

Exploring the Complicated Association between Knowledge Management and Management Accounting Systems with The Directed Acyclic Graph Technique

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ABSTRACT: *The linkage between the implementation of management accounting systems and the adoption of knowledge management is quite complicated. The implementation of management accounting systems is not only the causation, but also a consequence of adopting knowledge management. Nevertheless, this relationship has not been comprehensively explored in prior research. This research tries to investigate the complex link between the implementation of management accounting systems and the adoption of knowledge management by applying the directed acyclic graph technique. The findings reveal that the implementation of management accounting systems is the first factor of the two resulting in the adoption of knowledge management. However, subsequently, adopting knowledge management in business imposes a positive influence back on the implementing level of management accounting systems. The statistical results are useful to researchers and especially to managers by offering them an insight into this complicated relationship. This will help the managers make a better decision on the acceptance of management accounting systems as well as knowledge management in their business in order to obtain competitive advantages over their rivals.*

KEYWORDS: *Implementation of management accounting system; Adoption of knowledge management; Directed acyclic graph technique*

I. INTRODUCTION

In this research, I deal with the two main variables, which are the adoption of knowledge management and the implementation of management accounting systems; in particular, I discuss the complicated relationship between them. Knowledge management is the art of creating value by leveraging intangible assets, which consists of activities in all relevant managerial areas (Salojarvi et al. 2005). It is also considered as the process of converting intellectual assets into enduring value in business. Recently, the business circle begins to take interest in knowledge management. Consequently, it becomes a hot topic in management research. Firms that consistently control and integrate knowledge into business activities to achieve their objectives can achieve superior success (Droge et al. 2003). Knowledge management is also suggested by Darroch (2005) to provide a coordinating mechanism to transform resources into competences. Adopting and performing knowledge management allows managers to enjoy many positive benefits for business (Wong and Aspinwall 2005). However, the adoption of knowledge management in business challenges business managers, because it is not only affected by other factors, especially by the implementation of management accounting systems, but it also determines the implementation of management accounting systems in business. Management accounting systems play an important role in providing managers with timely and exact important information, which helps them to make better decisions on business; as a result their firms can gain competitive advantages over rivals. The implementation of management accounting systems is suggested to have a mutually causal relationship with the adoption of knowledge management (Tayles et al. 2002, 2007; Edwards et al. 2005; Novas et al. 2012). To date, it seems that no research has investigated this mutually causal relationship in the joint model. Hence, we find it necessary to investigate the complex link between the adoption of knowledge management and the implementation of management accounting systems in the joint research model.

This research attempts to employ the directed acyclic graph method to discover which factor of the two main factors “the adoption of knowledge management and the implementation of management accounting systems” is the first to affect the other. To the best of our knowledge, this research is the first to apply the directed acyclic graph method in investigating the mutually causal relationship between the adoption of knowledge management and the implementation of management accounting systems. The findings reveal that the implementation of management accounting systems in business will come first in the mutual relationship between the adoption of knowledge management and the implementation of management accounting systems. This research offers some contributions to both literature and practical sides.

To the literature, this research discusses and justifies the mutual relationship between the adoption of knowledge management and the implementation of management accounting systems in the joint research model. To the practice, the findings offer management researchers with the better understanding of the complex mutual link between the adoption of knowledge management and the implementation of management accounting systems in business. The empirical results are also useful to managers in knowledge management and management accounting by providing them an insight into the mutually causal association between the implementation of management accounting systems and the adoption of knowledge management in business. Accordingly, they can offer better decisions on the implementation of management accounting systems and the adoption of knowledge management in their business, which will enhance their firm success. The research will continue as follows. A literature review will discuss and develop hypotheses in the subsequent section. Then, the research methodology will show how to collect and analyze the data, followed by the empirical results. The final section will provide some conclusions.

II. LITERATURE REVIEW

The complex correlation between the implementation of management accounting systems and the adoption of knowledge management will be explained in this part. The adoption of knowledge management is suggested as a driving force leading to the implementation of management accounting systems in business, but it is determined by the implementing level of management accounting systems in business. This intricate association will be discussed in more detail below. Knowledge is defined by Alavi and Leidner (2001) as being the state of knowing and understanding, an object to be stored and manipulated, a process of applying expertise and a condition of access to information as well as the potential to affect action. It is also referred to as a valuable asset that helps a company to perform business activities superior to others. When a company has the knowledge to do business, it has a core competency, which allows the company to create competitive advantages over their competitors. Sullivan (2000) and Kok (2007) imply that knowledge is constituted from intellectual capital that contains three main important variables, namely human capital, structural capital and customer capital. In addition, Klein and Prusak (1994) define intellectual capital as “useful knowledge”. Following their perspectives, we consider intellectual capital as knowledge. Knowledge management is a process of creating, capturing and using knowledge to improve firm performance (Edwards et al. 2005). It is also considered as a management tool to control organizational knowledge to create competitive advantage and so improve organizational performance (Droge et al. 2003). In addition, Lakshman (2007) refers knowledge management as an organizational capability, which allows its employees to work together to generate, capture, share, and leverage their collective knowledge to boost their performance. Consequently, the adoption of knowledge management is essential to firms in improving organizational performance. Based on previous studies (Gold et al. 2001; Lin and Lee 2005), we define the adoption of knowledge management as the extent to which firms are contented with the adopting levels of knowledge management, resulting in knowledge sharing and application.

