Impact of Size of the Manufacturing Firms on Knowledge Management Practices: An Empirical Analysis

(Impak Saiz Firma Pembuatan ke atas Amalan Pengurusan Pengetahuan: Satu Analisis Empirikal)

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ABSTRACT

Manufacturing sector is the driver of economic growth of developing countries and employment. Knowledge and knowledge management result in manufacturing excellence by improving productivity and flexibility of the organizations' operations. This study has identified four fundamental knowledge management processes from the literature, namely knowledge acquisition, knowledge creation, knowledge storage and knowledge sharing that contribute to the growth of the organizations. Thus, we had developed a questionnaire to analyze these processes in the Indian manufacturing sector. Confirmatory factor analysis was performed using LISREL (Linear Structural Relations) software, that is, to test the convergence of the observed variables to each of the knowledge management processes. The results showed a good model fit for all the knowledge managerial processes. Then the data were explored, analyzed and compared with the current status of KM practices with respect to their sizes. It is found that size has a profound impact on the extent of adoption of KM practices.

Keywords: Knowledge; knowledge management; manufacturing sector; confirmatory factor analysis; size of the firms

ABSTRAK

Sektor pembuatan adalah pemacu pertumbuhan ekonomi negara-negara membangun dan pekerjaan. Pengetahuan dan pengurusan pengetahuan menyediakan kecemerlangan pembuatan menerusi peningkatan produktiviti dan fleksibiliti operasi organisasi. Kajian ini mengenal pasti empat proses asas pengurusan pengetahuan daripada literatur; pemerolehan pengetahuan, penciptaan pengetahuan, penyimpanan pengetahuan dan perkongsian pengetahuan, yang menyumbang kepada pertumbuhan organisasi. Oleh itu, soal selidik telah dibangunkan untuk menganalisa proses-proses ini dalam sektor pembuatan India. Analisis faktor pengesahan telah dilakukan dengan menggunakan perisian (Perhubungan Berstruktur Linear) LISREL, untuk menguji penumpuan pembolehubahyang dikenalpasti kepada setiap proses pengurusan pengetahuan. Hasil kajian memperolehi model yang sesuai untuk semua proses pengurusan pengetahuan. Kemudian data dianalisis untuk meneroka, menganalisis dan membandingkan status semasa amalan KM berkaitan dengan saiz mereka. Dapatan menunjukkan bahawa saiz mempunyai kesan besar terhadap tahap perlaksanaan amalan KM.

INTRODUCTION

Today's business world is very uncertain. According to Nonaka (1991)*"...the markets shift, technologies proliferate, competitors multiply, products become obsolete overnight... only those companies which create new knowledge, disseminate it throughout the organization and quickly embody the created knowledge in new technologies and products are successful."* Sustainability of success and further growth in this ever changing business environment necessitate the organizations to shift their focus from traditional business management strategies to innovative strategies. Several such strategies have been developed to enhance the competitiveness of the manufacturing sector; and knowledge management (KM) has emerged as the most potential tool (Rigby & Bilodeu 2007).

Even though the manufacturing sector has been the driver of economic growth, especially in developing countries like India, the challenges faced by manufacturing sector are multifarious; which include control of operating cost, availability of cheaper substitutes, increasing market pressure and high value for quality. To achieve manufacturing excellence, firms should strive for the highest customer satisfaction, employee satisfaction, manufacturing performance, productivity and process efficiency and product quality (Azhashemi 2001). Extant literature provides ample evidence to embrace knowledge as the resource for achieving manufacturing excellence and competitiveness (Liu, Chen & Tsai 2004).

In spite of the proven success record of KM in organizations in varying contexts across the globe, KM in India has not gained its momentum yet. Even though the adoption of KM in IT and ITES, and few large manufacturing organizations is quite impressive, it is still at its infancy among the manufacturing SMEs in India (Dixit 2011). Hence, this paper attempts to develop a questionnaire suitable to the Indian context and validate them using confirmatory factor analysis. Further, it also attempts to explore, analyze and compare the current status of KM in Indian manufacturing organizations with respect to their sizes.

The paper is presented in three sections. In the next section a detailed literature review on knowledge, knowledge management and its processes are presented. The section further presents the impact of organization's size on KM. Then, the research methodology adopted and data analysis, results and discussions are presented.

LITERATURE REVIEW

Resource based view of firms linked the competitive advantage of the organizations with resources and capabilities that are firm specific, and difficult to imitate or substitute (Barney 1991). Knowledge based view of firm (Grant 1996) is the extension of resource based view which considers knowledge as a very special strategic resource, i.e. intangible, inimitable and unique (Afiouni 2007; Wiig 1995); does not depreciate in the way traditional economic productive factors do; and can generate increasing returns (Eisenhardt & Santos 2002).

Ernst and Young (1998) prophesised that in the 21st century, brain power will be the differentiating and deciding success factor in manufacturing and not the traditional hard assets. However, managing knowledge is a challenge to organizations. This is due to its unique

properties like less shelf life, dispersed, elusive and different forms of existence such as tacit and explicit, making managing knowledge difficult. Also, firms differ from each other in terms of their processes, products/services, strategies, vision, mission, skills of employees, culture, geographical location and so on; and as such, their knowledge requirements are also multifarious. However, knowledge is not available holistically; and it is fragmented and lies within the organization's processes, people, products and services, customers, organizational memory and relationships (Skyrme 2001).

