people are particularly responsible for the recognition of the KM-related benefits, which support the firm's operations. However, SMEs' day-to-day business operations specifically require close attention (Hofer and Charan, 1984). This very often results in situations where owners or managing directors have insufficient time for strategic issues. This, in conjunction with lack of financial resources and expertise (Bridge et al., 2003), very often results in most knowledge being kept in the minds of the owner and some key employees, rather than physically stored or shared through substitution arrangements (Wong and Aspinwall, 2004).

Previous research on KM in SMEs has shown many differences compared to larger firms. Most SMEs have no explicit policy targeted at strategic KM, and they tend to treat KM on an operational level (i.e. systems and instruments) (McAdam and Reid, 2001). SMEs tend to place more emphasis on the management of tacit knowledge than larger firms (Corso et al., 2003) do. The SME sector appears to be less advanced in terms of knowledge construction, having a more mechanistic approach to this concept and relying less on social interaction (McAdam and Reid, 2001). Managers in smaller firms even tend to prevent outflow of knowledge from the company and thereby block knowledge sharing (Beijerse, 2000). Hutchinson and Quintas (2008) found that certain processes and means are given within SMEs, indicating that they do understand knowledge management, but it mostly happens in an informal way.

As resources are scarce in SMEs, knowledge is likely to result from secondary data (e.g. trade journals, sector research, conferences and professional magazines) or from personal contacts (Egbu et al., 2005). Knowledge acquisition activities in SMEs are concentrated in a few individuals, primarily managers, who have to divide their attention over several tasks (Lowik et al., 2012). In addition, as systematic knowledge search and creation will be more expensive compared to informal meetings with suppliers or customers, it is likely that the latter will be favored by SMEs (Cegarra-Navarro and Martínez-Conesa, 2007).

2.3 The construction industry in Germany

The industry contributes around 11 per cent of gross domestic product (GDP) and employs around 4.7 million people (12 per cent of total employment in Germany) (Wertschöpfungskette Bau, 2013). The German construction industry is predominately characterized by SMEs, i.e. 99.9 per cent of all companies are SMEs (Söllner, 2011). Whereas the majority of these SMEs are local/regional-oriented firms having a focus on private housing, local civil engineering and housing renovation (Roland Berger, 2011). One in five companies offers vocational training.

2.4 The construction industry and knowledge creation

The construction industry used to be regarded as somewhat conservative (Maqsood and Finegan, 2009). Growing challenges in the business environment due to fierce (price) competition and/or increased requirements on the part of the customers have caused many firms to reconsider their past practice. This development generally calls for a better management of knowledge within the construction industry (Hari et al., 2005). Bigliardi et al. (2010) summarize the following factors, which underline the importance of KM in project-based organizations: “the turbulence of the construction industry, where the demand is generally characterized by low predictability; the temporal and economic relevance of each project; the uncertainty that characterize the realization phase, mainly related to the heterogeneity of the technological processes involved and to the site location; the low standardization of the construction product and process; and the management and organizational firm’s complexity” (p. 20).

Knowledge creation activities may play a particular role with regard to firm survival (Egbu et al., 2005). Additionally, firms operating in the construction industry are people-reliant (Bishop et al., 2008). Consequently, another reason is there as to why construction firms should put an emphasis on KM activities. Considering the nature of SMEs and their reliance on people, one may expect construction companies to be rich in tacit knowledge, so providing a huge potential for knowledge creation and innovation (Du Plessis, 2007). On the other hand, the situation suggests that KM activities in general may better work if the emphasis is on people-oriented activities rather than on IT-oriented aspects (Bishop et al., 2008). With regard to the latter, the literature suggests that the construction industry is reluctant, even though more and more actors are recognizing the benefits of IT for successful KM (Yun et al., 2011).

