



Knowledge management process effectiveness: measurement of preliminary knowledge management implementation

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Abstract

While knowledge management (KM) has been widely discussed by many academics and practitioners, measurement is undoubtedly the least developed aspect of KM due to the intangibility of knowledge assets. It is of paramount importance to establish performance measures at different stages of KM implementation even from the beginning so that its effectiveness can be identified. This paper thus serves to explore KM performance measurement from the angle of KM process effectiveness. Through the data collected from 289 managers in the Malaysian telecommunication industry, where KM implementation is just beginning to take place, significant interactions were found between four of the five proposed KM preliminary success factors (i.e. business strategy, K audit, K map, KM team) and all four KM elements of strategies (i.e. technology, culture, leadership, measurement) with KM process effectiveness. The findings of this study serve as a guide for organizations in driving their KM journey and reaching their destinations even at the beginning stage of their KM implementation.

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Introduction

Knowledge management (KM) may be regarded as a mature and established theoretical concept today as a result of the overwhelming research carried out in organizations of different sizes and geographical locations, be they public or private (e.g., McAdam & Reid, 2001; Moffet *et al.*, 2003; Syed-Ikhsan & Rowland, 2004a; Egbu *et al.*, 2005; Hung *et al.*, 2005; Wong, 2005; Chong, 2006a, 2006b; Chong *et al.*, 2006a, 2006b; Edvardsson, 2006; Kalsom & Syed Noh, 2006; Elsa *et al.*, 2007; Curado, 2008; Gorry, 2008; Matzkin, 2008; Pathirage *et al.*, 2008; Sharmillah Devi *et al.*, 2008; Yi, 2008). While many researchers have arrived at the same conclusion that KM is a core competency that determines the success of any organization in this knowledge-based economy (k-economy) (Okunoye & Karsten, 2002; Droge *et al.*, 2003; Johannessen & Olsen, 2003; Grant & Baden-Fuller, 2004; Kess *et al.*, 2008), many organizations are still struggling with its implementation. The empirical evidences provided by Chong (2006a, b), Chong *et al.* (2006b) and Sharmillah Devi *et al.* (2008) are enough to substantiate this notion. The studies pointed towards the same conclusion where KM is perceived to be more important than to the extent that it was implemented in organizations.

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The significant gap is not difficult to understand. From a practical perspective, Malhotra (1998) has rightfully remarked that the current KM solutions are still *ad hoc* – constrained by basic rigid and limited views of knowledge – and lack the necessary zeal and dynamics to meet the knowledge requirements of organizations in today's competitive environment. This is probably attributed to the absence of a universally accepted definition of KM (Earl, 1999; Salleh & Goh, 2002). Furthermore, the economic development of KM has not stabilized and filtered into the industry (Stankosky & Baldanza, 2001), where organizations usually implement well-established practices (Levette & Guenov, 2000). As many organizations have a narrow focus on KM, their KM practices and expected outcomes will thus have a narrow focus.

More important is the issue of KM paradox, that is, failure of organizations to refine their performance measures to consider the impact of KM activities even though these activities increase the cost of doing business (Hallett & Stephens, 2003). While KM has been widely discussed by many academics and practitioners, measurement is undoubtedly the least developed aspect of KM (Boumarafi & Jabnoun, 2008). This is not surprising given the difficulties in defining it, let alone measuring it. This problem is found to be more prevalent, especially among organizations that have just started to implement KM, as they are yet to see the effectiveness of their KM initiatives in a longer time period. Some practitioners feel that measurement is premature at the early stage, and that trying to measure knowledge before an organization fully understands how knowledge is created, shared, and used is likely to lead them to focus on the wrong things (Chong *et al.*, 2006b). However, it can be argued that as KM requires an investment decision and should therefore demand results from its implementation, it is of paramount importance to establish performance measures at different stages of KM implementation even from the beginning so that its effectiveness can be identified. Thus far, there has been a dearth of studies that propose a comprehensive measurement of KM initiatives, particularly during the early stage of KM implementation. A cursory look at the literature shows that Bohn (1994) is among the first who proposed a progress of growth of knowledge in an organization, which can be described in eight stages: complete ignorance, awareness, measurement, control of the mean, process capability, process characterization, knowing why, and complete knowledge. His framework provided an alternative way of figuring out where the firm stands relative to the firm's knowledge. Specifically, Holt *et al.* (2007) proposed an instrument to measure readiness for KM in the early stage of KM implementation.