In addition to the adoption of knowledge management, the other main variable mentioned in this research is the implementation of management accounting systems in business. Management accounting is crucial to firms in controlling their business activities by offering the firms’ managers with useful information, which will help them deliver better decisions on business and hence they can maintain effective management over firm resources. Management accounting systems are necessary for firms in providing timely and accurate information so as to facilitate the management of costs, pricing decision, as well as the measurement and enhancement of productivity (Johnson and Kaplan 1987). Previous studies (Otley 1999; Fullerton and McWatters 2001) have argued that the new techniques have affected the practices of management accounting in business in which they have turned the focus of management accounting from a simple role of financial control to an intricate role of creating value by better using resources. In addition, Kaplan (1983) emphasizes that management accounting systems play an important role in providing essential information for management planning to enhance firm performance. Nonetheless, Lucas (1997) argues that traditional management accounting systems, such as traditional budgeting, cost volume profit analysis, and variance analysis, which are financially oriented, are not still regarded as a helpful means to offer adequate information for the control of organizational activities in the current dynamic business environment. In addition to the traditional management accounting systems, firms should refer to more advanced management systems- such as activity based costing, total quality management and balanced scorecard- for meeting the requirements of customers as well as other stakeholders. In concurrence with the above-mentioned viewpoints, we refer to the adoption of management accounting systems in business as the extent to which a firm adopts the management accounting systems, including both the above-mentioned traditional and advanced practices for controlling business activities. Accounting is involved in the production,

processing and reporting of information; whereas, management accounting tries to offer managers with information-based intelligence (Bhimani and Roberts 2004). Furthermore, Bhimani and Roberts (2003) claim that management accounting is increasingly deemed to affect knowledge management activities. They also call for more studies on the relationship between management accounting and knowledge management. In addition, Klein and Prusak (1994) refer to intellectual capital as “useful knowledge”; whereas Sullivan (2000) implies that intellectual capital constitutes knowledge. Hence, the connection between management accounting and knowledge management can be regarded similarly to the link between management accounting and intellectual capital. The adoption of management accounting systems are reported to positively affect and be positively affected by the adoption level of intellectual capital (Tayles et al. 2002, 2007; Edwards et al. 2005; Novas et al. 2012). For the effect of management accounting systems on the adoption level of intellectual capital, Novas et al. (2012) in a study “on the relations between management accounting systems and intellectual capital: evidence for Portuguese companies” discuss the role that management accounting systems play in the development of intellectual capital. They find out that management accounting systems put statistically positive effect on the level of implementation in intellectual capital. Similarly, Tayles et al. (2002) when having investigated the relationship between the level of intellectual capital management and the adoption of accounting management systems, suggest that the adoption of accounting management systems supports the management of intellectual capital. As regards the influence of the management level of intellectual capital on the adoption of accounting management systems, it is implied by Edwards et al. (2005) in the research on “knowledge management and its impact on the management accountant” that the level of knowledge management affects the management accountant, and hence affects the adoption of management accounting systems. Additionally, Tayles et al. (2007) also explore the effect of intellectual capital management on the adoption of accounting management systems. Their findings reveal that the level of implementation in intellectual capital has a positive relationship with the adoption of management accounting systems. Based on the above discussions, a suggestion that there is a positively mutual association between the level of intellectual capital management and the adoption of management accounting systems can be reached. Also grounded on the argument by Klein and Prusak (1994) that intellectual capital is defined as “knowledge”, we can posit the two following hypotheses.

H1: The implementation of management accounting systems positively influences the adoption of knowledge management

H2: The implementation of management accounting systems is positively affected by the adoption of knowledge management

As above discussed, the implementation of management accounting systems is both the causation and the consequence of adopting knowledge management in business, nevertheless, which factor comes first in the mutual relationship has not been justified and examined in previous research. This research applies the directed acyclic graph (DAG) model to determine which variable of the two above variables comes first in the effect on the other. Having theoretically discussed the complicated link between the implementation of management accounting systems and the adoption of knowledge management in business, I will explain in detail the research methodology employed in this research to guide the data collection and facilitate the data analysis.

