Knowledge Management in Small and Micro Enterprises: Applying a Maturity Model

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Abstract: Micro, small and medium enterprises (SMEs) are important to the economy of any country and knowledge is an important intangible asset for such companies in attempting to achieve a sustainable competitive advantage. Maturity models can be used to assess a situation in relation to the possibility of achieving certain objectives, as well as identifying necessary improvements. Hence, the main objective of this study is to assess the maturity of knowledge management in a group of Brazilian SMEs. Hence, data were collected from 232 Brazilian SMEs operating in different business sectors, namely industry, trade and service. The companies have a maximum of ninety nine employees and a maximum annual turnover of 36,000,000.00 Reais (Brazilian currency). The maturity model used has five levels. The analysed constructs were classified into four key factors: internal context, process, content and external environment. The analysed group of companies was rated (on average): at level 2 regarding the constructs information technology, explicit knowledge, partners, knowledge creation and knowledge storage, at level 3 regarding the constructs tacit knowledge, customers, suppliers and knowledge sharing and, at level 4 regarding the construct top management support. The items comprising each construct were analysed in order to indicate the actions required to reach the next level. The results obtained by applying the knowledge management maturity model in a group of companies can be used by individual companies as well as contribute towards the development by organizations of collective actions designed to improve knowledge management in companies of this size. This study contributes at both the business and academic spheres. Business managers can use the instrument to assess their companies and make comparisons with other companies. In academic terms, the study contributes towards the discussion on knowledge management in SMEs, given that they are more dependent on external knowledge than are large companies.

Keywords: knowledge management, maturity model, SMEs, Brazil

1. Introduction

Knowledge management (KM) is a set of processes for creating, sharing and using knowledge, which help the company achieve its organizational goals (Lee and Yang, 2000). KM contributes towards the achievement of competitive advantage (Zhao et al., 2012), which explains its importance for companies.

Several models have been developed to evaluate KM (Oliveira et al., 2011; Lee and Kim, 2001) which, in general, focus on large enterprises (Durst and Edvardsson, 2012). Although there are several proposed models for evaluating KM, there are few reports in the literature of those models being applied. This makes it difficult to identify benchmarks that would allow each company to compare its situation with the industry average, to define sectorial actions, and also to be able to analyse the evolution of KM over time in companies. Moreover, the application of KM assessment models to can generate lessons learned on the use of these models, as well as on the adoption of KM.

Micro, small and medium enterprises (SMEs) have characteristics that do not mean the lessons learned in large companies cannot be directly used by them (Lim and Klobas, 2000). Small business are important for any national economy (Desouza and Awazu, 2006), and knowledge is vital to their success (Chong et al., 2011). The main objective of this study is to assess the maturity of KM in a group of Brazilian SMEs. The results of this research should help managers by showing how to interpret the results of KM evaluation, and providing values that can be used to make comparison between companies in Brazil, which may also serve as a reference for sectorial actions. The discussion on the application of a model of KM, and the evaluation of KM in SMEs is the main academic contribution.

This article is structured in six sections. Following this introduction, there is a review of the literature on KM and the characteristics of small and micro enterprises. Section 3 describes the methodology adopted in this

research. Sections 4 and 5 contain the data analysis and a discussion of the results. The conclusions are presented in section 6.

2. Evaluating KM in SMEs

For the evaluation of KM conducted in this study, the four key factors proposed by Oliveira et al. (2011), namely internal context, content, process and external environment are adopted. The constructs that represent each key factor (Oliveira and Pedron, 2014) as well as the characteristics of small and micro enterprises are discussed below.

2.1 Internal context

KM involves change and therefore support from top management is relevant in ensuring that change provides value to the company (Lin and Lee, 2006). Financial and moral support from top management have been confirmed as relevant to KM over time (Jarrar, 2002; Lin, 2011; Vo and Mounoud, 2014). Top management support (TM) "refers to the degree to which top management understands the importance of KM and the extent to which top management is involved in KM practices" (Lin, 2011, p. 140). Lin (2007a) examined the influence of TM in knowledge sharing (KS), which is one of the KM processes. Later, Lin (2011) identified that TM facilitates the evolution of KM in the company, considering three stages, namely, KM initiation, KM implementation and KM institutionalization.

