Challenges for Danish Small and Medium-sized Manufacturing Enterprises – an Exploratory Study in Knowledge Management

by

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Abstract: Based on an exploratory study of 138 firms this study analyzes the development within the field of Knowledge Management (KM) in Danish SMEs in the manufacturing industry. It is proposed that Danish SMEs do not (yet) have formalized knowledge structures, knowledge cultures, knowledge strategies, or knowledge systems in place. Hence, there could well be a large unexploited pool of knowledge assets in the SMEs. Empirical results verify the above propositions and suggestions to build or improve a knowledge process within the SME context are offered. The results of the study lead to challenges within different areas of KM that Danish SMEs face in the quest to stay competitive. Finally, the perspectives and the practical implications of a management orientation that can leverage knowledge advances and improve the types of knowledge that best fit innovative efforts and competitive strategies are also discussed.
Introduction

This is a national study on KM based on SMEs in the Danish manufacturing industry. Such a study has not previously been performed. In general, Danish SMEs have not received much attention up until now in Danish business literature. Yet, SMEs make up more than half of the Danish economy (Nielsen, 2001), which elucidates the relevance of this study. Research in KM so far has been almost solely focused on knowledge intensive industries and large companies. With this study, the opportunities as well as the challenges in KM for SMEs will be specified and this might serve as a catalyst for KM in these firms as well as further research.

Recently, the OECD (2001) performed a general study on KM in Denmark. They included both service and production firms although most respondents were service firms. They also included both small and large firms, but small firms made up the large majority. OECD had 61 respondents in their study. In 2000 PWC (2000) published the results from a study with 32 of the biggest companies in Denmark. These companies were mostly from the manufacturing industry. The study behind this paper has 138 respondents and is solely focused on SMEs in the manufacturing industry. Very interesting, results from these three studies have many common traits. Therefore, a reliable picture of KM in Denmark is clearly emerging with this study.

The purpose of this study is to analyze the current management of knowledge resources in Danish SMEs in the manufacturing industry. This also includes a normative discussion of how the SMEs could improve their KM and what they could do to generate value and build competitive advantage from KM. Finally, it includes a discussion of the perspectives and implications in a KM focus within the Danish SME context.

Apart from discussing the challenges in KM for SMEs and suggesting ways for improvement, this study is also an attempt to make KM tangible. For firms, it has been difficult to quantify KM, and since knowledge is intangible and hard to measure it has been undermanaged in firms (Carneiro, 2000). I.e. the fact that there is no common terminology for KM has halted the development of KM. Therefore, this study attempts to start paving the way for a common terminology to KM in the Danish SME context.
Methodological Approach\(^1\)

This will be an exploratory study of 138 Danish SMEs in the manufacturing industry. The respondents are examined on four overall areas of KM – knowledge strategy, structure, culture, and systems. Hence, cornerstones of KM will generally be the subjects of examination and less the specific details of KM elements.

In order to explore as many respondents as possible, a quantitative approach has been applied to this study. Data has been collected through questionnaires that, with the help of ResearchIt ApS, were sent to randomly chosen companies. The firms were chosen from a pool of companies based on the following requirements: according to Mønsted (1987) the leadership task changes when a firm has more than 20 employees, so this is the lower limit for firms in the study. Similarly, 200 employees is considered the upper limit for an SME in Denmark (Mønsted, 1987; OECD, 1995).

With respect to data processing, the influence of firm size has been tested by calculating the results for firms with both 20-49 employees, 50-99 employees, and 100-200 employees. The influence of firm type has also been tested according to the Pavitt taxonomy (Pavitt, 1984), which classifies firms according to four categorizations – science-based, scale intensive, specialized suppliers, and supplier dominated firms.

As to reliability, the questionnaire in this study consists of standardized and mostly closed questions to minimize the interviewer effect (Arbnor, Bjerke, 1997). Furthermore, some questions that were more or less similar in the studies by OECD (2001) and PWC (2000) have been included in order to control reliability, i.e. check if the same results were achieved. It was found that the results were, in fact, surprisingly complementary.

In the attempt to undertake a valid study, which measures what it is supposed to measure, the questionnaires in this study have been addressed to people in management in the sample firms in order to receive answers from people with some overview of the firm. In this connection, it is understood that management may be biased in some questions as to their performance and involvement in certain aspects of the firm. This is regarded as random bias and it is taken into consideration in the analysis. Another problem with validity is the fact that although the questionnaires were sent to people in management, many answers received indicate that the respondents have had trouble understanding the subject and hence also the questions. In some cases there were a rather large portion of non-responses leading to non-response bias. I.e. some answers were insufficient and some were self-contradictory. On the other hand, these contradicting results make for exciting discussions. Furthermore, the broader picture from the empirical results cannot be misunderstood. Hence, there are clear indications that the study measures what it is supposed to measure (Arbnor, Bjerke, 1997).

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\(^1\) For more on sampling see appendix 2.
Theoretical Definitions and Success Factors

In order to create a foundation for this study, management of knowledge is defined below. Furthermore, this chapter presents some of the critical success factors in KM that will be examined further in the empirical analysis.

Duffy (2001) defines KM as “... a formal process that engages an organization’s people, processes, and technology in a solution that captures the right knowledge and delivers it to the right people at the right time.” This definition is good in the sense that it focuses on KM as a formal and holistic process aimed at effective knowledge capture and knowledge sharing. However, it is not very action-oriented.

Beijerse (2000) defines KM as “... facilitating and motivating people to tap into and develop their capacities and to stimulate their attitude to intrapreneurship”, with which “... the achievement of the organizations goals by making the factor knowledge productive” can be reached. This definition is very action-oriented. Knowledge in itself is not so important; it must be used to develop one’s capacities. However, the definition does not acknowledge the importance of collective dedication to KM. Hence, the following definition of KM for this study:

“Management with the objective of motivating and facilitating employees to collectively acquire2, share, exploit, and evaluate knowledge effectively and efficiently in order to reach business goals and to become better and better at what they do.”