Hence, identifying, collecting, capturing, generating, acquiring, sharing, and documenting knowledge are vital for organizational performance. Based on the literature, four major KM dimensions have been identified to be suitable for the study and they are
1. Knowledge acquisition
2. Knowledge creation
3. Knowledge storage
4. Knowledge sharing

Knowledge Acquisition (KA) Knowledge acquisition is the ability of firms to identify and acquire knowledge for competitive advantage (Martínez-Cañas et al. 2012). All required knowledge is not available within the organizations (Davenport & Prusak 1998); and it is spread across various sources, structured and unstructured; and thus, the ability to acquire such knowledge becomes crucial. Some of the knowledge acquisition strategies reported in literature include, learning (Senge 1997), collaboration with public research institutes (Fukugawa 2006) and strategic alliances (Connell & Voola 2007).

Knowledge Creation (KC) Capability of the firms to create new knowledge and embody it in products, services and systems is called knowledge creation (Nonaka & Takecuhi 1995). It refers to the activities associated with the entry of new knowledge into the system, and includes knowledge development, discovery and capture (Newman 2000). With the present globalised business environment, generation of new knowledge that relates to market, technologies, products and processes, provides competitive advantage (Inkpen 1996; Song et al. 2006). Some of the KC practices cited in literature include: problem solving, innovation, experimentation and knowledge integration, tacit knowledge sharing, justifying a concept, building a prototype, establishing R & D, informal and self-organizing networks and communities of practice (Nonaka & Takeuchi 1995) and inter-firm collaborative networks (Balestrin et al. 2008).

Knowledge Storage (KST) Knowledge storage is the process of storing organizational and individual knowledge through information technology applications, written devices, or other mechanism for future reference (Lawson 2003). The purpose of knowledge storage is to create a knowledge repository which in turn enhances organizational memory (Dalkir 2004). Retrenchment, retirement and resignations lead to loss of knowledge (Lesser & Prusak 2001), leaving "skill gaps". These "black spots" in the organizational structure impede the flow of knowledge across the organization. To narrow down the skill gap and black spots, knowledge repositories which are user friendly and accessible should be created.

Knowledge Sharing (KSH) Knowledge sharing is a process which involves bidirectional flows of knowledge between individuals, from individual to group, from group to individual or among groups (Friesl, Sackmann & Kremser 2011). Knowledge sharing is the most challenging

KM process because it is voluntary (Davenport & Prusak 1998); yet, it is crucial because individual knowledge is not useful to the organization unless shared (Jasimuddin & Zhang 2011). Some of the common knowledge sharing practices reported include mentoring, consultation, culture, communication, team building, training, electronic networks, central archiving, and communities of practices (CoP) (Uit Beijerse 2000). Methodologies used for tacit knowledge transfer include interviews, storytelling (Swap et al 2001; Haesli & Boxall 2005), narration, use of analogies and metaphors (Delen & Al-Hawamdeh 2009), shadowing and team work (Liebowitz 2009) and communities of practice (Wenger & Snyder 2000).

The literature cited above explains the importance of the four KM processes, i.e. KA, KC, KSH and KST, for an organization to enhance its performance. The unique characteristics, different forms of existence and its fragmented nature spawned several definitions, propositions and frameworks for KM. The present study considers knowledge as the capacity to act (Uit Beijerse, 2000); and KM as a systematic, organized, explicit and deliberate ongoing process of creating, disseminating, applying, renewing and updating the knowledge towards achieving organizational objectives (Pillannia, 2004).

SIZE OF THE ORGANISATIONS AND KNOWLEDGE MANAGEMENT

Classification of manufacturing organizations with respect to size is purely based on investments on plant and machinery in India (Micro, Small & Medium Enterprises Development (MSMED) Act 2006.

Enterprises		Investment in plant & machinery
Micro Enterprises	:	Does not exceed INR 25,00,000
Small Enterprises	:	More than INR25,00,000 and less than INR5,00,00,000
Medium Enterprises	:	More than INR5,00,00,000 but does not exceed INR10,00,00,000
Large Enterprises	:	>INR 10,00,00,000

Source: http://www.dcmsme.gov.in/ssiindia/defination_msme.htm

Literature reported that the size of a firm has a positive and significant impact on the adoption of KM by the firm (Jafari, Fathian, Akhavan & Hosnavi 2007). Large companies follow KM at ease, whereas KM adoption by the SMEs has not gained momentum (Valaei et al. 2011) and it is mostly informal (Earl & Gault 2003). This may be because SMEs do not enjoy the luxury of surplus in terms of infrastructure or finance (Lee & Lan 2011). Understanding KM and recognizing the benefits of KM (Nunes et al. 2006) and the availability of skilled labor and their retention (Economist Intelligence Unit 2012) are also the reasons behind the SMEs' lack of adoption (Nunes et al. 2006). In spite of the above challenges, those SMEs which adopted KM shows greater performance, in terms of sales growth (Salojarvi, Furu & Sveiby 2005), innovation (Keizer 2002), new product development (Liu, Chen & Tsai 2005) and competitiveness (Liu et al. 2004; Dayasindhu 2002).

KNOWLEDGE MANAGEMENT IN INDIA

KM research in India mainly focused on exploring the status of KM in multiple sectors (Pillania 2006; Sanghani 2009; Chawla & Joshi 2010a, 2010b), IT sector (Suganthi et al. 2012**;** Dayasindhu 2002), enablers (Gautam & Savita 2013; Singh 2008), SMEs (Anand & Singh 2011), telecommunication sector (Singh & Sharma 2011) and banking sector (Goswami 2008).

Even though KM has diffused profusely into IT and ITES industry (Chaudhuri 2011; Chawla & Joshi 2010a; Kumar et al. 2005), manufacturing companies still lack KM (Singh et al. 2006). Case studies conducted in large manufacturing firms in India revealed an extensive adoption of KM (Rangnekar 2010), however, KM in SMEs is yet to gain its strategic status in Indian companies (Anand & Singh 2011; Lavanya 2011).