As the construction industry is a project-based industry (Maqsood and Finegan, 2009), projects are often unique which require in turn a new set of knowledge and/or skills. Consequently, learning in the sense of knowledge creation as well as the

development of existing knowledge is a key objective (Ribeiro and Ferreira, 2010). Moreover, taking advantage of knowledge from prior projects may help the firms to improve the execution of following projects (Maqsood and Finegan, 2009). Given the growing complexity of projects, a number of different actors are involved; therefore, knowledge sharing and knowledge transfer is important (Yun et al., 2011). On the other hand, the involvement of different actors also forms the potential for new knowledge sources and innovation (Du Plessis, 2007).

The study of KM activities in the construction industry in general is rather new (Maqsood and Finegan, 2009). Yet, it is expected that KM could “enhance individual, group and organizational learning, improve information circulation, and even support innovation” (Ribeiro and Ferreira, 2010, p. 362). Against the background of the industry’s contribution to employment in many countries, more research is needed that aims at helping the industry to better manage its knowledge. As outlined above, the intense competition in the (German) construction industry as well as the industry’s project-based mode of operation make permanent knowledge creation activities essential.

A literature review resulted in a few articles that addressed knowledge creation in construction firms. Fong and Choi (2009), for example, investigated knowledge managing activities/actions undertaken in quantity surveying firms from Hong Kong. Findings related to knowledge acquisition suggest that external sources do not play a critical role as a means to new knowledge. The firms seem to prefer the training of own staff over hiring external staff in order to solve possible knowledge gaps. With regard to internal knowledge acquisition, some firms make use of job rotation, the transformation of valuable knowledge into writing in the case of departing staff, and experience evaluations at project conclusion. In terms of knowledge creation, the findings indicate that the organization members are encouraged “to suggest alternatives methods of performing the same/similar task(s), and to identify best practice for sharing” (p. 117). Therefore, they are permanently working on further developing existing knowledge. Additionally, staff is encouraged to evaluate mistakes. This is explained by reputational and liability issues. Knowledge sharing (distribution) in these companies mainly addresses the transfer of tacit knowledge. For example, many firms reported that experienced staff is encouraged to mentor new or less developed staff. In addition, knowledge gained from projects is made available throughout the firms. It is shared by daily interaction with colleagues. Moreover, many firms stated that staff with specific skills is assigned to specific projects.

Ribeiro and Ferreira (2010) studied ways by which construction projects are prepared. The findings from five case studies indicate that the informants involved did not make use of experiences for the preparation and execution of new projects. Lessons learned, errors/mistakes etc. are not documented, and engineers working in construction sites often lack time or motivation to write down detailed accounts of problem solving solutions. Construction knowledge is shared and discussed personally among the different actors involved, yet is not documented for possible future use. With regard to the type of knowledge produced in projects, the informants stated that both tacit knowledge and explicit knowledge could arise.

Bigliardi et al. (2010) looked into the process of knowledge creation and transfer in construction firms. Using one case out of their sample, the authors illustrate how

other construction firms can better share knowledge from past projects for reuse in following projects. In the presented case firm, this was realized through the introduction of an information system. Findings suggest that the information system has contributed to cost-savings, reduced knowledge access and response time, errors and defects reduction, an improved firm image, reduced site set-up time while at the same time improved on-site productivity, and improved online call for tenders.

3 Research methodology

Given the study's aim, an exploratory (qualitative) research approach appears to be appropriate. A qualitative approach allows us to get closer to the participants and their way of thinking in order to scrutinize the entire research problem in depth (Maykut and Morehouse, 1994).