Figure 1. A Knowledge Process

Researchers in KM (Maula, 2000; Chang, Powell, 1998; Hamel and Prahalad in Mahnke, 1999; Chase, 1998; Seufert et al., 1999; Carneiro, 2000; Valentin, 1989; Tetzschner, 2000; Mårtensson, 2000; Harvard Computing Group, 2000; Edvinsson, Malone, 1997; Takeuchi, 1998; Armistead, 1999; Cooper, 2000; Allee, 1999; Mahnke, 1998; Tissén et al., 1998; Duffy, 2001; Beijerse, 2000) have found that KM can improve performance and bottom line results in firms. Some of the most critical factors of success can be categorized according to knowledge strategy, knowledge culture, and knowledge structure. These factors will serve as a basis for empirical analysis in this study.

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2 Throughout the paper, ‘acquisition’ will be used as an umbrella expression covering the different ways of obtaining or acquiring knowledge such as development, creation, collection, and purchase.
Knowledge Strategy

Successful KM requires that (the right) knowledge is made productive. This requires that firms have a clear and cohesive plan as to why KM is implemented and where the company is going. Furthermore, success requires that both management and other employees know what they want to achieve and that the knowledge and competencies required to reach those goals are identified and developed. In this way KM becomes part of a change process.

This also means that management must communicate the strategy and their vision clearly to the employees. Optimally the employees are a part of the strategic process and a two-way communication is established. By identifying their own “gaps” in connection to an overall vision, employees are bound to think strategically.

Moreover, firms adopt a strategic KM focus on personification (tacit knowledge sharing) or codification (externalization and codified knowledge sharing). See figure 2 below. In the SME context, this focus is influenced by different firm characteristics. Therefore, their approaches to KM depend on the degree of

1. standardization or customization – since the structured and formalized approach in IT networks favors codification and the less structured, ad hoc approach among people better suits personification.

2. the importance of innovation – since development of innovation can only take place with existing knowledge in IT networks they are best suited for codification whereas people networks can take advantage of new knowledge development and knowledge synergies among people and thereby have more potential for innovation.

3. focus on explicit or tacit knowledge – since IT networks consist of codified knowledge they are favored when focus is on explicit knowledge, information and data whereas people networks consist of both explicit and tacit knowledge and hence are more useful when focus is on tacit knowledge.

4. focus on formal or informal knowledge sharing – since IT networks are formalized structures they are best suited for formal knowledge sharing and people networks are more suited for informal socializing and knowledge sharing (Hansen et al., 1999).

The choice of KM focus determines whether the company will build people networks or IT networks as their main driver of KM. The choice between personification or codification is not a choice of either or. In practice, strategies will develop somewhere between personification and codification. Only focus will mainly be on one or the other. Deciding on a KM focus also involves adopting this focus as a central part of management in the firm. KM should not be an independent discipline on the sideline. It needs to be an integrated part of general management of the firm since it represents a change of values and behavior.
Knowledge Culture

Within a knowledge culture in particular, two elements are considered as essential in this context. First of all, employee motivation is a key success criterion for KM. Employees need to be involved and feel that they get something out of the effort in KM. Financial incentives could be a part of this, but as Tissén et al. (1998) found, there are many other levers to pull when motivating the modern knowledge worker. For instance, they are motivated by the opportunity for doing meaningful work, by a concern for the company, and by opportunities for personal growth. They are motivated if they are treated as professionals and given operational autonomy just as they thrive on task achievement (pride). It is also of critical importance to make employees feel part of a solution and not part of a problem. They need to know that their knowledge is valuable and that they are very important to the firm. This is also connected to offering them tasks where they are
really challenged, which is in accordance with Herzberg’s motivational factors. These factors are recognition, achievement, advancement, growth, responsibility, and challenge (Herzberg, 1999).

Secondly, learning is critical. Some may need to learn how to learn and how to unlearn. Learning should be directly correlated to the identification of what knowledge is important and a gap analysis with employee participation. Then employees realize what they need to improve. When knowledge is evaluated, employees should automatically be offered learning opportunities. Furthermore, learning abilities could even be connected to a reward system, cf. the initiation of a change process mentioned above. Very important, learning should be communication intensive. I.e. it should be double-loop learning in which teachers and students are given the opportunity to reflect on what they learn and the methods they learn with. Giving and receiving feedback is necessary (Weick, Ashford, 2001). Such learning is very important to the development of both employees and management regarding KM. Hence, it is very important to the development of the company and KM.

As depicted in the knowledge process, figure 1, this is a continuous process.

Knowledge Structure

Particularly important to SMEs, KM can improve both internal and external knowledge acquisition and knowledge sharing by installing formalized KM procedures within the firm and by emphasizing more network activity and better contacts with knowledge centers and institutions. This is very important to the competitiveness of Danish firms (Stokbro, 2002).

If the company decides to focus on people networks within the firm for sharing of knowledge, it will, similarly to external networks, be important to facilitate knowledge sharing so it is as easy as possible. And it should enable employees to share any kind of knowledge in spite of being in two different locations. This also requires a transparent organizational structure in which people can easily find out who knows what and where these people are in the organization.

Decentralization is correlated with autonomy for the knowledge worker. It increases spontaneity and a sense of responsibility. Consequently, it allows people to try new things and it instills a sense of purpose, which can motivate to increased work efforts.
Theoretical Framework

There are great rewards to reap from KM for many firms no matter small or large, low- or high-tech. However, it is important to assess the needs for KM for the individual firm, and it is important to identify the knowledge and competencies that are critical to the firm. Furthermore, some of the most important success criteria for KM are: motivation, learning, communication, and facilitation of the employees to acquire, share, exploit, and evaluate their knowledge.