SIGNIFICANCE OF THE STUDY

Literature review revealed that cross sectional research on KM is fewer in Indian manufacturing sector compared to that of theoretical and case-based research. Also, studies conducted in other parts of India revealed that the implementation of KM in Indian manufacturing sector has not been encouraging, especially among SMEs. Size based comparative studies on the extent of KM adoption are also scarce.

Hence, this paper attempts to explore the following research questions.
1. What is the extent to which the manufacturing companies adopt the four KM dimensions under study, KA, KC, KST and KSH?
2. Is there a difference among the firms based on their sizes in adopting KM?
3. Which of the KM practices are predominately used by the manufacturing firms?

RESEARCH METHODOLOGY

SAMPLE

Population for the study is from one of the industrial hubs of south India comprising more than 27,000 industrial units distributed across 16 industrial estates. A pilot study was conducted and the sample size needed for the study was calculated to be at 243. Convenience sampling method was adopted owing to the constraints in terms of finance, accessibility and uncertainty in getting consent from the respondent firms. For this study, 175 manufacturing firms had participated; 143 firms responded from top management and middle management with 81.7% response rate.

RESEARCH INSTRUMENT

A structured questionnaire was developed based on the literature (Khalil, Claudio & Seliem 2006; Uit Beijerse 2000; Wong & Aspinwall 2005) and was validated by a panel of experts comprising academicians and industry experts. Based on their suggestions, few items were rephrased, reframed and added. The questionnaire uses 5 point Likert scale for analysis, whereby 1 represents 'never' and 5 represents 'very often'. The items under each construct (KM process) are given under appropriate construct discussions.

DATA ANALYSIS AND RESULTS

Demographic profile of the respondents is presented in Table 1 which shows that the sample is predominantly SMEs, mainly ancillary units supplying to the industrial customers. The firms represented various manufacturing industries such as, chemicals, fibers, food, automobile components, metal based and others.

TABLE 1. Demographic profile of the respondents

Demographic variables	Percentage	Demographic variables	Percentage
Size		Market orientation	
Small	39.8	Domestic	44.6
Medium	41	Export	3.6
Large	19.1	Both	51.8
Nature of operations		*Customers*	
Ancillary	59.4	Industrial customers	66.9
Subsidiary	1.6	Individual customers	15.5
Has global operations	20.3	Both	17.5
Original product / equipment manufacturers	18.7		

The data collected were then tested for their reliability and internal consistency. An examination had been made from reliable data to check whether random error causing inconsistency; and in turn reliability is at a manageable level. Table 2 shows that Cronbach's alpha values for all the factors are more than 0.6 confirming the reliability of the data (Hair et al. 2010).
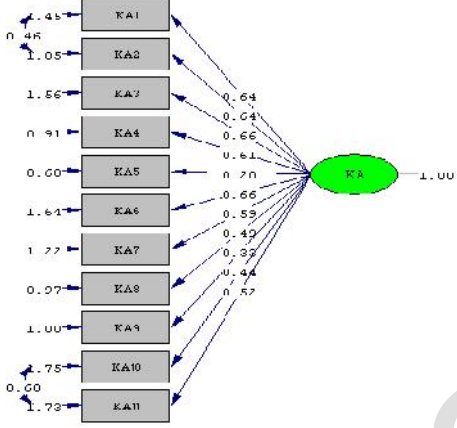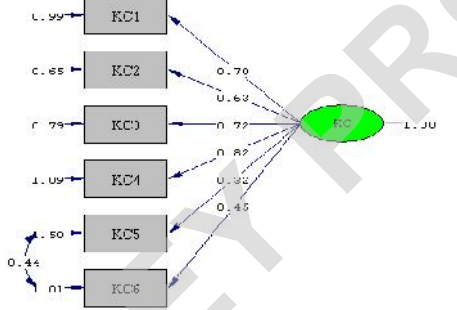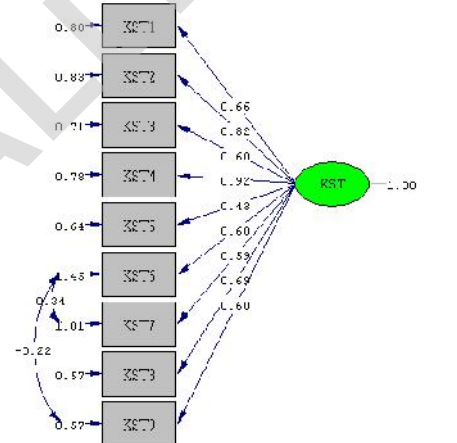
TABLE 2. Reliability values

Construct	No. of items	Size of the firms	Cronbach's alpha
Knowledge acquisition	11	Small	.658
		Medium	.708
		Large	.733
Knowledge creation	6	Small	.605
		Medium	.610
		Large	.746
Knowledge storage	9	Small	.798
		Medium	.818
		Large	.895
Knowledge sharing	10	Small	.652
		Medium	.713
		Large	.778

The data were then subjected to Confirmatory Factor analysis (CFA) through LISREL software, which examines whether the number of factors and the loadings of measured (indicator) variables conformed to the concepts developed based on the theory. The results of CFA are presented in Table 3. As recommended by the literature, multiple criteria were used to assess the goodness–of–fit (Barrett 2007) between the model and the data. Critical goodness of fit measures cited in the literature and their acceptable limits are as given:

1. Chi-square value (2) should be insignificant (>0.05)
2. Ratio of chi-square to degrees of freedom (CMIN / df) should be between 2 and 3
3. Root mean square error (RMSEA) should be less than 0.08
4. Standard root mean square residual (SRMR) should be less than 0.08
5. GFI (Goodness of Fit index), NFI (Normed fit Index) and CFI (Comparative Fit Index) (Shevlin & Miles, 1998) should be greater than 0.9.