The companies selected for the study include smaller German firms operating in the construction industry. Because of the fact that we were not able to rely on a single database, we identified convenience sampling as a suitable sampling method for the study. Therefore, the firms were recruited through the researchers' informal and formal contacts. Semi-structured interviews have been conducted with the managing directors of the firms. The semi-structured approach is regarded as appropriate when very little is known about the subject in hand (Maykut and Morehouse, 1994). Ten firms have been involved in the study. An interview guide supported the interview process. All questions were open ended, underlining the paper's explorative character. The interview guide was tested with one managing director. The question wording was amended because of this step. The final interview guide focuses upon the following points: general facts concerning the business and managing director, issues related to determination of knowledge demand, knowledge creation, and knowledge sharing. This structure follows the three main activities relating to knowledge creation as suggested by Amalia and Nugroho (2011). The interviews were conducted in January 2013 and took place over telephone. The interviews lasted anywhere from 30 minutes to 1 hour, were recorded and later transcribed. Note taking after the interviews was used as a means to bring forward thinking and to write down seemingly important aspects related to the phenomenon under investigation.

Data analysis involved reading the transcripts several times to become familiar with the data. In addition, it helped to identify specific patterns of each transcript. Each transcript was then compared with the others, which allowed for cross-case analysis (Eisenhardt, 1989). This was conducted by two of the authors.

The characteristics of the interviewees and their firms are summarized in Table 1.

Table 1. Demographic characteristics of the participants

Interviewee	Legal form	Position	Year of foundation	Number of employees
1	Sole proprietorship	Managing director (MD)	1885	1
2	Limited company	MD	1970	30
3	Sole proprietorship	MD	1870	15
4	GmbH & Co. KG	MD	1933	60
5	Limited company	MD	1960	9
6	Corporation	MD	1980	4
7	Limited company	MD	1929	210
8	Sole proprietorship	MD	1979	7
9	Limited company	MD	1983	10
10	Limited company	MD	1982	6

4 Findings

4.1 Determination of required and/or new knowledge

This KM process focuses on activities that help to identify the knowledge necessary for the company as well as sources to acquire this knowledge. This activity also comprises the identification of already existing knowledge (Egbu et al., 2005). With regard to the findings, the informants identify new or required knowledge during personal discussions with different stakeholders such as architects, suppliers and customers. Journals, trade association releases and trade shows also fulfill this function.

Interviewee 7, for instance, sees the need for new knowledge in the context of the introduction of new processes. The people that work at the intersections (the link between new processes and existing work routines) are those individuals that notice whether the newly generated knowledge has been spread appropriately in the organization. The need for knowledge is discovered at construction sites when tasks can no longer be solved using the existing knowledge base. Furthermore, all types of problems can justify knowledge demand. Both outdated software, which must be internally adjusted, as well as new software whose introduction requires additional knowledge for the organizations employees have been mentioned in this context. Additionally, Interviewee 7 noticed that the signalization for the need for knowledge could also arise in situations that are not related to day-to-day business. This individual gave the example of a company anniversary where the company should present their innovations. Interviewee 4 confirmed that production processes are an area providing the basis for new knowledge relevant. Human-related issues can mean another area of knowledge demand. Three interviewees (3, 4 and 6) mentioned sickness and labor turnover as examples.

Interviewee 3 mentioned the changes in standards and „actual consulting requirements”. Interviewee 3 additionally stated that the need for knowledge is discovered through “consistent double-checking”. Interviewee 8 stated that the preparation phase is the stage in which (new) project-related knowledge is identified

conforming previous research (Ribeiro and Ferreira, 2010). Additionally, the interviewee makes use of professional journals for new information regarding the trade. Interviewee 9 reported that further training courses are occasions in which the need for new knowledge becomes apparent. According to interviewee 10, new knowledge identification results from an emotional state: “a feeling of being out of date”.