By basing a study in KM on a knowledge process as defined in figure 1, it is possible to create a normative KM framework. Four overall cornerstones of business and KM can be combined in a theoretical frame of reference (Beijerse, 2000; Davenport, Prusak, 1998; Hansen et al., 1999).

Knowledge Strategy sets the guidelines for the knowledge process and is closely connected to ‘Evaluation’.

Knowledge Structure facilitates the process and is closely connected to ‘Acquisition’ and ‘Sharing’.

Knowledge Culture represents the softer values including learning, motivation and other people issues. Culture refers mostly to ‘Sharing’ and ‘Exploitation’ of knowledge.

Knowledge Systems refer to the entire process in itself as an underlying element that is not just support, but a critical piece of the KM puzzle.

Figure 3. A Knowledge Management Framework.
Apart from the theoretical frame of reference for the empirical analysis, this is also a suggestion for a common approach to KM in SMEs based on the knowledge process presented earlier.
Empirical Analysis and Results

The empirical analysis will be presented in accordance with the above framework for KM. Each chapter will commence with a short presentation of the most important results within each category. Subsequently, there will be a more thorough investigation of the main results.

Knowledge Strategy

Main results:
The analysis shows that the strategic element of KM is somewhat neglected in the SMEs. Only 23% have action plans or strategies for knowledge, and only 46% identify their knowledge and/or knowledge gaps.

Only a few SMEs treat knowledge as a strategic asset and with regards to future planning in KM 66% have nothing planned. This lack of strategic KM is in accordance with the results from OECD (2001), which show that 46% feel that action plans and strategies for knowledge are irrelevant.

Finally, it seems that the sample firms focus just as much on personification as codification. As mentioned previously, this depends very much on the degree of standardization/customization. For simple or standardized solutions and tasks, a codification strategy is most effective, whereas for complex or customized solutions, a personification strategy is most effective (Hansen, Nohria, Tierney, 1999).

Lack of identification of knowledge and knowledge gaps

Less than half of the respondents identify and assess their knowledge resources. This is particularly outspoken in firms with 20-49 employees where only 30% identify what knowledge and competencies they possess. If firms are not aware of what knowledge their employees possess, it will be difficult to assess how the firm should develop in the most effective way. In this sense, it would be relevant to know who knows what and how good they are at what they do.

Figure 4.

The empirical analysis showed that internal expert training occurs more often if firms identify what knowledge and competencies they possess and what not. For firms who make the identification, 51% also use internal expert training to a very large or considerable extent. Only 15% of these firms use internal expert training to a limited or very small extent. For firms that do not make the identification, only 34% use internal expert training to a very large or considerable
extent, and 34% use it to a limited or very small extent. Regarding external training, the same correlation exists. I.e. some firms develop their knowledge resources in a somewhat structured way. Knowledge identification can help firms focus on the knowledge and competencies they need in order to develop their core competencies. Hence, it is only natural that identification of knowledge and competencies, including gap analysis, should always be accompanied by learning. Otherwise, such identification may well have little effect on the closing of knowledge and competency gaps or on firm performance. Nevertheless, there is a contrast between the fact that approximately 50% of the firms identify their knowledge resources, but action plans and learning are much less common. I.e. some sample firms perform knowledge identification without using it for improvements or corrective actions. This means that it has no effect and it is a waste of time. These firms seem to lack a structured approach to KM.

**Lack of action plans and formalized strategies for KM**

Only about one in four firms has some sort of action plan on how to work with knowledge in the firm. Action plans are most common among science-based firms (31%) and least common among scale intensive firms (19%). On one hand, this is perhaps a little surprising, since science-based firms have the lowest degree of formalized knowledge sharing practices. On the other hand, it reinforces other results indicating that science-based firms in general are ahead of other types of firms in respect to KM. Furthermore, action plans are uncommon in firms with 20-49 employees. This is an indication that the smallest of the SMEs are least developed with regards to KM.

Finally, the sample firms were asked what changes they had planned for the near future with regards to KM. 66% answered ‘None’ or did not answer. This as a sign that many SMEs are either uninterested in KM or confused about what to do with KM. 15% answered that they will improve their IT facilities, and 6% answered that they will perform structural changes to their organization. However, certain innovative initiatives stood out: establish development programs for employees, social zones, structure the identification of knowledge as a strategic parameter, better exploit HRM, as well as set and communicate visible goals.

Neglecting the strategic element in KM means that the sample firms do not yet have systematic KM processes. In support of the findings in this study, PWC (2000) found that only 9% have knowledge strategies. OECD (2001) also found that only 13% have formalized plans for knowledge. This is in spite of the fact that it is strategies and plans for knowledge that create the best results. These are critical for SMEs, which means that for these firms to truly generate value from the knowledge embedded within the firm they need to build a knowledge strategy that supports the corporate strategy.
Knowledge Structure

Main results:

The sample firms’ organizational structures facilitate KM relatively well. Most important, they are decentralized. This holds two advantages. First of all, the divisions between functions are quite fluid, which also involves a more holistic style of leadership. Holism and cross-functionality are very important to the extent of internal knowledge sharing, but indeed also to external knowledge sharing with network partners. Secondly, there is a clear correlation between decentralization in SMEs and firms with high levels of creativity and spontaneity. I.e. there is room for trying new things on ones own and make mistakes. This increases the innovative abilities of the firm (Holm, 2002). Furthermore, there is often no separate HR-function in the sample firms. This is an integrated part of general management, which is fruitful with respect to KM since this should be an ingrown element in general management and not an independent discipline. On the other hand, SMEs proved to be low in change proficiency, networking, and they seem to lack ownership of KM projects – i.e. there is no one who is directly responsible for KM activities.