The critical values conformed to the threshold limits of the goodness of fit measures, as given in Table 3; thus, confirming the validity of the constructs and the factors used.

TABLE 3. Results of confirmatory factor analysis

Factors / Constructs	Output	Goodness of fit measures
Knowledge Acquisition (KA)		$\chi^2 = 70.05$ df = 40 RMSEA = 0.058 SRMR = 0.058 GFI = 0.98 NFI = 0.93 CFI = 0.95
Knowledge Creation (KC)		$\chi^2 = 18.49$ df = 18 RMSEA = 0.01 SRMR = 0.031 GFI = 0.98 NFI = 0.97 CFI = 1.00
Knowledge Storage (KST)		$\chi^2 = 56.43$ df = 25 RMSEA = 0.071 SRMR = 0.05 GFI = 0.95 NFI = 0.96 CFI = 0.97

Knowledge Sharing
(KSH)
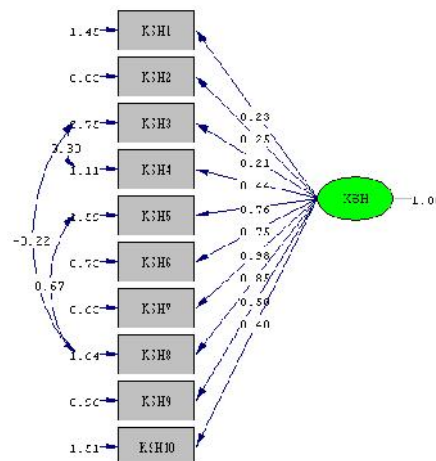
^{2} = 145
df = 51
RMSEA = 0.082
SRMR = 0.067
GFI = 0.90
NFI = 0.92
CFI = 0.91

The status of adoption of KM by the manufacturing firms with respect to their sizes was analyzed through descriptive statistical values, such as mean, standard deviation and coefficient of variation. Mean values provide an overview of the patterns of the data. The results are presented in the Appendix 1 which provides useful insights on the extent of adoption of KM practices and the type of practices that dominates the manufacturing firms. The forthcoming section presents the comparison of mean values of the KM practices among the firms based on their sizes.

KNOWLEDGE ACQUISITION

Knowledge acquisition is an umbrella term that encompasses capturing knowledge from the employees and also acquiring knowledge from the external environment. Knowledge acquisition (KA) practices used in the study and their references are given in Table 4.

TABLE 4. Knowledge acquisition practices

Items	Item descriptions	References
KA1	We actively participate in an outside professional network like Industry's associations, conferences etc.	Khalil et al. 2006
KA2	We attend courses, seminars or other training for skill development	Khalil et al. 2006
KA3	Exit interviews are carried out to capture critical knowledge and experience when our employees leave our organization	Serrat 2008
KA4	We hire consultants when important skills/expertise or information about any activity are not available in our organization	Khalil et al. 2006
KA5	We regularly collect information about the needs of the customer	Khalil et al. 2006
KA6	We encourage workers to continue their education by reimbursing tuition fee for successful completion of work related courses	Khalil et al. 2006
KA7	We hire new staff members, when missing skills/information are needed	Khalil et al. 2006
KA8	We attend presentations of innovations by our suppliers and customers	Khalil et al. 2006
KA9	We practice Job rotation	Uit Beijerse 2000
KA10	We have Networks of practice	Present study
KA11	We practice Apprenticing	Uit Beijerse 2000

Figure 1 presents the mean values of KA practices in small, medium and large companies.
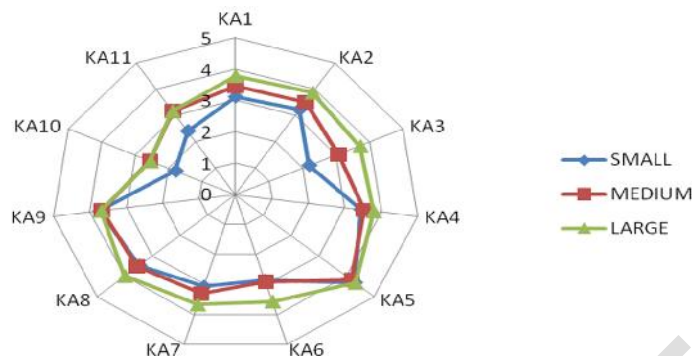

FIGURE 1. Mean values of KA practices

The mean values suggest a moderate adoption of KA by the firms. It is interesting to note that small and medium firms did not differ much in their extent of adoption of KA practices. The individual items' mean values suggested that small firms were weak in their KA practices.

Knowledge regarding the customers (KA5) is the most crucial knowledge for any organization in this customer centric business environment. The mean values >4 for the item KA5 revealed that those firms regularly collected information about the needs of their customers irrespective of their sizes. It is interesting to note that the adoption of KA5 by small companies was in par with that of large companies in this aspect.

Only 41% of the respondents agreed that the employees are sponsored to further their higher education that is work-related (KA6). While large companies adopted KA6 comparatively to a higher extent (mean = 3.56), both small and medium companies showed a low mean value (<3). This may be due to the financial constraint of the SMEs. Sponsoring employees to continue their education is expensive and there is no guarantee that the sponsored employees will continue to work with the same organization. Another crucial point is that SMEs are scarce of labor and sparing even one employee for skill development will not be feasible.