4.2 Knowledge creation

The findings suggest that the informants regard knowledge as crucial resource of organizational development and they continuously carry out knowledge creation activities. For example, company 3 regularly conducts exchanges of experience, which contribute to knowledge creation. They occur internally via various paths. The entire workforce meets in regularly held “social rounds” (every six weeks) in order to jointly discuss “problems of a human nature” in an “enjoyable environment”. The trainees are the only ones of the workforce who do not take part in these rounds. These meetings are meant to improve the employee network and increase the exchange of information and knowledge. Irregular meetings of project groups deal more directly with the professional problems. The employees come together for 15 minutes before the start of every workday – gratuitously – in order to discuss the project of the day. Each employee is expected to actively participate in the discussion, not only those employees from the project. The responsible employees later record these suggestions and compare them with the performance contents. The result of this process may lead either to savings in time or quality improvements. These discussions used to only be held between the managing director and foremen. This led, however, to the ignorance of suggestions and some employees feeling that they were being brushed off which resulted in lower motivation for the acquisition and sharing of knowledge. Similar approaches were found in the companies 6, 8, 9 and 10. The meaning of meetings (informal and formal) concerning knowledge creation is in line with previous findings (Fong and Choi, 2009).

A “conventional way” of knowledge creation in company 7 is to carry out workshops. The workshops consist of internal and external participants to allow the inflow of external perspectives. The remaining interviewees would not (companies 1, 5, 6, 8, 9 and 10) or only rarely (companies 2, 3 and 4) carry out workshops. Instead, they found informal gatherings to be of better use for knowledge creation. This finding points to size differences in SMEs (Perry, 2001).

An example of a knowledge creation outcome provided Interviewee 3 who mentioned the development of a new calculation software. All employees helped create a central control instrument for the capacity and time planning made from the standard software. “Everyone brought in their own knowledge and expertise. This brought happiness and strengthened the feeling of community. “

4.2.1 Collaboration as a means to knowledge creation

As stated by Du Plessis (2007) collaboration with external sources provide the basis for knowledge creation and innovation. The interviewees reported that they take advantage of a number of different external stakeholders, such as customers, suppliers, befriended companies etc.

With regard to customers, the companies have close relationships confirming an attribute that is associated with SMEs (Salavou et al., 2004). The knowledge creation process, which is started by special customer wishes, is largely of an operative nature. This means that solutions for the feasibility of current projects are created. Interviewee 3 mentioned, for example, the “increasing demand for energetic consulting”. Only Interviewee 7 stated the implementation of additional instruments besides personal discussions in order to collect complaints and critique from customers. Knowledge creation processes are introduced based on the responses of an internally produced questionnaire as well as the use of telephone interviews. In the following improvement process, the customers are simply included in special cases. Interviewee 2 mentioned that the customers with an academic background would often like to be more strongly included “but then want to reinvent the wheel” and “in this fashion it all just goes up in smoke”. Interviewee 4 added out a small amount of project-related customer wishes in their performance program, mostly as detailed changes or alternatives. Whereas Interviewee 8 told that his business model requires close customer relationships. Consequently, ideas from customers flow into knowledge creation. These ideas do not refer to technical solutions but to design issues, an emphasis which was mentioned by Interviewee 7 as well. Interviewee 10 underlined the benefit of having demanding customers who are willing to pay a premium for specific orders but also expect different solutions in return. On the other hand, interviewee 9 did not see the relevance of customers in knowledge creation, according to him “they lack the necessary understanding”. This statement suggests that this interviewee is mainly interested in technical ideas rather than general ideas the firm could use to improve its offers.

Suppliers are used by all companies to update their technical knowledge. Occasionally the companies attend professional lectures offered by suppliers, but instructions from sales representatives on building sites or company headquarters are more common. The lessons from the sales representatives mostly address the products directly, whereas the instructions from the suppliers are often “broader” (Interviewee 3). Interviewee 5 confirmed this and mentioned that three of their employees had attended a fire safety training as a related example. Interviewee 2 additionally uses the suppliers’ sales representatives in order to detect “grey zones” in the professional knowledge of their employees. Interviewee 5 reported that employees schooled on the construction sites spread their newly acquired knowledge “as needed” (i.e. for similar problem situations) with their respective colleagues. In contrast, Interviewee 8 stated that suppliers are mainly sales people with no professional competences: “today they are selling cars and tomorrow fiberboards”.