Lack of change proficiency and flexibility

The empirical results indicate that Danish SMEs in manufacturing are not very change proficient. According to Dove’s change proficiency maturity model (1999), they belong to stages one and two: the repeatable stage and the defined stage. Change in the repeatable stage is characterized by ‘lessons learned’, and in the defined stage it is characterized by more formal change processes. However, procedures are still rigid. Generally, the firms have 80% weak change competencies and 20% strong change competencies. Moreover, their competencies are mostly reactive and not proactive.

Figure 6.

Flexibility and change proficiency are closely related. Flexibility in SMEs is halted by an inability to control the market and lacking abilities in strategic planning (Mønsted, 1987). This means that they must develop strong competencies in adapting to changing circumstances in the market in order to uphold flexibility. I.e. their change proficiency needs to be high.

As the results indicate, this change proficiency is not present. Therefore it can be concluded that flexibility in SMEs is in fact lower than expected and this has negative consequences for the innovative abilities of SMEs. In fact, there is still a large unexploited potential for innovation in Danish firms according to World Economic Forum (Hovmand, 2002). Similarly, results from this study show that the SMEs are not as good innovators as they, themselves, think they should be.
Low network activity and loose network ties

With respect to networking, approximately 85% of the firms answered that they engage in knowledge sharing with their network partners. They also indicate that they have relatively strong ties to their network partners. 26% assert that they have strong ties to their network and 53% that they have relatively strong ties. However, it is questionable how strong the ties between firms and their partners really are and how active they are in their networking. When disclosing how they specifically exchange knowledge in their network, it becomes evident that network activity is in fact low. Firms rely almost solely on meetings. Only 9% have mutual product development and only approximately 20% use the telephone for the sharing of knowledge. In addition, a handful of firms answered that they have only annual or semi-annual meetings with their network partners. Nevertheless, networking is very important to SMEs. They often lack external information, they often lack critical mass in their knowledge repositories, and they often depend on a few customers and suppliers. These are all reasons why SMEs should engage themselves more in networks and try to create network cultures of collaborative learning. In this connection, it should be mentioned that management may not be aware exactly how much interaction goes on between employees from their firm and their network partners. I.e. these numbers could be biased, but nevertheless, it is established that more could be done to strengthen network ties and knowledge networking.

Organizational designs facilitating KM

The sample firms proved to be rather decentralized which, for the following reasons, is an important facilitator of KM in SMEs. When coordination of knowledge is decentralized, creativity and spontaneity are to a large extent encouraged, whereas when knowledge sharing is coordinated centrally, creativity and spontaneity are only encouraged to a small extent. This is very important for the understanding of the significance of decentralization. Creativity and spontaneity are important for innovation, and innovation is important for SMEs. And since creativity and spontaneity are closer correlated to decentralization than centralization this is very important for the analysis of which organizational structures enable KM best. Sample firms that encourage creativity and spontaneity show considerably better innovative abilities than others (Holm, 2002). In addition, if creativity and spontaneity are encouraged, employees from different units in the firm work together more often than if these factors are not encouraged. Similarly, in sample firms where coordination of knowledge sharing is decentralized, sharing of knowledge occurs across the entire organization to a much larger extent than if coordination is centralized (Holm, 2002).

The empirical results also suggest that there is considerable cross-functionality within Danish SMEs in manufacturing. Cross-functionality is important to the sample firms, among other things due to a relatively high degree of customization in products and production. It is also an advantage in the sense that employees will have overlapping knowledge and a more holistic view of the firm, which can benefit the firm in assessing and evaluating employee competencies and functions.

Although cross-functionality is suggested from the empirical results, project team structures are uncommon in the sample firms, but they are needed in the effort to further enhance coordination and cross-functional knowledge sharing and knowledge acquisition. Moreover, they would be a step in a direction towards building flexible and communication intensive structures, which is very important. Cross-organizational and cross-functional communication is essential for the further development and learning in SMEs.
That most SMEs regard the firm as a unity suggests that they are rather holistic. Similarly to cross-functionality, this is an advantage with regard to KM. This is the case, because sample firms that consider their firm as one unity, share knowledge across the entire organization to a much larger extent than sample firms that consider their firm as several independent units (Holm, 2002).

Another point in this respect is that firms that answered that they regard their firm as a unified whole are much more inclined to share knowledge with their network partners than firms that see themselves as several independent units. Again, this highlights the importance of holism in KM.

Ownership of KM

Ownership refers to someone taking responsibility for activities and initiatives in the area of KM. Large firms have the luxury of being able to allocate time and resources to have managers who do not take part in daily operations, but spend their time thinking in the lines of visions and business development. This also means they have the possibility e.g. of creating a position as CKO (Chief Knowledge Officer). Consequently, it was found that SMEs do not use CKOs as often as large firms. OECD (2001) found that 62% of their sample firms believe that a CKO is irrelevant. And the consequences could be a lack of time and resources dedicated to KM.

Since the concept of CKOs is unknown to SMEs, there is a danger that no one feels responsible to spur the development with KM along and most likely only few people make an effort to improve the knowledge process in the firm.

However, OECD (2001) found that in 57% of their sample firms, top management takes responsibility for KM. This indicates that KM is already an integrated part of general management. This is perhaps correlated to the fact that SMEs quite often do not have separate HR-functions. When top management initiates KM activities a CKO should not be necessary. Naturally, this depends on the dedication of top management to KM.

Knowledge Culture

Main results:
The most vigorous barrier to KM in the sample firms is lack of time. Nevertheless, only three firms wanted to set aside more time for KM.

Results from this study show that employee willingness to share knowledge is relatively high, but, interestingly, it is increased significantly if management demands/orders that employees share knowledge.

38% of the firms in this study do not take any particular actions to motivate their employees to share or exploit their knowledge.