In addition to TM, information technology (IT) has also been described as an important antecedent for KM (Jarrar, 2002; Lin and Tseng, 2005; Ragab and Arisha, 2013). IT is seen as a support for KM (Lin and Tseng, 2005), as it aids the storage and access to explicit knowledge as well as contributing to the sharing of tacit knowledge by facilitating contact between individuals. Arisha and Ragab (2013) organize KM support systems into four approaches: personalization - social interaction activities, for example, collaborative services; codification - capturing and storing knowledge in repositories, such as document management; people-finder - mapping the location of people, for instance, expert networks; hybrid - more than one approach, for example, knowledge portals.

2.2 Content

The SECI (socialization, externalization, combination and internalization) model considers the possibilities of converting tacit and explicit knowledge (Nonaka, 1994). Explicit knowledge (EK) can be easily codified and communicated and can be obtained through process documentation, problem solving and project results, among other ways (Choi and Lee, 2003; Ragab and Arisha, 2013). Tacit knowledge (TK) is difficult to express and transmit (Hansen et al, 1999.) and can be obtained through observation and informal meetings or conversations (Choi and Lee, 2003; Ragab and Arisha, 2013). Both TK and EK are considered essential resources for businesses (Johannessen et al., 2001). According to Hansen et al. (1999) and Jasimuddin et al. (2005), companies should employ two strategies, namely: personalization (focused on TK) and codification (focus on EK), while varying the intensity with which each is adopted. A company may lose TK more easily than EK, because it is stored in the minds of individuals (Jasimuddin et al., 2005). On the other hand, EK can be easily transferred to competitors (Chilton and Bloodgood, 2008). This shows that both types of knowledge have advantages and disadvantages for the company.

2.3 Process

The types of the KM process are discussed by several authors (Heisig, 2009; Goldoni and Oliveira, 2010). In terms of content, there are similarities in the types proposed by these authors, although the nomenclature and the number of processes may be different. In the present study, the processes of knowledge creation, storage and sharing are considered. Organizational knowledge is created "through dialogue between tacit and explicit knowledge" (Nonaka, 1994, p. 14). Knowledge creation (CR) is important because it allows knowledge to be exploited, which is necessary for the company to enter new markets or develop new products or services (Curado and Bontis, 2007). Knowledge storage (ST) considers appropriation, revision and organization of knowledge in a way that allows it to be accessed and updated (Goldoni and Oliveira, 2010). The goal is to keep the knowledge in the company (Beckett et al., 2000). Knowledge sharing (KS) is defined as "the degree to which employees share their acquired knowledge with their colleagues" (Teh and Yong, 2011, p.11).This is considered one of the most relevant processes for KM (Velmurugan et al., 2010). Increased capacity for innovation is one example of the benefits associated with KS (Liao et al., 2007).

2.4 External environment

KM considers sources of knowledge that are internal (employees) and external (customers (CU), suppliers (SU) and partners (PA)) to a company (Durst and Edvardsson, 2012). According to Lin (2007b), KM can be said to be mature when the company integrates external partners such as suppliers and customers into the process. The customer's knowledge is classified into three types: knowledge for customers, knowledge about customers and knowledge from customers (Garcia-Murillo and Annabi, 2002). The capability to improve processes and generate new products and services depends on knowledge from and about customers, while knowledge for customers contributes to customer support (Khodakarami and Chan, 2014). Supplier's knowledge is considered relevant by Jarrar (2002) because it can be used to leverage improvements in process. Tirpak (2005) highlights the importance of partnerships with, for example, universities and associations, as they can lead to knowledge creation and sharing.

2.5 Characteristics of micro, small and medium enterprises

Small businesses need to obtain external knowledge due to the small number of employees and often limited managerial experience (Lim and Klobas, 2000; Desouza et al., 2006). Different ways of sharing knowledge with the external environment are identified in SMEs: regular meetings with suppliers or customers, advice from friends or people from other companies (Chen et al., 2006), whether in bilateral relations (for example, two companies) or multilateral (several companies and an association) (Dyer and Nobeoka, 2000). Research has shown that KM is positively perceived by SMEs (Durst and Edvardsson, 2012). The flat structure of SMEs facilitates socialization, so encouraging KS (Wee and Chua, 2013). In SMEs, KM may be more difficult due to the lack of documentation, as, in general, the knowledge is in people's minds (Durst and Edvardsson, 2012; Wee and Chua, 2013), which leads to a greater emphasis on TK than on EK (Durst and Edvardsson, 2012).