Based upon an extended framework developed by Chong *et al.* (2006a, 2009), this paper attempts to investigate the association between the proposed five KM preliminary success factors and four KM elements of strategies and KM process effectiveness. Coukos' (2001)

index of KM process effectiveness is adopted for the KM preliminary success factors and elements of strategies. Data were collected from 289 middle managers from the telecommunication industry in Malaysia through a cross-sectional survey. This industry has been noted to play a prominent role in Malaysia's efforts towards becoming a k-economy nation (Chong & Yeow, 2005; Chong *et al.*, 2006a, 2009). The findings provide understanding of KM implementation from among organizations that have just started to undertake such initiatives, so as to inform decisions regarding proper focus on the prerequisites needed to deploy a full-range and well-organized KM implementation from a measurement perspective. This will allow organizations to reap maximum benefit from their KM efforts (Chong, 2006c). This is the main objective of this paper. In addition, it also contributes to the KM body of knowledge by summarizing what has been achieved and identifying new areas that need to be explored in future research.

The rest of the paper is organized as follows. The next section reviews relevant literature. This is followed by the methodology used. The empirical results and analysis are presented next, followed by the discussion and implications of the findings. The key findings are then summarized to conclude the paper, along with research limitations and suggestions for future research.

Literature

KM preliminary success factors

Chong & Yeow (2005) and Chong *et al.* (2009) are perhaps among the earliest researchers who attempted to comprehensively propose and provide empirical evidence on the KM preliminary success factors. They proposed five factors based on a myriad of KM literature in this area (Barney, 1995; Tiwana, 2000; Nesbitt, 2002): (1) business strategy; (2) organizational structure; (3) KM team; (4) K-audit; and (5) K-map. In both the studies, Chong *et al.* found that there are significant differences between the preliminary success factors perceived as important and the actual level of KM implementation, with business strategy significantly predicting organizational performance. They attributed the results to the relative newness of KM in the telecommunication industry surveyed. Many organizations were at their early stages of KM implementation, and therefore were not aware of the full spectrum of KM activities.

KM elements of strategies

KM strategies work in concert to streamline and enhance the capture, flow, and transfer of an organization's data, information, and knowledge for the purpose of delivering it to individuals and groups engaged in accomplishing specific tasks (Dove, 1998; O'Dell & Grayson, 1999; Sveiby, 2000). Based on the findings from leading KM researchers (Davenport & Prusak, 1998; O'Dell & Grayson, 1999; Sveiby, 2000; Coukos, 2001), culture, leadership, technology, and measurement have been identified as

important elements of KM strategies for successful KM implementation. Chong *et al.* (2009) found that all the four elements of strategies have been perceived as more important than being actually implemented, with the cultural element identified as an important determinant in the performance of the telecommunication organizations. This again implied their minimal understanding of the KM elements of strategies due to their infancy stage of KM implementation.

KM process effectiveness index

For organizations that are in the early stages of KM implementation, it is challenging to measure its influence on organizational performance from both tangible and intangible aspects since it takes time and resource commitment from organizations to reap the benefits brought about by KM implementation success (Bennett & Gabriel, 1999; Dyer, 2000; Ahmed & Omar, 2007). This is evident from the low adjusted squared multiple correlation coefficient (adjusted R^2) value obtained in Chong *et al.*'s (2009) study when they attempted to correlate the KM preliminary success factors, KM elements of strategies, and KM processes with performance of the telecommunication organizations. This finding seems to make sense, as organizations that are at the beginning stage of KM implementation are unable to fully enhance their competitive position. This is supported by Hartz *et al.* (2006), who remarked that measurement of financial returns should not be undertaken at this stage, as people tend to measure the wrong things.

As such, if a KM program is to be measured in the early stages of its implementation, then it is logical to look at the effectiveness of the KM processes themselves. This argument is supported by many researchers: if the impact of KM preliminary success factors and KM elements of strategies can result in high effectiveness of the KM processes, it will lead to higher organizational performance in the long run (Stewart, 1997; Dyer, 2000; Coukos, 2001).