Furthermore, learning and training are neglected in the SMEs. The low level of learning is to be regarded in connection with the lack of the strategic element. Consequently, change is halted and the ability to innovate is impaired.
**Barriers for KM**

The empirical analysis showed that with a large majority, lack of time is the most prominent barrier to knowledge sharing and the implementation of knowledge sharing initiatives in the sample firms. Lack of time indicates that the sample firms have no formal guidelines in place regarding knowledge sharing – i.e. it is too troublesome and takes too much time to share knowledge. This again could indicate a lack of responsibility for the KM issue and hence a lack of ownership of the problem. The second most frequently mentioned barrier to KM was that they have no problems, which explicates the need for awareness on KM. Perhaps this also spells out the lack of interest in KM. To elaborate on the time barrier, there is a striking contrast between the fact that lack of time is the main barrier and the fact that only three firms feel that they need to make better time in alleviating barriers. Apparently, most sample firms do not feel that it is necessary to make time for KM. This could be because SMEs are not yet completely aware of the benefits of a better management of their knowledge resources.

PWC (2000) found that cultural resistance to knowledge sharing is the main barrier and OECD (2001) found that firms are good at allocating time for KM. This is contrary to the findings in this study. This could be the case due to the fact that PWC (2000) studied large firms and OECD (2001) studied mainly firms in the service sector with formal guidelines for KM somewhat in place. The question of cultural barriers and employee willingness to share knowledge was examined further.

**High willingness to share knowledge**

When measuring the employee willingness to share knowledge in the sample firms, it seems that willingness is relatively high, in general. Results also show a high degree of management support. However, there is a high risk that both results are biased since the questionnaires were sent to people in management.

The analysis shows a dramatic increase in employee willingness to share knowledge when it is a demand from the management that employees do so. Again, there is risk of bias. Nevertheless, this result is striking and in contrast to ordinary belief. One would intuitively think that requiring people to act in a certain way would jeopardize motivation and lower productivity, but the analysis shows that regarding knowledge sharing in SMEs that is not the case. In order to set off the change in how employees go about their work tasks a requirement from management is apparently a productive demand and a way to conceive a knowledge culture. The increase in motivation could also be caused by the fact that someone takes responsibility for the KM project. As mentioned above, PWC (2000) found cultural resistance against knowledge sharing to be the biggest barrier to KM. This is contradictory to the findings in this study. Some of the difference could be explained by the fact that PWC studied large firms whereas this study was made with SMEs. In small firms it is possible that willingness to exchange knowledge is inherently bigger than in large firms, since people here know the people who will receive/offer knowledge. I.e. they know each other and it might be easier to see how the receiver of knowledge can benefit from the knowledge exchanged.
Weak motivation and HRM

In order to motivate and make it a natural habit for employees to share knowledge, the sample firms also undertake other initiatives than demanding knowledge sharing. Initiation of project groups, cross-functional groups, and dialogue and meetings are most common, but also job rotation and training is widely used. There is only made little use of financial incentives to improve knowledge sharing. In this study, only about 10% make use of financial incentives. OECD (2001) found that 13% make use of financial incentives for KM and they also found that non-financial incentives are only used by 18% of the firms.

In order to help employees better exploit their knowledge, SMEs seem to favor the delegation of assignments for employees to use their acquired knowledge to incorporate new knowledge into products and processes. Job rotation, training, group work, and delegation of responsibility and competencies are other widespread means of promoting better knowledge exploitation. For example, delegation of responsibility will most likely motivate employees to work extra hours and put in extra efforts to learn, add new competencies, and to deliver results. Being challenged in new ways will also serve the purpose of motivating employees. Among this group of answers the empirical evidence showed that 38% either do nothing or do not know what to do. Most likely, managers need to receive better training on this issue.

Low degree of learning and training

With respect to the use of internal training, the overall mean is just 2,89 on a scale from 1-5 with 1 = ‘large extent’ and 3 = ‘average’. Firms with 20-49 employees score particularly low on internal as well as external training. In science-based firms and specialized suppliers, particularly competent employees are used relatively significantly more widely for training etc. than in other firms. This is because tacit knowledge and the transfer of tacit knowledge are most important in these types of firms (Holm, 2002). I.e. these firms could benefit from focusing more on socialization and informal relations to share tacit knowledge. Nevertheless, when cross tabulating this question with the Pavitt taxonomy, it becomes evident that these two types of firms only focus marginally more on knowledge sharing through informal relations (16,9% and 16,3% respectively) than other firms (15,4% for supplier dominated firms and 15,7% for scale intensive firms). They could most likely benefit from focusing more on informal knowledge sharing.

Regarding external training, this is comparatively much more widely used in firms with 100-200 employees than in smaller firms. Nevertheless, it is still not very widely used in absolute terms (between 3,0 and 3,6 on a scale from 1-5 with 1 = ‘large extent’ and 3 = ‘average’). Among specialized suppliers it is relatively much more common than among other types of firms. This
could be due to their need for specialized knowledge. It could also be because of their dependence of a customer due to their position as specialized suppliers and they might very well obtain knowledge and training from their customers.

When cross tabulating questions on internal and external learning with firms’ ability to innovate, the analysis showed that firms that put great emphasis on both internal and external learning are also very good at innovating. This suggests that learning has an important influence on the ability to innovate. Furthermore, it is a paradox that only a few firms use external training, since SMEs depend on external sources of knowledge. Danish SMEs in manufacturing are obviously under-exposed to learning. This is a difficult mould to break since it is reinforced by

1) the fact that SMEs do not have close links to knowledge institutions, and

2) the fact that they have a great need for training of managers, too.

Learning among managers is imperative in the knowledge economy and this is also apparent in SMEs. Lundvall et al. (1999) believe that: "More focus on education, supplementary education, and development of competencies among supervisors and middle managers is a key to progressive organizational renewal." Middle managers must communicate guidelines and strategies from top management and convert them into value adding initiatives as well as bring information the other way. Apart from that, they should motivate employees as well as manage daily operational matters. For these reasons, there must be consistency of purpose between top management, middle management, and other employees (Poulfelt, 2000). In addition, it is essential that management has a perfect understanding of core competencies and sources of competitive advantage of the firm as well as employee knowledge and competencies (Godbout, 2000).