3. Method

Due to the nature of its objective, this is a survey-type quantitative study. The data collection instrument used was proposed by Oliveira and Pedron (2014) for the KM maturity model. The instrument includes four key factors (internal context, content, process and external environment) and 10 constructs (IT, TM, TK, EK, CR, ST, KS, CU, SU and PA) and is designed to check the KM maturity using a five-point Likert scale ranging from one (strongly disagree) to five (strongly agree). The link and password to access the instrument were included in an e-mail containing an invitation to participate that was sent to a register of small and micro enterprises located in two Brazilian states (Rio Grande do Sul and São Paulo). The instrument was made available through the Qualtrics®. The instrument was completed by one person per company. The 232 respondents are at the managerial level in the participating companies. The profile of the respondent companies is shown in Table 1. The constructs were analysed using descriptive analysis (mean and standard deviation), with the support of SPSS 17.0®.

Table 1: Profile of the respondents

	Frequency	Percentage
Number of employees		
Up to 9	117	50.40
From 10 to 19	67	28.90
From 20 to 49	39	16.80
From 50 to 99	9	3.90
Annual revenue		
Up to R$ 60,000.00	26	11.20
From R$ 60,001.00 to R$ 360,000.00	74	31.90
From R$ 360,001.00 to R$ 3,600,000.00	115	49.60
From R$ 3,600,001.00 to R$ 36,000,000.00	16	6.90
More than R$ 36,000,000.00	1	0.40
Business sector		
Industry (e.g. civil construction, shoe manufacturing, etc.)	106	45.70
Trade (wholesale or retail)	53	22.80
Services (e.g., transport and e communication, banking, etc.)	73	31.50

4. Data analysis

The analysis can be performed by comparing the result obtained for each construct, as shown in Figure 1, or in more detail, the result of checking the items that form the constructs, as shown in Tables 2 to 11.

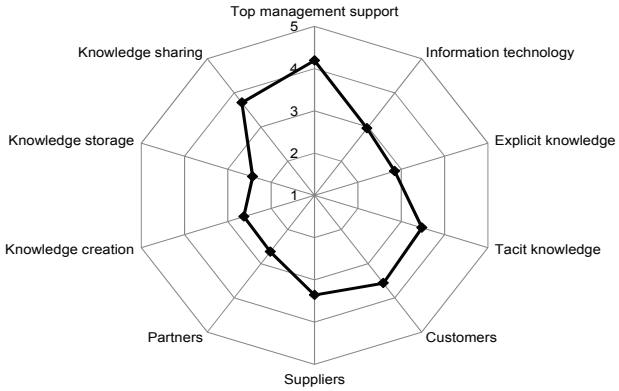

Figure 1: Overview of the constructs

This result shows that while there are KM initiatives in the companies, there is still a need to invest in improvements, for example, in intensifying documentation, since EK obtained a lower score then TK. Regarding the key factor external environment, the construct partners has a lower score than the constructs suppliers and customers. For these companies, intensifying the relationship with partners is an opportunity to increase innovation and improve processes, among other benefits. In the key factor process, the most developed construct was KS. While KS is important, to remain competitive, companies also need to create knowledge. Regarding the key factor internal context, the construct TM scored higher than the construct IT. IT is an indispensable tool for KM support, as it can be used to leverage both tacit and explicit knowledge.

4.1 Internal environment

This survey was answered by the company manager, which may partly explain the positive result in the assessment of the construct TM. This result is in line with that of Durst and Edvardsson (2012), who identified a positive perception of KM in SMEs. A comparison between the response from the manager and that from staff would allow this result to be checked, and show the manager whether there is a difference between what he thinks and what employees perceive. Table 2 shows the results for the in items in the construct TM.

The mean score for the item related to the provision of the resources necessary for employees to share knowledge was the lowest in the construct, being significantly different from the mean scores of the remaining items. This result is not in line with that found by Jarrar (2002), who believe that support should be through moral and financial incentives.

Table 2: TM

Adapted from Lin (2007a)	Mean	Standard Deviation
TM1_top management believes in encouraging knowledge sharing among employees is beneficial	4.53	0.84
TM2_top management always encourages employees to share their knowledge with colleagues	4.22	1.05
TM3_top management provides most of the resources necessary for employees to share knowledge	3.94	1.12
TM4_top management strives to see the employees satisfied in sharing their knowledge with colleagues	4.06	1.09
TM	4.19	0.91

In Table 3, the mean scores of the items related to the construct IT are presented. The item related to connecting with other companies obtained the lowest score, with a mean significantly different from the remaining items in the construct. It can also be seen that the standard deviation of these items represents more than 50% of the observed mean scores, which indicates a greater spread of the values, and therefore greater differences among the surveyed companies with regard to this construct.