KM processes can be defined as the degree to which organizations are currently involved in the comprehensiveness of knowledge processes, which consist of constructing, embodying, and deploying organizational knowledge and its management. Construction comprises the set of activities associated with the entry of new artifacts into the system, and includes such activities as development, discovery, and capture. It is a continuous

and self-transcending process. Embodiment refers to the translation of data and information into symbols that others can understand. It involves the sub-processes of storing, categorizing, and mapping knowledge. Deployment refers to knowledge transfer, and represents the mechanisms used to make the repository content accessible. It involves two or more parties, and there has to be a source and a destination (Syed-Ikhsan & Rowland, 2004b). As these processes are regarded as 'management of knowledge' in many of the KM definitions proposed, it is thus logical to measure KM from this perspective.

From among the KM processes models developed, Coukos' (2001) model is considered to be the most comprehensive to date. He proposes KM process effectiveness as a KM index to measure the effectiveness of the KM processes among research universities. Process effectiveness was measured by an index calculated by totaling the construction 'actual implementation' score, the embodiment 'actual implementation' score, and the deployment 'actual implementation' score (Table 1). KM process effectiveness scores can range from a low of 3.0 to a high of 15.0. As KM processes are very essential in ensuring successful KM implementation, this index is particularly useful and yet practical to measure the effectiveness of the KM processes being implemented in organizations.

As a conclusion, five preliminary success factors and four elements of strategies for KM implementation are proposed in this study. As shown in Figure 1, to ensure an

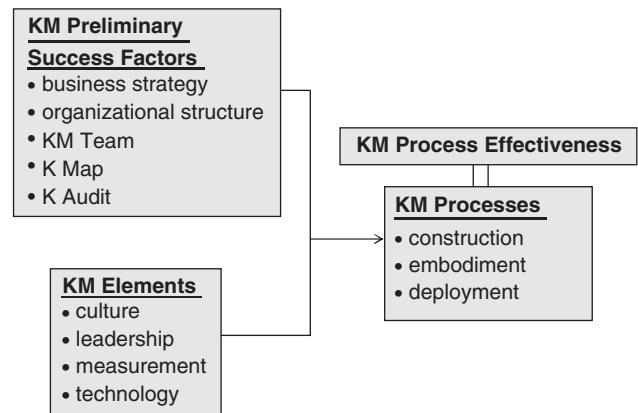


Figure 1 Research framework on KM preliminary success factors, KM elements of strategies, and KM process effectiveness.

Table 1 KM index measurement of KM process effectiveness

KM Processes	Construction (C)	Mean 'actual implementation' scores (5 = high; 1 = low) collapsed across five survey items.
	Embodiment (E)	Mean 'actual implementation' scores (5 = high; 1 = low) collapsed across five survey items.
	Deployment (D)	Mean 'actual implementation' scores (5 = high; 1 = low) collapsed across five survey items.
KM process effectiveness	Sum of (C)+(E)+(D)	(3 = low; 15 = high)

effective KM process, the KM preliminary success factors and KM elements of strategies must be present. This will ensure KM implementation success, and will further enhance organizational performance and its competitiveness. The next section presents the methodology employed in this study.

Methods

A set of questionnaires was developed and sent to 800 respondents comprising middle managers from various functional areas working in the Malaysian telecommunication organizations, based on a convenience sampling technique. The list of organizations was obtained from two online pages: the Telecommunication Services in Malaysia: A Market Analysis (http://www.gii.co.jp/english/ae11397_telecom_malaysia_toc.html), and Telekom Malaysia's (TM) online Yellow Pages (<http://www.yellowpages.com.my/psearch/index.jsp?sf=wandp=7&name=telecommunication+companies>). The middle managers were selected because their importance in KM implementation success has been widely acknowledged (Nonaka & Takeuchi, 1995; Mintzberg, 1996; Salleh & Goh, 2002). They are considered knowledge workers, and are described as the strategic 'knot' that binds top management with front-line workers (Nonaka & Takeuchi, 1995). Approximately 289 (or 36%) completed questionnaires were returned.

The questionnaire comprised two sections. The first section asked about the stage of KM development in the organizations surveyed (evaluation stage, implementation of one or more pilot projects, and full-scale implementation stage). In the second section, there were 59 questions measuring the respondents' perceived importance and the degree of implementation of KM preliminary success factors, KM elements of strategies, and processes in their organizations, using a scale from 1 (not important/not implemented) to 5 (very important/extensively implemented). These questions were developed based on a review of prior literature (Barney, 1995; Tiwana, 2000; Coukos, 2001; Nesbitt, 2002).