Learning is also an important element of change proficiency in the firm. “Learning can be preservative as well as innovative” (Weick, Ashford, 2001). Nevertheless, even if learning does not have to imply change, it might very well determine the ability of firms to change (Stratigos, 2001). Furthermore, the quality of their learning is to a large extent determined by communication and their ability to perform double-loop learning instead of single-loop learning. With double-loop and continuously good feedback their ability to add new competencies will be improved significantly (Weick, Ashford, 2001). However, feedback hardly exists because, as OECD (2001) found, only 22% of Danish firms measure the effect of their KM activities.
Knowledge Systems

Main results:
30% of the firms store knowledge only on paper without use of electronic means of storage. Thereby, the benefit from codifying knowledge is eroded since it will be difficult to diffuse this knowledge just as new knowledge cannot be created through combination (Nonaka, Takeuchi, 1995). Furthermore, the potentially major savings from electronic information handling cannot be achieved (Harvard Computing Group, 2000)

Storage of information and knowledge

When information is stored in SMEs, it is equally common to store information in paper form as in electronic form. This represents another critical contrast in the empirical results. More than 50% of the firms feel that it is more important to focus on codifying knowledge than on retaining employees. However, one in three firms only store knowledge on paper and not electronically in any way. This is very problematic since electronic storage is critical for the ability of the firm to create new explicit knowledge. Referring to Nonaka and Takeuchi (1995), this occurs through combination of existing explicit knowledge. This is a process of systematization and also computerization. Similarly, the process of externalizing tacit knowledge through codification will be halted without electronic storage facilities. Without such facilities there is little point in codifying tacit knowledge, because the extent of potential diffusion will be very limited. I.e. sharing of explicit knowledge will also be greatly affected in a negative way without electronic storage and diffusion facilities. Regarding firm type, science-based firms proved to be clearly most used to storing information electronically.

Figure 8.

In this connection, a study by Harvard Computing Group (2000), although based on certain assumptions, showed how major savings (more than 400%) in information handling can be gained through electronic storage. Not only will it lead to savings in storage, it will also lead to manifold improvements of efficiency in updating, delivering, and exploiting knowledge. Firms will also be able to better administer and measure the use of information and knowledge e.g. on the Intranet.

Codification and storage of codified knowledge is most relevant in firms that have chosen to focus on a codification strategy. For firms with a personification strategy, which favors tacit knowledge, electronic storage of knowledge is not so important. For them, it is much more important that IT supports interactive knowledge sharing. Most knowledge is context dependent and hence face-to-face knowledge sharing and sense making is necessary. Codified knowledge will not be as
applicable in different contexts. Hence, innovation depends on tacit knowledge, but standardized processes and products in which procedures are repeated favor codified knowledge. IT and storage as well as sharing of knowledge therefore depend on the choice of strategy on knowledge and on the types of knowledge and contexts.

Current IT and future investments

With respect to current systems in the sample firms, they mostly use Intranets and Internet, but IT was only rated average as to how it facilitates KM.

Improvements on IT for better KM will therefore be a necessity. These investments need to be accompanied by learning offers for both employees and managers so they learn to exploit the benefits of IT. Systems must be based on uniform platforms and everyone must be able and encouraged to frequent them.

According to PWCs study on large firms (2000), 93% of the firms have received external assistance on IT for KM, while only 14% have received assistance on how to build strategies for knowledge. This proves that firms realize that they need to work on their IT, but it also proves that they are not aware of the importance of strategies and action plans for knowledge. This is supported by the fact that 46% believe that knowledge strategies are irrelevant (OECD, 2001).

Summary on Firm Size and Firm Type

The analysis proved the smallest of the sample firms (with 20-49 employees) to be less developed than their larger counterparts in respect to KM. I.e. the larger the SME, the more aware they are of the developments within the knowledge economy and the more competencies they possess for the challenges of the knowledge economy. The smallest of the SMEs score low on learning and on the strategic element – specifically a low degree of KM action plans and knowledge identification. Furthermore, they feel less in need of more systematic KM than larger firms do. Nevertheless, relatively larger SMEs are also weak on key elements of KM in absolute terms. And so are large firms (PWC, 2000). One must keep in mind that KM is a relatively new concept.

As for firm type, which was examined according to the Pavitt taxonomy, supplier dominated firms have a low level of training among their employees. Only 80% of these firms gather market information, and 60% see it as more important to retain employees than to make their knowledge accessible to others. Furthermore, they identify knowledge and competencies to a lower degree than other firm types. However, they are relatively holistic.

For science-based firms, innovation is relatively more important than for other firm types. Therefore, they are more protective of their knowledge, and it is more important to them with internal training. Hence, it is more important with internally generated knowledge and sharing of tacit knowledge. Nevertheless, they lack informal knowledge sharing which is very important in the process of sharing tacit knowledge. They are holistic, they score high on creativity and spontaneity, and they are very decentralized. Science-based firms also have the highest percentage of action plans on how they work with knowledge, just as they identify knowledge and competencies to a higher degree than other firm types.
Scale intensive firms are generally very decentralized, creativity and spontaneity is well nourished in these firms, and they focus more on making individual knowledge accessible to others than retaining employees. However, they have a low level of training, they are less holistic than others, and they have the lowest percentage of action plans.

Specialized suppliers have relatively good training and learning among their employees. However, they are not very holistic, and they do not yet focus on informal knowledge sharing although the transfer of tacit knowledge is very important to them – much like science-based firms. Specialized suppliers focus on codification.
**Practical Implications, Perspectives, and Challenges in KM for Danish SMEs**

A natural obstacle for SMEs when changing is lack of resources - mainly financial resources. This is a valid argument, and it is imperative that SMEs carefully review their needs of KM before going ahead with the implementation.