Similarly, hiring new staff members whenever new skills are needed (KA7) is done only sometimes in small (Mean = 3.07) and medium organizations (Mean = 3.3). Large companies also showed a moderate mean value 3.66 for KA7. This may be because it is not economically feasible for any firm to hire staff as needed. Instead, firms may train the available employees for the required skill.

Networks of practice (KA10) refers to "*....network that link people to others whom they may never get to know, but who work on similar practices*" (Brown & Duiguid 2002). It is practically unknown to small firms as shown by a low mean value of 1.79. Even medium and large firms rarely used networks of practice with mean values of 2.5 in both cases. Use of technology and its integration into daily working practices is a sophisticated KA practice in which the manufacturing firms' operations might not allow. Apprenticing (KA11) is learning at individual level (Comas & Sieber 2001); and it was found that apprenticing is not a common practice among small firms (mean = 2.4). Meanwhile, the medium and large firms sometimes practiced apprenticing (mean = 3.1).

More recently, exit interviews (KA3) are seen as a knowledge management tool, emphasizing on the importance of capturing knowledge from leavers and storing it. Even though it is not possible to capture all the knowledge, it certainly minimizes the loss of critical

knowledge through staff turnover. KA3 is rare in small companies, and medium companies sometimes adopted it. Nonetheless, large firms often conducted exit interviews as shown by mean value of 3.73. As the employees' turnover and mobility are high in the case of SMEs, the scope of conducting exit interviews is minimal. SMEs need to understand the importance of capturing the critical knowledge that is walking away with the employees. This is because the employees constitute knowledge repository. Such a knowledge repository is an asset to SMEs for future reference, and also to avoid costly mistakes.

The other practices such as participating in professional network activities (KA1), attending courses (KA2) and hiring consultants (KA4) are of moderate to high in all the respondent firms. Interestingly, it is observed that job rotation (KA9) is often practiced in small companies (mean = 3.72) and is at par with medium and large companies (mean = 3.68). It should be noted that the respondent firms did not practice job rotation in the real sense of enhancing job satisfaction and skills levels; but it is to maintain their productivity whenever a particular employee is absent or if emergency arises.

KNOWLEDGE CREATION

Table 5 presents knowledge creation (KC) practices. Figure 2 shows the mean values for KC in small, medium and large firms.

TABLE 5. Knowledge creation practices

Items	Item descriptions	References
KC1	We have a team to study and communicate the market scenario to the management for further action	Present study
KC2	Brainstorming sessions are used for problem solving	Khalil et al. 2006
KC3	We do research to explore future possibilities of expansion in terms of capacity, markets etc.	Khalil et al. 2006
KC4	We collaborate with research institutes, educational institutions for problem solving, projects, innovations	OECD-Germany, 2000
KC5	We use communities of practice for problem solving	Wenger & Snyder 2000
KC6	We have quality circles	Present study

It can be observed from Figure 2 that small firms have low mean values, thus indicating KC adoption was low compared to medium firms. Large firms' adoption of KC practices is on a higher side of spectrum; thus, indicating that KC was often practiced in these firms.
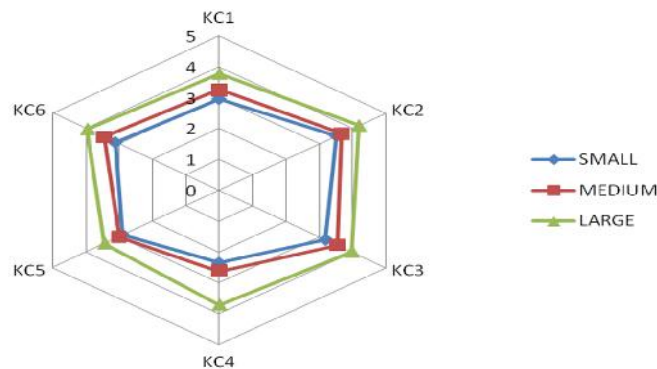
FIGURE 2. Mean values of KC practices

46% of the respondents opined that their organizations studied the market scenario in order to proactively generate strategies (KC1). Large firms showed a better adoption of this practice with a high mean value (3.77), whereas SMEs showed a low mean value of 2.96 and 3.26 respectively. The resources scarcity of the SMEs hinders the appointment of a team to study market scenario and this might be the reason for poor adoption of KC1.

Interestingly, brainstorming is the most widely acknowledged KC practice whereby more than 90% responded that their organizations brainstormed from "sometimes" to "very often". The mean value is as high as 3.67, and is the highest among the KC variables, thus suggesting that KC2 is practiced by the firms regularly. A similar trend is seen for KC3, i.e. the firms scanned and researched the environment for future expansion. More than 80% of the respondents favorably responded to the question. However, the firms showed a significant difference in KC4, i.e. collaboration with educational institutions or research institutes. SMEs lagged far behind large companies in this aspect with only 2.3 and 2.6 as mean values.

Communities of practice (CoP) is an activity which is informal, involving knowledge sharing and may be external or internal (Wenger & Snyder 2000). People tend to work in communities and working with peers keeps them together (Allee 2000), especially when the challenges are complex. A moderate practice of CoP is observed in the respondent firms as shown by mean values between 2.8 and 3.4. This may be due to the employees in the firms share their experiences which may not be relevant to the work.

Unlike CoPs, quality circles are formal volunteer groups who meet to solve problems, plan improvements or share ideas. The existence of quality circles and their activities at creating new knowledge for enhancing organizational performance is encouraging in those firms, even though there were variations noted among them. Small firms show a mean value of 3.11, mean for medium firms is 3.43 and mean of large firms is 3.95.