The reliability test conducted on the KM preliminary success factors, elements of strategies, and processes yielded an overall Cronbach Alpha value of 0.9667 for the degree of perceived importance, and 0.9744 for the degree of actual implementation (Table 2). As they fall within the acceptable range of alpha (Nunnally, 1978), the variables tested in this study are considered to be highly reliable. Face validity was achieved based on an earlier pilot study conducted by Chong & Yeow (2005), and construct validity was attained based on the factor analyses conducted by Chong *et al.* (2009). As all the items have coefficients of over 0.50, no items were dropped. Further, with an $\alpha=0.001$ cutoff level, no respondents produced scores that identified them as outliers. We can safely conclude that the instrument is considered valid and reliable in all aspects, and can therefore be applied for further analysis.

Table 2 Reliability test

	Perceived importance	Actual implementation
<i>KM preliminary success factors</i>		
Business strategy	0.9015	0.9260
Organizational structure	0.8621	0.9231
KM team	0.8799	0.9489
K-audit	0.9228	0.9469
K-map	0.9356	0.9566
	0.9265	0.9548
<i>KM elements</i>		
Technology	0.9320	0.9560
Culture	0.9095	0.9242
Leadership	0.9424	0.9555
Measurement	0.9452	0.9627
	0.9460	0.9288
<i>KM processes</i>		
Construction	0.9170	0.9427
Embodiment	0.9017	0.9258
Deployment	0.8911	0.9472
	0.8787	0.9212
Overall	0.9667	0.9744

Of the 289 responses received, 29.8% of the respondents indicated that they have implemented full-scale KM programs in their organizations, followed by 37% who already had one or more pilot applications on KM. Approximately 31% of the respondents are at the planning and evaluation stage. It is therefore logical to deduce that the majority of the Malaysian telecommunication organizations are at the beginning stage of KM implementation. Hence it is appropriate for a study of this nature to be conducted on the industry.

Results

Table 3 presents the results of paired *t*-test between the degree of importance and implementation of the KM preliminary success factors, KM elements of strategies, and KM processes. The results indicate significant differences between all the factors. Two preliminary success factors (K-audit and K-map), two KM elements of strategies (leadership and measurement), and two KM processes (construction and embodiment) scored above the average mean differences.

Table 4 shows the results of multiple regression analysis among the perceived importance of KM preliminary success factors, elements of strategies, and KM process effectiveness. The adjusted *R*-squared multiple correlation coefficients (adjusted *R*²) clearly explained 10.9% of the variance associated with the KM process effectiveness. The *F*-statistic is also significant ($F=36.191$), which confirms that the variables on the whole make a significant contribution to the fitness of the regression

Table 3 Comparison of the perceived importance and implementation of KM preliminary success factors, KM elements of strategies, and KM processes

	Mean difference	t-value	Sig. value
<i>Preliminary success factor</i>			
1. Business strategy	0.89	13.93*	0.000
2. Organizational structure	0.96	13.13*	0.000
3. KM team	0.96	13.40*	0.000
4. K-audit	1.04	15.15*	0.000
5. K-map	0.99	14.58*	0.000
Average mean difference	0.97		
<i>KM elements</i>			
1. Technology	0.81	12.51*	0.000
2. Culture	0.86	14.19*	0.000
3. Leadership	0.93	14.03*	0.000
4. Measurement	1.00	14.31*	0.000
Average mean difference	0.90		
<i>KM processes</i>			
1. Construction	0.97	14.67*	0.000
2. Embodiment	0.98	15.42*	0.000
3. Deployment	0.93	14.65*	0.000
Average mean difference	0.96		

Table 4 The results of regression analysis between the perceived importance of KM preliminary success factors, KM elements of strategies, and KM process effectiveness

Strategy	B	Std. error	Beta	T	Sig.
Measurement	1.179	0196	0335	6.016	0000

$F = 36.191$ ($P = 0.000$); $R^2 = 0.109$.

model. The measurement factor is found to be significantly associated with KM process effectiveness.

Table 5 shows the results of multiple regression analysis among the degree of implementation of KM preliminary success factors, elements of strategies, and KM process effectiveness. The adjusted R -squared multiple correlation coefficients (adjusted R^2) clearly explained 91.1% of the variance associated with the KM process effectiveness. The F -statistic is also highly significant ($F = 368.991$), which confirms that the variables make significant contributions to the fitness of the regression model. K-map, culture, KM Team, measurement, technology, leadership, business strategy, and K-audit factors are found to be significantly associated with KM process effectiveness.