In addition to customers and suppliers, the interviewees named joint knowledge creation with cooperative partners. The findings points towards an expanded cooperation at the interfaces between subcontractors and contractors. Interviewee 1 mentioned a master roofer. They work together with the master roofer as a means to continually adjust the work process. The Interviewee further mentioned optimization attempts within the subsystem carried out together with subcontractors. Companies 4 and 7 go one step further. Companies of the respective confederations take on strategic partnerships. Interviewee 4 mentioned an example for knowledge creation in relationship with external business partners. They “completely redesigned the entire flow for the tile seals” in the sanitary construction together with three other

prefabricated house manufacturers. It met all of the current requirements and yet achieved a “technical simplicity” that made a cost effective implementation possible. This group performance was necessary, as the suggested solutions of the three competing prefabricated house manufacturers were much too expensive. Interviewee 7 painted a similar picture in reporting that experts from multiple prefabricated house manufacturers jointly worked on improved prefabrication techniques.

The craftsmen’s guild and the construction association represent further external knowledge sources that are regularly used by interviewees 1, 2, 3, 5, 8, 9 and 10. These organizations especially offer commercial information and supply the companies with facts concerning new norms and juristic affairs. Companies 4 and 7 make use of corresponding organizations of the prefabricated house manufacturers. Interviewee 5 expands the firm’s commercial knowledge through discussions with tax consultants whereas Interviewee 8 turns to competent authors and surveyors of professional journals in order to discuss professional and technical innovation and problems.

Additionally, the interviewees 1, 2, 3, 5, 6 and 9 make use of personal (private) contacts to other SME managing directors. According to Interviewee 6, the initially private level of conversation usually switches over to professional discussions where knowledge “of all sorts” can be generated. This was confirmed by Interviewee 9 who stated that these discussions are used to work out solutions for problems on current construction sites. Interviewee 3’s network includes craftsmen from the Lake Constance region. Meetings regularly take place, which include “intensive exchanges of experience”. News and projects are discussed in detail among participants of the same trade. Interviewee 2 indicates that he was able to build up more trust with other craftsmen thanks to his membership in “Craftsmanship in Ravensburg”. This led to the occasional exchange of commercial “know-how” whereby “small puzzle” knowledge could be generated. Interviewee 8 specified that he would hope for more regular meetings with other guild members, as current discussions seldom produce relevant issues regarding knowledge creation.

Interviewee 5 claims it to be “very beneficial that all members of the guild board are good friends. Everyone knows the special strengths of their colleagues and asks questions when needed.” The meaning of such relationships, especially within one’s own group, has been investigated in a British study of Hughes et al. (2009). This showed that the more successful companies tended to search for advice within their network concerning their core competencies. The findings also clarify the statements concerning the relationship between social capital and knowledge creation (McFadyen and Cannella, 2004).

4.2.2 Knowledge creation through training and further education

Training and further education represent important instruments for knowledge acquisition (Ueki et al., 2011). All interviewees stressed the relevance of regular training and further education measures. Interviewee 2 finds further education to be essential due to the increasing performance spectrum from customer requests and the constant development in the sector underlining the growing challenges firms operating in the construction industry are facing (Hari et al., 2005). According to this interviewee, many skilled workers would not fulfill the requirements for 2013. The Interviewee expects his employees to show more interest in further education. He