A lot of the changes towards the knowledge firm occur in the mind of the managers, the employees, and the firm and its culture as such. Physical changes can be better communication facilities, better IT facilities, and more training and learning. On the other hand, new ways to motivate, knowledge action plans, gap analysis, networking, cross-functionality, holism, visions, and increased communication will cost brainpower and human resources.

The physical transition is slowly taking place and results from this study as well as the studies by PWC (2000) and OECD (2001) confirm that investments in IT have taken place or are under way. The psychological transition is not taking place and seems to be more difficult for the SMEs.

They seem to need a more thorough understanding of KM. They answered that they have no problems with KM (next to lack of time, this was rated the second most prominent barrier to KM). 62% feel that CKOs are irrelevant and 46% regard KM strategies as irrelevant even though strategies create the most significant results (OECD, 2001). Furthermore, they do not combine knowledge identification with learning and action plans, and they do not store knowledge electronically although they focus on codification. There are other contrasts and self-contradictions among the results from this study and they support the indication that SMEs lack an understanding of KM. The lack of a common terminology on KM and the intangible nature of knowledge are important reasons for this.

The psychological transition presents the biggest hurdle for SMEs with respect to KM. Once they understand what KM is, how they can benefit from KM, and what they need to do, these firms can indeed gain the advantages of KM.
Most important empirical results from this study:

Strategically:
Action plans for KM and knowledge identification/gap analyses exist only in a few SMEs. Similarly, evaluation and measurement of knowledge is not performed, which halts the knowledge process. Generally, the sample firms need a structured approach to KM.

Structurally:
The SMEs are decentralized, encourage creativity and spontaneity, and they are relatively cross-functional and holistic. This is important to innovation and the extent of knowledge sharing internally as well as externally. However, they have low network activity, and a lack of change proficiency, which has negative consequences for flexibility and innovation. Some firms lack an ownership of the KM project – in other firms management takes responsibility.

Culturally:
The SMEs have an unexpectedly high willingness to share knowledge. This is even higher when sharing is demanded. However, they lack an understanding of the implications of a knowledge orientation on HRM and motivation of the knowledge worker. They also have a relatively low degree of internal and external learning. Furthermore, learning in the SMEs is not connected to gap analyses, and there is no feedback on learning or the learning process. This means there is no double loop learning. Finally, the SMEs rate lack of time as the most important barrier to KM. Lack of time could indicate that responsibility for KM is not taken and that no one is in charge of setting aside resources and taking KM initiatives. That only three firms want to set aside more time, could indicate a lack of interest in KM.

Systems:
Many firms that focus on codification store knowledge (e.g. best practices) only on paper. This in itself does not facilitate the knowledge process. Moreover, the SMEs rate their IT relatively low in user-friendliness and facilitation of KM.
Some of the challenges for SMEs with respect to KM:

**Strategic challenges:**
- Formulate a knowledge strategy in relation to the core competencies and the corporate strategy
- Identify knowledge and make employees think in simple strategic terms, e.g. through gap analysis with employee participation
- Construct action plans for knowledge and KM
- Evaluate and measure the knowledge process and the effects of the KM activities

**Structural challenges:**
- Ownership – assign responsibility for the KM project so someone can work on the optimization of the knowledge process in the firm and work on KM activities and KM investments for the firm – this can be management or someone else in a central position as long as management supports KM
- Allocate time and resources for knowledge acquisition, sharing, exploitation, and evaluation.
- Take a holistic view of the firm - stimulate cross-functionality within the firm and within the network, e.g. through project groups and team work - also with network partners.

**Cultural challenges:**
- Focus on learning and communication – make employees and managers able to develop their knowledge resources. Make sure what is learned is communicated and that feedback for the knowledge gained and the process of learning is offered. Learning offers should be closely connected to the identification and closure of knowledge gaps as well as perhaps an incentive system. Learning among managers is at least as important as learning among employees.
- Motivate people as knowledge workers – make people willing to develop their knowledge resources. Make sure to involve employees, make them know the value of their knowledge, encourage spontaneity and creativity, decentralize, delegate responsibility, and challenge employees.

**IT challenges:**
- Implement IT in accordance with the knowledge strategy (people networks or IT networks)
- Ensure electronic storage of knowledge when focus is on codification
- Ensure learning offers in connection with IT implementation
- Make sure that IT enhances communication, interconnectedness, speed, and transparency.
Future research

As an exploratory study of 138 respondents among a group of firms previously neglected by researchers of knowledge management, there has been a great danger of bias among the answers received for this questionnaire study. However, considering the context this study has been quite successful in presenting an overview of the situation among these firm types with respect to knowledge management.

Nevertheless, several areas could justifiably be analyzed further. The theory of this study has the ambition of a holistic, integrated approach in order to present a general picture of KM in Danish SMEs. However, the empirical discussions take the variables one by one or two by two with the risk of rendering a rather fragmented picture. Hence, three approaches could well be applied on the basis of this study. First of all, a multivariate analysis on KM in SMEs would serve to create the holism within the empirical analysis not achieved in this study. Secondly, it would also be appropriate to dive further into single elements of KM in SMEs. Thirdly, a qualitative case study would enable the researcher to take a holistic approach within a clearly defined context.
References


Poullfert, Flemming (2000) ”Når vidensintensive virksomheder skal ledes”, s. 169-183 i: Viden om (Peter Holdt Christensen, red.): Samfundslitteratur, København.


Tetzschner, Helge (2000) Viden og radikale innovationer, s. 131-149 i: Viden om (Peter Holdt Christensen, red.). Samfundslitteratur, København.