Discussion and implications

This study has achieved its objective where it attempts to use KM process effectiveness as a means to measure the

extent of KM implementation (as judged by the KM preliminary success factors and KM elements of strategies) among organizations that are in the beginning stage of their KM initiatives. As the majority of the organizations surveyed (70.2%) are at the beginning stage of KM implementation, the telecommunication industry selected is deemed to be appropriate. Further, another novelty stems from the adoption of Coukos' (2001) index. The index that was originally used for research universities is proven to be applicable to the corporate settings as well.

Table 3 shows that there are significant differences among all the KM preliminary success factors, KM elements of strategies, and KM processes perceived as important and their level of implementation. With reference to Bohn's (1994) stage of knowledge growth, the findings imply that the Malaysian telecommunication organizations can be positioned at the awareness stage, as the majority of them are aware of the importance of KM but are not fully ready with its implementation. This is not surprising given the fact that many of them have just begun to implement KM, and are therefore unsure of the whole spectrum of KM implementation. This finding has implications for the importance of educating organizational members on what constitutes KM, as well as the usefulness of the KM index in guiding the KM implementation process in organizations.

Table 4 shows that the perceived importance of measurement is the only significant variable, with a Beta value of 0.34 and t -value of 6.02. Similarly, implementation of measurement has also been found to be significantly related to KM process effectiveness. It appears that the more measurement is perceived as important and implemented, the more effective the KM processes will be. This reinforces the importance of having a knowledge-based performance measurement system in organizations, as stressed by many researchers (Carneiro, 2001; Hall, 2001; Chong & Choi, 2005; Chong, 2006a, b). Having a proper measurement system is important, as it is a basis through which it is possible to control, evaluate, and improve knowledge processes (Ahmed *et al.*, 1999) so that organizational objectives can be attained. It enables organizations to track the progress of KM and to determine its benefits and effectiveness (Wong, 2005). The values of performance measurement can therefore ensure an organization's continuous success, as measuring and evaluating organizational knowledge can be helpful in making a company more efficient, more profitable, and more competitive (Edvinsson & Malone, 1997). The findings suggest that a proper performance measurement system should be established and adopted throughout the organization, and that it should not be limited only to measuring employees' knowledge, expertise, and individual performance. Without such organizational-wide performance measures, enthusiasm and support for KM is unlikely to continue.

Table 5 The results of regression analysis between the implementation of KM preliminary success factors, KM elements of strategies, and KM process effectiveness

Strategy	B	Std. error	Beta	T	Sig.
K-map	0.538	0.118	0.202	4.578	0.000
Culture	0.297	0.100	0.105	2.965	0.003
KM team	0.484	0.094	0.187	5.125	0.000
Measurement	0.322	0.102	0.127	3.161	0.002
Technology	0.408	0.074	0.162	5.492	0.000
Leadership	0.319	0.102	0.118	3.134	0.002
Business strategy	0.215	0.089	0.078	2.430	0.016
K-audit	0.275	0.120	0.105	2.290	0.023

$F = 368.991$ ($P = 0.000$); $R^2 = 0.911$.

However, the low adjusted R -squared multiple correlation coefficient (adjusted R^2) value of 10.9% can be explained by the fact that the telecommunication organizations have just started to implement KM, and that they have little understanding of what constitutes KM activities. This is evident from the wide mean differences among all the factors, as shown in Table 3. Another possibility is that they might perceive that KM practices related to measurement have not reached the optimum level for them to fully enjoy the effectiveness of the KM processes. In addition, they might think of some other factors that could contribute to the effectiveness of the KM processes.

When it comes to the actual level of implementation, however, four of the KM preliminary success factors and all of the four KM elements of strategies are found to be related to KM process effectiveness, with a high adjusted R -squared multiple correlation coefficient (adjusted R^2) value of 91.1%. This implies that the implementation of the four KM preliminary success factors (K-map, KM Team, business strategy, and K-audit) together with all the four KM elements of strategies (culture, measurement, technology, and leadership) are very crucial in order to ensure an effective KM process in organizations. To some extent, the results imply that the telecommunication organizations are on the right track, and that they should be informed of this so as to encourage them to continue enhancing their KM practices so that they can reach the stage of complete knowledge, as elucidated by Bohn (1994).