“continually pushes the employees to motivate them towards further education.” In most cases, he identified a lack of ambition. “The employees do not want to do anything related to their job after five o’clock in the afternoon, and in the mornings before their work begins they are only interested in the ‘Bild newspaper’ and not in the trade journals spread over the employee break room.” The negative evaluation regarding employee motivation stands in stark contrast to the contents of their homepage where open-minded employees are presented. For example, a video is shown where a trainee presents both the company and the trainee program. Contents of a firm homepage do not necessarily need to mirror reality, but in this case, they signalize a higher employee motivation than mentioned during the interview. Interviewee 3 is content with his employee’s will to learn, even though he adds that he must sometimes show the advantages of these activities. The different businesses are managed by different master carpenters, who constantly improves their skills. “Several sections, such as the energetic consultation, undergo especially fast development, and we must consider this.” Interviewee 5 confirms the necessity of further education measures. However, he has decided to no longer financially support these measures after two of his employees left the company “shortly” after completing a polishing course he had paid for. Interviewee 8 addressed the issue of training measures needed in some construction projects indicating that projects are often not comparable but call for specific knowledge (Ribeiro and Ferreira, 2010). Addressing the competitive pressure, interviewee 10 highlighted the need for a constant development in order to avoid “running far behind”. Nevertheless, at the same time he also mentioned the missing time, which precludes the idea of having regular internal training.

Additionally learning by doing is considered as a nearly automatic given. Statements, such as that each individual grows with their tasks dominate among the interviewees. In special cases, the trainees receive tasks that lie above their professional level (Interviewee 4). This should train them in the ability to find a solution. This presumes, however, that the respective foreman does not operated at full capacity so that he can intervene if necessary. Interviewee 8 mentioned that one employee is “just thrown in at the deep end and has to get on with it”. The informant hopes that this proceeding allows the employee to be able to solve problems on his own. These statements are in line with Fong and Choi’s (2009) findings. Interviewee 9 stressed the importance of observations with regard knowledge creation and stated that during vocational training the employees simply “run along” (Nonaka, 1994). Once the vocational training is terminated smaller projects are transferred to the employees concerned. Interviewee 10 talked about similar proceedings.

4.3 Knowledge sharing

Knowledge sharing is another crucial process as it gives individuals the opportunity to create new knowledge through the combination with existing knowledge (Amalia and Nugroho, 2011). The findings indicated that the current state of knowledge sharing is perceived as satisfactory. Most interviewees observed partial, but clear, improvements in comparison to what they had in the past. Interviewee 2 mentioned that the willingness to share knowledge is pronounced more strongly with some foremen than others. The interviewee’s efforts still contribute towards an improvement of the

knowledge sharing. Interviewees 3 and 10 emphasized that much convincing was needed and the employees needed recurring reminders. Interviewee 3 mentioned the “exchange between old and young”. Older employees were more willing to share their handiwork abilities with others as they realized that this could help balance out the purely theoretical (new) knowledge of the younger generation. Additionally, Interviewee 3 mentioned the disadvantage of “having that what is taken for granted being passed on”, which all employees already mastered, e.g. screwing a screw into a piece of wood.

Interviewee 10 stated that knowledge sharing has long been a problem in the firm as an older journeyman was of the opinion that the younger ones had to acquire the relevant knowledge independently. Because of a longer (perennial) process, the interviewee succeeded in changing the journeyman’s mind who is now willing to share his knowledge and expertise. Incentives for the transfer of knowledge are given more indirectly, e.g. a foreman is praised if their trainee “develops well” (Interviewee 5). The findings nicely illustrate the efforts needed to motivate to knowledge sharing (Egbu et al., 2005).

5 Discussion and conclusion

This paper examined knowledge creation in German SMEs operating in the construction industry. Given the meaning of knowledge creation in innovation on the one hand (Du Plessis, 2007) and the lack of knowledge creation studies on the other hand (Mitchell and Boyle, 2010), our understanding of the topic would benefit from more research. The present study’s intention was to contribute to the knowledge creation literature with regard to SMEs.