### General Questions

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<th>Supplier dominated</th>
<th>Specialized suppliers</th>
<th>Scale intensive</th>
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### Knowledge Strategy

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### Knowledge Structure

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<td>firms that exchange knowledge in their network</td>
<td>86,2%</td>
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<td>strength of network ties from firm to partners</td>
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<td>degree to which KM coordination is centralized</td>
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### Knowledge Culture

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### Knowledge Systems

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3 When use of scale from 1-5: '1'=very positive answer ('very good', 'very strong', 'to a large extent' etc.), '2'=relatively positive answer, '3'=medium, '4'= relatively negative answer, '5'=very negative answer
### General Questions

#### Percentages of firm sizes in the sample

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<thead>
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<td>Own rating of importance of innovation in firm</td>
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<td>Own rating of how well their own IT promotes KM</td>
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<td>2.67</td>
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#### Knowledge Strategy

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<tr>
<td>Firms that identify their knowledge &amp; gaps</td>
<td>30.8%</td>
<td>47.1%</td>
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<td>Firms that perform knowledge audits</td>
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<td>0%</td>
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<tr>
<td>Firms that focus on network partners in KM</td>
<td>26.2%</td>
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<td>23.7%</td>
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<tr>
<td>Firms that feel they need more systematic KM</td>
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<td>69.6%</td>
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#### Knowledge Structure

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<th>Structure</th>
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<tr>
<td>Firms that exchange knowledge in their network</td>
<td>73.3%</td>
<td>94.6%</td>
<td>89.8%</td>
</tr>
<tr>
<td>Degree to which KM coordination is centralized</td>
<td>2.25</td>
<td>1.78</td>
<td>1.90</td>
</tr>
<tr>
<td>Degree of formalized KM guidelines in the firms</td>
<td>3.21</td>
<td>3.05</td>
<td>3.50</td>
</tr>
<tr>
<td>Strength of network ties from firm to partners</td>
<td>3.52</td>
<td>3.55</td>
<td>3.52</td>
</tr>
</tbody>
</table>

#### Knowledge Culture

<table>
<thead>
<tr>
<th>Culture</th>
<th>281</th>
<th>340</th>
<th>399</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firms where knowledge sharing is required</td>
<td>71.4%</td>
<td>75.0%</td>
<td>74.5%</td>
</tr>
<tr>
<td>Employee willingness to share knowledge</td>
<td>2.24</td>
<td>2.21</td>
<td>2.16</td>
</tr>
<tr>
<td>Employee willingness if sharing is required</td>
<td>2.05</td>
<td>2.11</td>
<td>2.10</td>
</tr>
<tr>
<td>Management support for KM</td>
<td>2.88</td>
<td>2.55</td>
<td>2.29</td>
</tr>
<tr>
<td>Extent to which firms encourage creativity</td>
<td>2.25</td>
<td>1.95</td>
<td>2.02</td>
</tr>
<tr>
<td>Extent to which internal training is used in firms</td>
<td>2.61</td>
<td>2.85</td>
<td>2.60</td>
</tr>
<tr>
<td>Extent to which external training is used in firms</td>
<td>3.18</td>
<td>2.79</td>
<td>2.79</td>
</tr>
<tr>
<td>Extent of use of financial incentives for KM</td>
<td>3.65</td>
<td>3.56</td>
<td>3.08</td>
</tr>
<tr>
<td>Use of total KM</td>
<td>3.85</td>
<td>3.51</td>
<td>3.94</td>
</tr>
</tbody>
</table>

#### Knowledge Systems

<table>
<thead>
<tr>
<th>Systems</th>
<th>281</th>
<th>340</th>
<th>399</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firms that collect market information</td>
<td>93.3%</td>
<td>89.5%</td>
<td>91.9%</td>
</tr>
<tr>
<td>Firms that store knowledge electronically</td>
<td>70.0%</td>
<td>65.7%</td>
<td>71.9%</td>
</tr>
<tr>
<td>Firms that store knowledge on paper</td>
<td>73.3%</td>
<td>60.0%</td>
<td>63.2%</td>
</tr>
<tr>
<td>Firms that only store knowledge on paper</td>
<td>30.0%</td>
<td>34.3%</td>
<td>28.1%</td>
</tr>
<tr>
<td>Rating of the userfriendliness of own IT for KM</td>
<td>2.84</td>
<td>2.88</td>
<td>2.69</td>
</tr>
<tr>
<td>Rating of how well their own IT promotes KM</td>
<td>2.93</td>
<td>2.88</td>
<td>2.72</td>
</tr>
</tbody>
</table>
Appendix 2

Sampling

According to Danmarks Statistik (Nielsen, 2001) there are 4033 manufacturing firms with 20-200 employees in Denmark. From this the proportion of firms with formalized KM was estimated at 10%. This estimate was based on pilot interviews and estimates from Søren Olsen, ResearchIt. To find a representative sample size, the following formula was applied

\[ n = \left( \frac{(Z^2_{c.l})(p)(q)}{E^2} \right) \]  

(Zikmund, 1997)

where,

\[ n = \text{sample size} \]

\[ Z^2_{c.l} = \text{square of the confidence interval (95\%) in standard error units} \]

\[ p = \text{estimated proportion of success, i.e. firms that use KM} \]

\[ q = \text{estimated proportion of failures, (1-p)} \]

\[ E^2 = \text{square of the maximum allowance for error in percentage points between true proportion and sample proportion.} \]

\[ n = \left( \frac{(1.96)^2(0.1)(0.9)}{0.05^2} \right) = 138 \text{ firms (to be selected randomly from the 4033 firms in the population)} \]

In this case, population size is not taken into account in order for the study to remain representative with any population size (Zikmund, 1997). And according to (Arbnor, Bjerke, 1997) the proportion of the population and the population size are less important than absolute sample size.

Total response rate for this study reached 70%.