III. RESEARCH METHODOLOGY

3.1. Definition of Variable

This research deals with the two main variables, which are the adoption of knowledge management and the implementation of management accounting systems. The measurement of these two variables for statistical analyses is described below. First, “the adoption of knowledge management” (AKM) is evaluated based on the five items: (1) knowledge sharing between supervisors and subordinates- AKM1, (2) knowledge sharing among colleagues- AKM2, (3) knowledge sharing across the units- AKM3, (4) effective management of different sources and types of knowledge- AKM4 as well as (5) application of knowledge into practical use- AKM5. A five-point scale ranging from 1.dissatisfied, 2.a little dissatisfied, 3.a little satisfied, 4.quite satisfied, and to 5.very satisfied with the achievements in each dimension of knowledge management over the last three years is applied to assess these five items which are modified from Gold et al. (2001) and Lin and Lee (2005). Second, the implementation of management accounting systems (MAS) is measured by using a five-point scale, which ranges from 1.never considering, 2.decided not to introduce, 3.favored to introduce, 4.intended to introduce, to 5.under implementation of management accounting systems, adapted from Cinquini et al. (2008). The six dimensions that are traditional budgeting (MAS1), cost volume profit analysis (MAS2), variance analysis (MAS3), activity based costing (MAS4), total quality management (MAS5) and balanced scorecard (MAS6), are utilized for the main variable “MAS”, adapted from the prior studies (Lucas 1997; Hyvonen 2005; Al-Omiri and Drury 2007).

3.2. Data collection

This research uses the data sample collected from the two Vietnamese Stock Exchanges, composed of 705 firms in total. Of them, 397 firms are listed on Ha Noi Stock Exchange and the other 308 on Ho Chi Minh Stock Exchange. The initial solicitations were used to get replies from main informants implicated in knowledge management and management accounting. I conducted the questionnaire with a manager involved in knowledge management and management accounting for each surveyed firm. The questionnaires were emailed to 475 firms and in person interviewed in the other 230 firms. Of 475 questionnaires that were emailed, only 243 were returned, in which 83 questionnaires did not provide enough information as required and only 160 offered the complete answers. Of the 230 interviews that were planned to be face-to-face performed, only 187 offered the good outcomes for the questionnaire. Finally, 347 good replies with sufficiently required information for this research were obtained.

3.3. Analytic Procedures

For the reliability, this research employs the reliability analysis to test the properties of measurement scales and the items that create the scales. It also applies an exploratory factor analysis to test for construct validity. To investigate which variable of the two main variables in this research comes first in the mutual relationship between them, it performs the directed acyclic graph technique, which differentiate actual cause from spurious cause in a set of data, clearly distinguishes direct cause from indirect cause (Wang 2010). In addition, this method tests the statistical significance for the two hypotheses discussed in this research.

IV. EMPIRICAL RESULTS

The results of the reliability analysis to evaluate the internal reliability of items are given in Table 1. The results from step 1 show that although Cronbach’s Alphas exceed 0.7, the acceptable level stipulated by Nunnally (1978), its item-total correlation of MAS6- balanced scorecard obtains the value of 0.231 less than 0.5, the smallest suggested limit. Hence, MAS6 is removed from the data. Then, the 10 other items go through step 2. The findings reveal that all the ten items achieve the item-total correlation of more than 0.5. Furthermore, the Cronbach’s Alphas are both greater than 0.7. These results imply that the scales achieve sufficient internal reliability. As a result, the ten items (AKM1, AKM2, AKM3, AKM4, AKM5, MAS1, MAS2, MAS3, MAS4 and MAS5) are suitably retained for next analyses. The ten items are dealt with the exploratory factor analysis to evaluate construct validity. The exploratory factor analysis yields the results as exhibited Figure 1 in Table 2, which suppresses the values of factor loadings below 0.35. According to Figure 1, the scree plot, which indicates a plot of the variance associated with each factor- used to determine how many factors should be kept, shows a distinct break at step 2, where the Eigenvalues move from 1.310 to 0.667. This implies that the data is classified into two main factors. Furthermore, Table 2 demonstrates that the five items AKM1, AKM2, AKM3, AKM4, AKM5 converge into the main factor AKM and the five other items congregate into the main factor MAS. In addition, Nunnally (1978) stipulates that in order to achieve the construct validity, the scales have to satisfy the discriminant validity and the convergent validity. To pass the discriminant validity, an item should obtain a cross loading larger than 0.3 and to satisfy the convergent validity, its factor loading should be more than 0.4. In addition, Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) that test whether the partial correlations among the variables are small and Communalities should be greater than 0.7 and 0.5 respectively, proposed by Hair et al. (2010). The results from Table 2 indicate that all the cross loadings are more than 0.3 and all the factor loadings are well over 0.4. Moreover, KMO obtains a value of 0.849 more than the acceptable level of 0.7, while all the communalities exceed the suggested level of 0.5. Additionally, the exploratory factor analysis obtains the statistical significance level of 0.01. The above findings show that all the scales in this research achieve the construct validity. Consequently, all the 10 items are appropriately and reliably retained for further analyses.