4.2 Content

Table 4 shows the mean scores for the items related to the construct TK. The item related to obtaining expert advice had the lowest mean, this may be a result of the low number of employees, who, although they may

have greater physical proximity, include a lower diversity of specialists. To improve these results, companies can stimulate internal contact between employees by conducting happy hour, creating areas for informal conversations, setting regular meetings, etc., as well as encouraging external relationship through the participation of their employees in lectures, courses, conferences, communities of practice, etc.

Table 3: IT

Adapted from Lin (2007a)	Mean	Standard Deviation
IT1_the employees use electronic storage to access knowledge	3.11	1.74
IT2_the employees use knowledge networks (e.g., virtual communities, groupware) to communicate	2.91	1.77
IT3_the information technology used allows employees to share knowledge with people from other companies	2.52	1.64
IT4_the information technology used allows employees to share knowledge with people from the company itself	3.28	1.83
IT	2.96	1.42

Table 4: TK

Adapted from Choi and Lee (2003)	Mean	Standard deviation
TK1_the knowledge I need can be easily obtained from experts or colleagues	3.53	1.13
TK2_it is easy to get advice face-to-face from experts	3.21	1.32
TK3_informal conversations and meetings are used to share knowledge	3.56	1.29
TK4_knowledge is obtained through relationships among colleagues	3.59	1.13
TK	3.48	1.01

Table 5 shows the means scores for the items related to the construct EK. The mean score for the construct TK is significantly higher than that for EK, which shows that the strategy personalization is a priority in these companies. This result is in line with that obtained by Durst and Edvardsson (2012). These companies can leverage EK by documenting: procedures, problem solving, project results, meeting content, etc. To stimulate EK it is necessary to discuss what should be documented, what is the best format and what IT use.

Table 5: EK

Adapted from Choi and Lee (2003)	Mean	Standard deviation
EK1_knowledge (how to, processes, procedures or methods for solving problems) is well documented	2.96	1.23
EK2_knowledge can be easily obtained from documents or manuals	2.90	1.28
EK3_the results of projects or meetings are documented	2.79	1.30
EK4_knowledge is shared through documents such as manuals	2.75	1.35
EK	2.85	1.15

4.3 Process

Table 6 shows the mean scores for items related to CR. The results can be partly explained by the small number of employees in these companies, because of which it may be interesting to encourage relationships with the external environment, and also by the limited dialogue between tacit and explicit knowledge, as indicated by the significantly lower mean scores for the construct EK in relation to TK.

Table 6: CR

Oliveira and Pedron (2014)	Mean	Standard deviation
CR1_the processes or tools for creating knowledge (generating ideas) are formalized in company	2.44	1.23
CR2_employees often participate in knowledge creation activities (generating ideas)	2.84	1.36
CR3_employees often conduct knowledge creation activities (generating ideas)	2.62	1.31
CR	2.63	1.15

Table 7 shows the mean scores for the items related to knowledge storage, and are consistent with the results found for EK.

Table 7: ST

Oliveira and Pedron (2014)	Mean	Standard deviation
ST1_the processes or tools for knowledge storage are formalized in company	2.56	1.31
ST2_employees often participate in knowledge storage activities	2.41	1.24
ST3_employees often conduct activities knowledge storage activities	2.32	1.19
ST	2.43	1.14

Table 8 shows the mean scores for the items related to KS. The results obtained for the collection (C) and donation (D) of knowledge were similar. Several practices can stimulate KS (lessons learned meetings, coffee area for informal conversations, etc.).

The flat structure commonly found in SMEs, with the physical proximity of the employees and greater use of TK ensure this KM process has the highest scores as well as the lowest dispersion, as observed in the standard deviation. Enhancing this widely found strength in SMEs might be an interesting means of facilitating sharing with external agents, and consequently the creation of new knowledge.