The findings suggest the importance of having a K-map in assisting organizations to better understand the knowledge resources that are available. A K-map helps an organization to visualize the relationships and processes that connect their knowledge resources, which include people, documentations, the value chain, and the like, and thus to compare it across the industry and its competitors. An effective K-map will help in the identification of an organization's opportunities and threats, strengths, and weaknesses, which enables a firm to determine its core and/or distinctive competencies for sustainable competitive advantage. It helps to determine and analyze all forces in the environment that might

have a profound effect on the organization's ability to survive, grow, and be profitable. The weaknesses of competitors will be exploited, and their strengths will thus be bypassed or neutralized. Further, a K-map can also be used to enhance internal capabilities, such as to evaluate and address discrepancies, particularly of what employees know vis-à-vis what they *should* know so that effective training programs can be planned.

This study has identified KM Team as the second-most influential variable. This is not surprising, given that many researchers have recognized teamwork as one of the critical factors for successful KM implementation (Phillips, 1994; Mohrman *et al.*, 1995; Nadkarni, 1995; Geraint, 1998; Greengard, 1998; Choi, 2000; Civi, 2000; Ryan & Prybutok, 2001; Haas, 2002; Chong & Choi, 2005; Chong, 2006a, b). This suggests that the telecommunication organizations should think of establishing KM teams if they want their KM program to be successful. The organizations should be made aware that by creating teams, they create an environment in which knowledge workers of various disciplines can come together and create new knowledge (Binney, 2001). More importantly, committed and dedicated KM team plays an important role in influencing people within the social network to adopt and effectively use the organizational knowledge centers. They will have the responsibility to create and sustain directories for the knowledge centers that are relevant and meaningful to potential users and contributors. They work with innovators and opinion leaders to institutionalize and codify new knowledge in a way that will be useful and understood by organizational users. They tap into new trends, processes, or ideas from different people and from different knowledge centers and directories. This can lead to performance improvements.

Table 5 also shows that technology is the third-most influential variable associated with KM process effectiveness (Beta value = 0.16, t -value = 5.49). This again conforms to the previous literature where information technology (IT) is identified as one of the most critical success factors in successful KM implementation (Covin *et al.*, 1997; Ruikar *et al.*, 2007; Rune & Petter, 2007; Zhang, 2007). This finding makes sense, as the middle

managers are involved in the telecommunication business, and they understand well the importance of IT in supporting their businesses. Technology is facilitating businesses by supporting many knowledge processes that were not possible before. The findings suggest that organizations should be informed of the important role played by technology in knowledge processes, that is, tracking, building, leveraging, using, transferring, and storing collective knowledge, best practices, and lessons learnt. Technology facilitates business by enabling enterprise problem-solving and enhancing the development of business strategies through the creation of opportunities for organizations. All these factors help in improving the overall performance of the organizations.

After measurement, leadership is the fifth-most influential variable associated with the KM process effectiveness, with a Beta value of 0.12 and *t*-value of 3.13. This again corroborates earlier findings, where leadership and commitment of top management is one of the most important factors for a successful knowledge creating and sharing culture (Davenport *et al.*, 1998; Goh, 1998; Van Buren, 1999; Choi, 2000; Martensson, 2000; Truch, 2001; Jarrar, 2002; Sharp, 2003; Chong & Choi, 2005; Chong, 2006a,b; Pillania, 2008). This suggests that the top management of organizations should re-evaluate their roles played in KM. The top management should realize that without their support, the success of KM activities is cumbersome (Civi, 2000). One of their important roles is providing the necessary direction of how to implement and effectively deploy a KM strategy. This includes establishing a conducive knowledge-sharing culture and climate, as well as incentives by which employees will be stimulated and motivated to create, organize, and share knowledge. This will result in the enhancement of creativity and innovation among the organizational members, and thus better organizational performance can be attained. In addition, as many major firms in the world already have strong and effective KM leaders such as Chief Knowledge Officers (CKOs) to oversee their KM programs, it is timely for other organizations to consider this.