KNOWLEDGE SHARING

Only when knowledge is shared and transferred, it could be used to solve problems or make right decisions or create new knowledge. Knowledge sharing (KSH) practices used by the study are given in Table 6.

TABLE 6. Knowledge sharing practices

Items	Item description	References

|		
KSH1	We use informal communication as the common mode of information sharing within the organization	Khalil et al. 2006
KSH2	Feedback is given to customers regarding the improvements made on products or services based on their complaints	Present study
KSH3	Problems related to processes are discussed openly in our organization	Khalil et al. 2006
KSH4	Employees inform each other about successful projects and methods of working	Khalil et al. 2006
KSH5	We subscribed to newsletters, bulletins and other material for our employees	Present study
KSH6	Individual performance evaluations are given and discussed	Khalile et al. 2006
KSH7	We have a structured induction program for new employees to get conversant with our system	Present study
KSH8	Employees have access to the newsletters and bulletins	Present study
KSH9	Business update meetings are held with suppliers, customers, stakeholders etc.	Khalil et al. 2006
KSH10	Shadowing (workers are paired up – usually a veteran with a less experienced) is practiced	Marques 2011
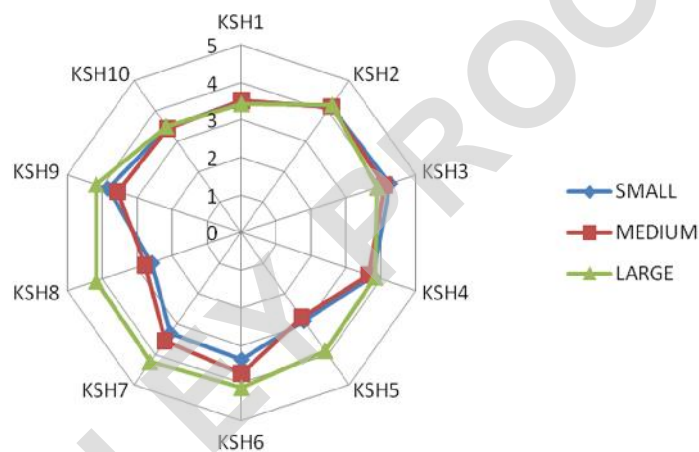
FIGURE 3. Mean values of KSH practices

It is observed that there were no significant differences among the firms in the extent of adoption of KSH1 and KSH2. The structure of small firms tends to be flat with lesser level of hierarchy; and thus, leading to the common usage of informal communication (Serenko et al. 2007). He further reported that larger organizations, which have more formal structure, hamper informal knowledge sharing. However, in this case, larger firms also used informal communication to a level almost equal to that of SMEs. This might be due to the availability of mechanisms for knowledge sharing in the formalized structure.

KSH2, feedback to customers is also equally adopted by the firms irrespective of their sizes, as shown by the mean values of more than 4.1. This might be due to the realization by the firms that customers are the pivot of the success of any organization; thus, regular interaction with the customers regarding their grievances and redressal are crucial.

A very significant difference can be seen among the firms in KSH5 and KSH8, namely on the practices dealing with newsletters. It was observed that SMEs had a weak practice of subscribing to newsletters and brochures and the accessibility of the newsletters compared to large firms. Newsletters and bulletins are a good medium for gathering information about the competitors, various events in the industry, current industrial scenario, about the new market

entrants and others. It was discovered that the SMEs rarely subscribed to newsletters and bulletins.

Performance evaluations (KSH6) were done in small firms only to a lesser extent compared to medium and large firms. The scope for performance evaluations in small firms was much lesser as they are predominantly production related whereby their workers followed well-established standard operating procedures for their daily activities, and there was a lack of formal performance evaluation procedures in these firms.

A job-shadowing program (KSH10) is a knowledge transfer program, whereby a less experienced performer is paired up with an experienced performer, which in turn facilitates knowledge sharing especially in most difficult situations. In those organizations, it was seen that "*shadowing*" was moderately practiced irrespective of their sizes. Since small firms are highly dependent on their key customers and suppliers, similar to large firms, business update meetings (KSH9) are regularly practiced in these firms. Large firms are in turn dependent on the small firms for their components and regular meetings are conducted regularly. However, medium firms showed only a moderate practice of KSH9.

KNOWLEDGE STORAGE

Figure 4 and Appendix 1 show that KST was being adopted to a greater extent by the firms irrespective of their sizes, except for KST6 and KST7. In the present study, knowledge is interpreted as information by the respondent firms. Since knowledge is considered as the output of information processing, the assumption is retained as such. Information on processes, projects, employees and others was collected and documented. The respondents opined that documentation is a fundamental requirement for ISO certification, which is an authentication for the products' quality. Hence, about 98.6% of the firms, i.e 141 out of 143 firms were ISO certified.