The findings indicate that knowledge creation is a process involving a number of external partners. This suggests that SMEs owners are obviously aware that to foster knowledge creation and therefore organizational development they need to involve various types of knowledge (Sammorra and Biggiero, 2008). The involvement of external sources also helps smaller firms to better deal with resource constraints (Egbu et al., 2005). Additionally, the findings clarify the various objectives these networking activities can fulfill in SMEs (cf. Fuller-Love and Thomas, 2004; Gilmore et al., 2001), i.e. problem-solving, access to new information etc. The sample firms in this study are making use of knowledge sources such as customers, suppliers, business partners, associations and befriended companies. It became clear that the interviewees give priority to informed external knowledge sources such as befriended companies from the same trade. The emphasis is on the exchange of technical knowledge; therefore leaving out the potential for improvement and development in other business areas and/or other types of innovation. For example, one would assume that customers can offer a contribution towards the product-specific knowledge creation during the supply creation process (i.e. production) as well. As regards different types of innovations, other external knowledge sources such as universities and research organization would contribute to more advanced products/innovations (Tödtling et al., 2009).

The findings also underline the importance of geographic proximity with regard to

knowledge creation; the majority of external partners involved are in the direct proximity of the organizations making possible face-to-face communication and meeting at short notice. This situation might be explained by the nature of the industry's area of activity, which is normally regional/local. So based on the findings one can conclude that proximity is not only relevant to start-ups (e.g. Presutti et al., 2011) or established technology-based firms working in clusters (e.g. Gilbert et al., 2008). Not surprisingly, the findings stress the role of the managing directors as initiators of knowledge creation (Culkin and Smith, 2000; Lowik et al., 2012). The managing directors of the sample firms are not only interested in external knowledge creation but in internal knowledge creation as well. Even though the latter process is time consuming and requires hard work in order to convince their staff of the usefulness of activities related to knowledge creation. Closely related to knowledge creation are the aspects of learning and further training. The informants are concerned with a constant development of the organizations' human capital. This may reflect Germany's tradition of vocational training and further education. It also underlines the role of knowledge in the construction industry as a means to competitiveness. With regard to the application of IT, the informants appear to be reluctant underlining previous research (Yun et al., 2011). Instead, activities relating to knowledge creation are mainly face-to-face-based.

From a theoretical point of view, the findings provide some fresh insights into how smaller firms deal with the issue of knowledge creation. These insights are important as continuous knowledge creation activities are considered as relevant to survival and innovation. Additionally, the findings provide a better understanding of knowledge creation activities in SMEs operating in the construction industry.

From a practical point of view, this study points out the need for firms to engage in activities related to knowledge creation to ensure the firm's well-being. The findings clarify that knowledge creation is an issue that concerns firms operating in traditional industries as well. The study demonstrates that the inclusion of different external sources can be a very cost-effective way of getting access to valuable sources of information and knowledge and therefore a means to organizational development and innovation. This approach can be used as a model for other SMEs operating in the construction sector. Even though the sample firms make use of several external sources of knowledge creation, they seem to have reservations when it comes to the inclusion of academia as embodied by universities and other research institutions. This clarifies that the latter needs to rethink their approach when trying to positioning themselves as a further source of knowledge creation. As many universities and research institutions emphasize their role for regional development and given the sector's impact with regard to regional employment, an instigation of appropriate activities are welcome.

The authors are aware that the presented study has several limitations. Firstly, the results were gained from a relatively small number of SMEs; therefore, the reliability of our findings is limited. As outlined in the literature review, empirical studies on the topic are rather rare, that is why this research is explorative in nature. Nevertheless, future studies should focus on a larger number of firms. Secondly, researchers should also consider alternative research approaches and research techniques as a way to enhance our understanding of knowledge creation. As knowledge creation results

from long-term processes, there is a need for longitudinal studies. Thirdly, future research could also expand the scope of the research by involving other aspects related to knowledge creation, for instance, the evaluation of knowledge creation activities. Finally, the emphasis on this particular country may have introduced another limitation, rendering the findings at least partly unsuitable for application in other countries. Yet, this gives us the opportunity to establish an understanding of knowledge creation in small firms in different parts of the world.

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