Knowledge-friendly culture and K-audit have been identified as the next most influential variables in KM process effectiveness. An egalitarian culture has been found to be one of the most crucial factors in successful KM implementation (De Long *et al.*, 1996; Chase, 1997; Galagan, 1997; Skyrme & Amidon, 1997; Greengard, 1998; Jager, 1999; Wah, 1999; Choi, 2000; Gupta *et al.*, 2000; McDermott & O'Dell, 2001; Ribiere, 2001; Ryan & Prybutok, 2001; Wild *et al.*, 2002; Chong & Choi, 2005; Chong, 2006a,b; Wei *et al.*, 2007; Liebowitz, 2008). This again signifies the importance of cultivating a knowledge-friendly culture, particularly regarding teamwork and the efforts to encourage knowledge creation, sharing, and application. The management should realize that KM only works if the culture of their organizations promotes it. In addition, culture also determines technological and management techniques based on the success of a KM

program. An organization that supports information sharing and knowledge creation among its members, and is committed to including and reconciling multiple viewpoints, is likely to establish effective and efficient processes, as well as to improve organizational life (Levine, 2001).

The finding also suggests that K-audit is a pre-requisite factor for an effective KM program. K-audit helps top managers to thoroughly realize what knowledge organizations need in order for them to sustain their competitive advantage (Dattero *et al.*, 2007). It also helps organizations to identify where knowledge resides within their firms. With reliable collections of knowledge assets, knowledge can be transferred to the respective person at the right time and at the right place with great accuracy when needed, and thus contributes to improved organizational performance.

Finally, business strategy has also been identified as influencing KM process effectiveness (Beta value = 0.78; *t*-value = 2.43). This suggests for understanding among organizations that their KM process effectiveness depends on the link between their business and knowledge strategy. A well-planned strategy is very important as it provides foundations for how these firms can deploy their capabilities and resources to achieve their KM goals. Thus, there must be a fit between organizational missions and objectives with KM strategies. Their strategic contexts help to identify KM initiatives that support their purpose or mission, strengthen their competitive position, and subsequently create values for the shareholders of the firms.

Conclusion

It is widely acknowledged that organization-wide KM programs require significant investments, and will entail major management efforts, as well as behavioural changes throughout the organization over a significant period of time. Hence, it will be difficult for anyone in the organization to get an accurate sense of what is happening, given the likely large scale of activity such as KM, unless systematic efforts are in place to provide reliable information on both the progress and shortfalls in performance. Without measurement, there is an ever-present danger of premature abandonment of successful efforts, or, alternatively, of complacent continuation of unsuccessful efforts when course correction is needed. Without measurement success, enthusiasm, and support for KM is unlikely to continue; organizations are unlikely to be able to determine what works and what does not, and will therefore be unable to make an informed judgment regarding what to continue doing, and what to adjust. Putting in place a system for measuring progress will therefore be an essential step for a sustainable and successful KM program.

The most significant contribution of this study is that it provides an alternative measurement tool in measuring the effectiveness of KM implementation in the early stage of KM implementation. From the analysis, it is obvious

that in order to have an effective and successful KM implementation, organizations must ensure that their KM processes are effective and that they are supported by the KM preliminary success factors and appropriate KM elements of strategies. The presence of and the close interaction between all these practices can result in improved efficiency, better productivity, and increased revenue. This will therefore lead organizations towards achieving long-term benefits and sustainable competitiveness as they progress towards attaining the stage of complete knowledge (Bohn, 1994).

It is hoped that the recommendations provided in this paper allow organizations to obtain a clearer picture of the entire spectrum of KM and how their KM process effectiveness can be measured. The results serve as a foundation for building a cumulative tradition of research in the early stage of KM implementation. From a practical perspective, the findings provide an opportunity for the practitioners to undergo a self-check for the various important KM areas that this research aims to study. This aids in the better understanding of the pre-requisites necessary to succeed, especially in today's competitive environment. As Wiig (1997) opines, such research would help organizations to act as intelligently

as possible to secure their viabilities and overall successes by realizing the best value of their knowledge assets.

As the findings were generated from a convenience sample, it is worth highlighting that the limitation of this paper is that it did not purport to develop a comprehensive picture of the 'best practices' in organizational KM implementation. Rather, it attempts to create a snapshot of an effective preliminary KM process, and to create a basic topology of strategic approaches to knowledge. It therefore establishes a baseline description of preliminary KM implementation and KM practices in organizations. It is hoped that additional research will be undertaken to build upon this work. Further studies are indeed needed to identify other measurement tools (e.g. Bohn's stages of organizational knowledge growth or Holt's measurement of readiness) in measuring the effectiveness of KM implementation, particularly in organizations that are in the early stages of their KM efforts. In addition, the sample is limited to middle managers in the Malaysian telecommunication industry. As such, the results might not be generalizable due to national and cultural differences. A retest of the survey instrument with different industry groups and sectors or in different countries may thus yield interesting insights.

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