TABLE 7. Knowledge storage practices

| Items	Item description	References
KST1	We update our databases about the various projects etc.	Khalil et al. 2006
KST2	We use our handbooks to update the information related to our area of operation	Khalil et al. 2006
KST3	We update the working manuals and operating procedures	Donate & Canales, 2012
KST4	We have a dedicated and authorized person/ department to control, update and release of the documents	Present study
KST5	We maintain documents on the skill levels of individual employees	Khalil et al. 2006
KST6	We have a structured methodology to collect information from various regions, analyze and prepare reports for future reference	Present study
KST7	We have up-to-date handbooks on processes, problem solving, rules or procedures throughout the organization	Donate & Canales 2012
KST8	We analyze our failures and successes; and results are documented for future reference	Wong & Aspinwall 2005
KST9	We create working manuals and standard operating procedures for smooth day to day activities	Khalil et al. 2006
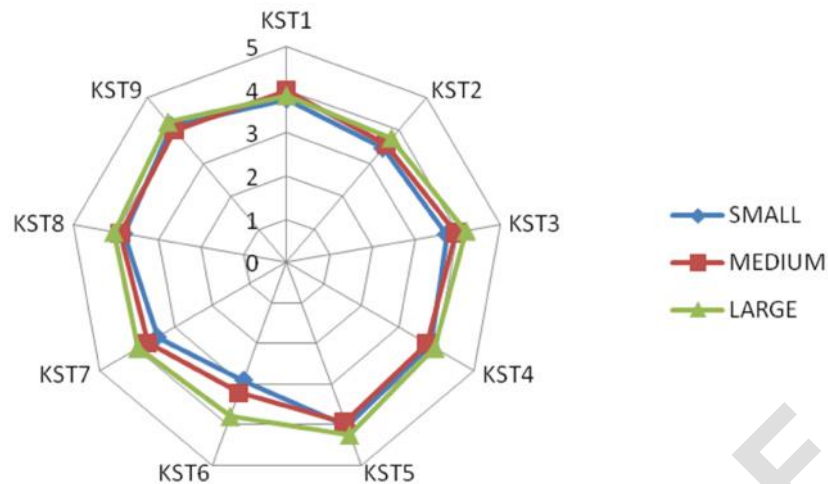
FIGURE 4. Mean values of KST practices

The respondent firms had standard operating procedures, working manuals, records on employees and projects and they used handbooks. Additionally, the firms authorized a senior person as "management representative" who is in-charge of the documentation.

However, the KST6 practices showed a significant difference in the extent of adoption by the firms. Structured methodology to collect information from various regions and documentation (KST6) adopted by SMEs was low compared to large firms. This might be due to the SME's resources constraint in adopting such practices and the lack of long-term orientation by the firms for expansion and growth.

ANALYSIS OF STANDARD DEVIATION AND COEFFICIENT OF VARIATION (CV)

Mean values illustrate the overall picture of the extent of adoption of KM practices. Additionally, on whether the respondent firms differ in the adoption of practices, the extent of variation in the adoption is given by standard deviation and coefficient variation. Analysis of standard deviation and coefficient of variation of items under KA construct reveals that:

1. Variation of adoption of KA practices is the highest among the small firms. CV values ranged from 20% for KA5 to 76% for KA10.
2. Variation is lesser in the case of medium firms, and large firms show still lesser variation in KA practices.

Coefficient of variation values of KC, KSH and KST practices also show a larger variation in the adoption KC, KSH and KST by small firms compared to the medium firms. Larger firms show a lesser variation in the adoption of KC, KSH and KST.

FINDINGS OF THE STUDY

The results of the analysis answer the research questions. It is revealed that the adoption of KM in manufacturing organizations averaged from low to moderate for most of the KM practices as

given in Appendix 1. In general it could be concluded that KSH and KST are better adopted practices as compared to KA and KC.

SMEs

KA and KSH practices of SMEs focus mainly on enhancing customer satisfaction (KA4, KA5, KA8, KSH2, KSH9) and productivity related factors (KA9, KSH3, KSH4 & KSH10). It was seen that practices related to skill development needed more attention. The results showed that KST activities are highly adopted as documentation of organizational activities and essential in manufacturing organizations, such as daily production, quality assurance, working manuals, standard operating procedures and others.

However, where KC activities are concerned, it could be concluded that SMEs lacked in the adoption of crucial KC practices such as market research, collaborations, use of CoPs and quality circles for problem solving. Brainstorming is a commonly used KC practice in generating new ideas by SMEs. Thus, the management should focus on expansion and innovation activities for long term sustainability.

SIZE OF THE FIRMS AND KM

Size of the firms has a significant impact on the extent of adoption of KM practices as revealed by the literature (Jafari et al. 2007; Valaei et al. 2011). It was seen that larger firms are better in KM adoption (Chawla & Joshi 2010a) as compared to SMEs. Also, in SMEs, KM was found to be at its infancy and lacked formal mechanisms to manage the organizations' intellectual assets for better performance. When firms were separately considered according to their sizes for analysis, such as small, medium and large firms, smaller firms showed the highest variation among them in adopting KM practices. Larger firms did not vary much in KM adoption and medium firms showed moderate variation.

It may be because not all the small firms are aware of the KM practices and they rarely adopted KM, as shown by the CV and mean values. Large firms did not vary much with respect to the adoption of KM practices. Larger variation denotes the significant difference in the adoption KM practices. SMEs, as already discussed, are resource-constrained and also the awareness level of KM practices is lesser in these firms. These firms traditionally operated with few key personnel being responsible for the entire operation. They are also highly customized and serve few key customers. Decisions such as adoption of KM, technology like networks of practice or doing research for future expansion are dependent on these key personnel. If these key personnel are technological savvy or aware of the benefits of KM, then they might have adopted KM, otherwise lack of it. Larger firms, on the other hand, showed lesser variation in the adoption of KM practices because of the appreciable awareness of KM and their benefits by the senior management.

IMPLICATIONS OF THE STUDY

The findings of the study may be critically important to academia, practicing managers and policy markers. The study emphasizes the previous research findings that large firms have a better adoption of KM as compared to SMEs. It should be noted that even without a formal mechanism of KM in SMEs, the firms followed certain essential 'people based KM practices' such as customer relationship, documentation, research on market scenario, informal

communication and others. Successful acquisition, creation, storage and sharing of knowledge are fully realized only when the objectives of KM implementation and its impacts on performance are understood by the practicing managers.