Table 8: KS

Adapted from Vries et al. (2006)	Mean	Standard deviation
KS_C1_when employees need a specific type of knowledge, they ask their colleagues about it	3.66	1.13
KS_C2_the employees ask colleagues to share their skills when they need to learn something	3.76	1.08
KS_C3_when an employee is good at something, their colleagues ask them to teach them the task	3.78	1.16
KS_D1_when employees learn something new, they share it with their colleagues	3.70	1.11
KS_D2_employees share the knowledge they have with their colleagues	3.78	1.03
KS_D3_employees regularly share what they are doing with their colleagues	3.61	1.07
KS	3.71	0.90

4.4 External environment

Table 9 shows the mean scores for the items related to the constructs customers, suppliers and partners. Unlike what was observed in relation to customers, the item 'knowledge is shared with our suppliers' has a significantly lower mean score, suggesting greater knowledge protection in this type of relationship. Relations with customers and suppliers linked to the marketing of products and inputs, respectively, may partially explain the higher scores found in these constructs. As can be seen in Table 9, the relationship with partners scores significantly lower than the others, which may be related to the cultural characteristics associated with the surveyed companies.

Table 9: CU, SU and PA

	Customers		Suppliers		Partners	
Oliveira and Pedron (2014)	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
CU1/SU1/PA1_Knowledge is shared with our [customers/suppliers/partners]	3.39	1.14	2.99	1.22	2.33	1.22
CU2/SU2/PA2_the [customers/suppliers/partners] are asked to share their knowledge with the company	3.08	1.31	3.24	1.25	2.43	1.31
CU3/SU3/PA3_knowledge obtained from [customers/suppliers/partners] is incorporated into company actions	3.84	1.13	3.60	1.1	2.88	1.39
CU4/SU4/PA4_knowledge obtained with [customers/suppliers/partners] is used in the development of new systems, products, processes or services.	3.98	1.07	3.59	1.11	2.95	1.38
CU/SU/PA	3.57	0.99	3.36	1.04	2.65	1.21

5. Discussion

A positive perception of KM in SMEs is necessary, but it is not enough to ensure the achievement of KM maturity. The results obtained for the constructs allows the aspects that the company needs to develop in relation to KM to be prioritized. The analysed group of companies was rated: at level 4 regarding the TM; at level 3 regarding the TK, CU, SU and KS; and, at level 2 regarding IT, EK, PA, CR and ST. This indicates that the constructs are not developed at the same rate in the firms. The results obtained for the constructs also enables the relationships among the constructs to be shown, for example, EK, ST and IT. The EK demands ST and IT is a key support for ST. To encourage ST, companies could map the processes including the knowledge storage activity and identify which IT best facilitates such storage. The low score for storage may increase the risk of knowledge loss with the departure of the company's employees, as mentioned by Beckett et al. (2000). While it is necessary for top management to believe in the value of knowledge, that belief alone is insufficient, because if the employees are not provided with the material conditions, in terms of processes and IT, the results will not be achieved. Given that SMEs are more dependent on external knowledge (Chong et al., 2011), leveraging the use of IT for the relationship with the external environment is an aspect that can be exploited by the managers of such companies. These results suggest that disseminating the use of different tools (IT) to collect and store the internal and external knowledge would be useful. CR has lower means than KS, which may be related to the number of employees. This supports the idea that firms need to integrate the external environment to leverage CR. The means scores for the items related to the constructs customers, suppliers and partners are significantly different from each other, and there is room for improvement in the three constructs. This might be explained by the fact that the relationship with the external environment demands a degree of KM maturity, according to Lin (2007b). One motivation for the relationship with suppliers, for example, by reporting problems and identifying strengths, can contribute to the improvement of processes and products. With regard to partners, companies could develop partnerships with associations, universities, etc., which would leverage the sharing and creation of new knowledge.

6. Conclusion

Evaluating the KM maturity in a group of Brazilian SMEs enabled the identification of those constructs requiring special attention, as well as the confirmation of some characteristics related to SMEs. The results obtained for each construct show they all have room for improvement. However, in particular, there is a need to invest in knowledge documentation (ST, EK) and in relationships with partners. By applying the instrument, it proved possible to evaluate KM in the enterprises and generate benchmarks that will allow companies to compare their results with industry averages. Presenting the results in aggregate form, as in Figure 1, allows one to compare the result of the constructs, and detailing the results, through the means for each item, allows one to identify the points worthy of special attention from the companies. As the present findings show the scores for TK are higher than those for EK, future research could focus on the relationship between the KM key factors, organizational performance and the retention of employees in SMEs, as well as investigate the influence of national cultural characteristics by carrying out studies in different countries. This paper contributes towards the discussion on KM in SMEs in different business sectors. While such companies do not always formally address KM, related processes exist and can be enhanced, thus providing them with competitive advantage.

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