As for India, 90% of the companies in manufacturing sector are SMEs and improving the competitiveness of these firms is imperative in surviving in the global arena. Findings of this study revealed the importance of intervention by the Government of India in creating awareness of KM and the need for its implementation to strive in the knowledge economy. Since the study is confined to the manufacturing firms in India, the results may not be generalized beyond India. However, at the same time, as there are hardly any empirical research investigations in the area of knowledge management in Indian manufacturing firms to explore the status of it with respect to size, the academia will also find the present study adds value to their academic pursuits.

CONCLUSION

This study is an attempt to explore KM practices in Indian context and validate the measures empirically through confirmatory factor analysis. It is found that the items used under the KM processes showed good fitness measures; thus, confirming the suitability of the measures for the research setting. Further analysis revealed that KM adoption varies significantly in accordance to the size of organization. Awareness of KM by small firms and the extent of adoption of KM practices are still low compared to the medium and large firms. Large firms showed a better understanding and adoption of KM practices. Also, even among the small firms, variation of adoption of KM is significant to more than 50% for some of the KM practices. This indicates that the adoption of KM is comparatively better for some of the small firms. Large firms showed a lesser variation and medium firms showed moderate variation.

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APPENDIX

APPENDIX 1. Results of descriptive statistical analysis

ITEMS	SMALL			MEDIUM			LARGE		
	Mean	Std. Deviation	C.V.	Mean	Std. Deviation	C.V.	Mean	Std. Deviation	C.V.
KA1	3.11	1.58844	51.07524	3.466	1.21925	35.17744	3.7917	1.0097	26.62922
KA2	3.21	1.2972	40.41121	3.5049	1.1451	32.6714	3.875	1.02366	26.41703
KA3	2.21	1.36548	61.78643	3.068	1.32297	43.12158	3.7292	1.04657	28.0642
KA4	3.45	1.17529	34.06638	3.5243	1.15338	32.7265	3.7917	0.98841	26.06773
KA5	4.3	0.87039	20.24163	4.1748	0.77241	18.50172	4.3125	0.68901	15.97704
KA6	2.87	1.52855	53.25958	2.9126	1.37987	47.37588	3.5625	1.27005	35.65053
KA7	3.07	1.30465	42.49674	3.3107	1.22897	37.12115	3.6667	1.11724	30.4699
KA8	3.47	1.19304	34.38156	3.534	1.03673	29.33588	3.9792	0.93375	23.46577
KA9	3.72	1.18986	31.98548	3.6699	0.99399	27.08493	3.6875	0.87898	23.83675
KA10	1.79	1.37286	76.69609	2.5534	1.31155	51.36485	2.5417	1.38316	54.4187
KA11	2.4	1.49071	62.11292	3.1456	1.28649	40.89808	3.1667	1.27719	40.33189
KC1	2.96	1.28645	43.46115	3.2621	1.16283	35.64667	3.7708	0.99444	26.37212
KC2	3.53	1.11423	31.56459	3.6796	0.9723	26.42407	4.1875	0.76231	18.20442
KC3	3.2	1.18918	37.16188	3.5534	1.12658	31.70428	3.9792	0.88701	22.29116
KC4	2.35	1.25831	53.54511	2.6214	1.26116	48.11017	3.7083	1.12908	30.44737
KC5	2.89	1.3401	46.37024	3.0194	1.24444	41.21481	3.4375	1.08972	31.70095
KC6	3.11	1.52352	48.98778	3.466	1.34175	38.71177	3.9583	1.16616	29.46113
KSH1	3.53	1.23464	34.97564	3.5243	1.23546	35.05547	3.4375	1.21876	35.45484
KSH2	4.15	1.0088	24.30843	4.1553	0.88292	21.24804	4.2083	0.96664	22.96985
KSH3	4.25	0.84537	19.89106	4.0971	0.91303	22.28479	3.8958	0.90482	23.22552
KSH4	3.75	1.19236	31.79627	3.6311	1.11135	30.60643	3.8333	1.11724	29.14564
KSH5	2.89	1.51687	52.48685	2.7767	1.47483	53.11449	3.875	1.02366	26.41703
KSH6	3.37	1.26854	37.64214	3.7573	1.0615	28.25167	4.125	0.81541	19.76752
KSH7	3.3	1.43196	43.39273	3.5631	1.14335	32.08863	4.25	0.78551	18.48259
KSH8	2.57	1.5651	60.89883	2.777	1.4946	53.82067	4.167	0.9749	23.39573
KSH9	3.83	1.09226	28.51854	3.5534	1.18593	33.37451	4.1667	0.78098	18.74337
KSH10	3.46	1.38111	39.91647	3.4272	1.22556	35.7598	3.5	1.27162	36.332
KST1	3.78	1.26794	33.54339	3.9903	0.97513	24.43751	3.875	1.02366	26.41703
KST2	3.45	1.41689	41.06928	3.5825	1.1248	31.39707	3.7708	0.99444	26.37212
KST3	3.74	1.23599	33.04786	3.9709	0.85699	21.58176	4.2083	0.87418	20.77276
KST4	3.81	1.39765	36.68373	3.7379	1.20425	32.21729	3.9583	1.16616	29.46113
KST5	4.01	0.93738	23.37606	3.932	0.87741	22.3146	4.25	0.88726	20.87671
KST6	2.9	1.39624	48.14621	3.2039	1.37455	42.9024	3.7917	0.96664	25.49358
KST7	3.45	1.33617	38.72957	3.7087	1.0993	29.64111	3.9583	0.82406	20.81853
KST8	3.82	1.12259	29.38717	3.8932	1.01858	26.16305	4.0417	0.79783	19.73996
KST9	4.14	1.05428	25.4657	4.0194	0.94952	23.62343	4.25	0.75794	17.83388