Table 1: Results from Reliability Analysis

Step 1:			
Item	Item-total Correlations	Cronbach’s Alpha	N of Items
AKM1	.751	.892	5
AKM2	.733		
AKM3	.696		
AKM4	.780		
AKM5	.739		
MAS1	.634	.810	6
MAS2	.624		
MAS3	.660		
MAS4	.677		
MAS5	.641		
MAS6	.231		

Step 2:

Item	Item-total Correlations	Cronbach's Alpha	N of Items
AKM1	.751	.892	5
AKM2	.733		
AKM3	.696		
AKM4	.780		
AKM5	.739		
MAS1	.664	.852	5
MAS2	.654		
MAS3	.646		
MAS4	.693		
MAS5	.662		

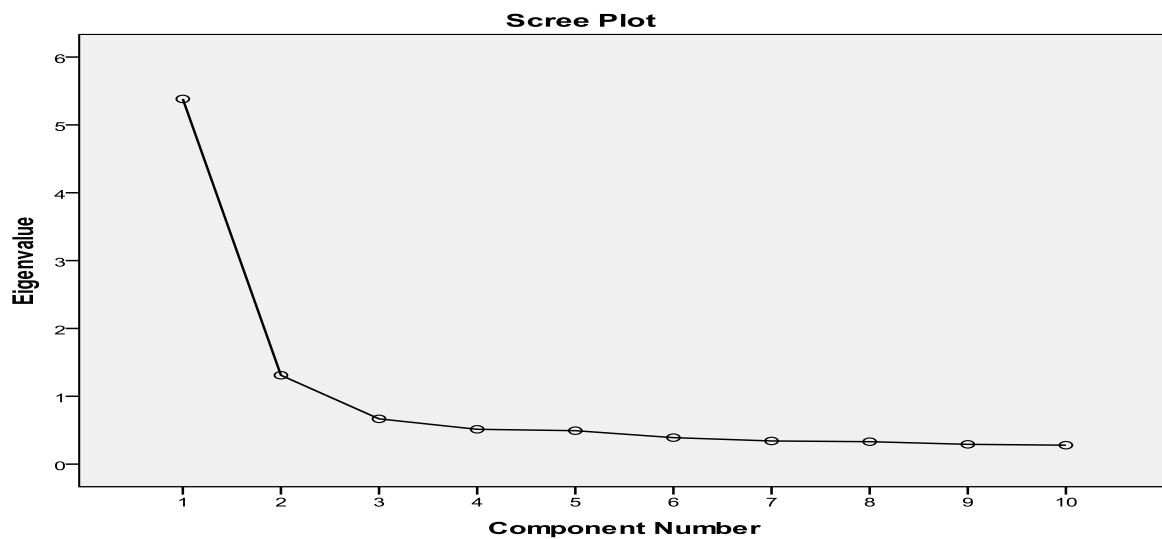


Figure 1: Scree Plot

Table 2: Results from Exploratory Factor Analysis

Item	Factor Loadings		Communalities
	AKM	MAS	
AKM1	.770		.711
AKM2	.766		.691
AKM3	.824		.696
AKM4	.789	.353	.748
AKM5	.801		.705
MAS1		.739	.618
MAS2		.721	.611
MAS3		.758	.616
MAS4		.782	.671
MAS5		.756	.626
N of Items	5	5	$\Sigma=10$
KMO		0.909	
P _{value}		0.000	

The mutual relationship between the implementation of management accounting systems and the adoption of knowledge management is mentioned in various studies (Tayles et al. 2002, 2007; Edwards et al. 2005; Novas et al. 2012). However, none of them has investigated which of them comes first in the relationship. This research applies the directed acyclic graph (DAG) approach to the first direction in the mutual link between the adoption of knowledge management and the implementation of management accounting systems in business. The result is displayed in Figure 2 and Table 3, which reveals that, first the implementation of management accounting systems is the factor leading to the adoption of knowledge management at the 0.01 significance level with the coefficient of 0.6095. However, after being affected by the implementation of management accounting systems, the adoption of knowledge management is also a causation of boosting the

implementing level of management accounting systems in business at the 0.01 significance level with the estimate of 0.5177.



Figure 2: Resulting Model from DAG approach

Table 3: Results from DAG approach

Relationships		Coefficients	Standard Error	<i>t</i> -statistics	<i>P</i> _{value}	Supported
From	To					
MAS	AKM	0.6095	0.0483	12.6294	0.000	H1
AKM	MAS	0.5177	0.0410	12.6294	0.000	H2

In addition, Table 3 also provides statistical evidence for the two hypotheses being tested in this research. The implementation of management accounting systems positively put a statistically significant effect on the adoption of knowledge management. The firms that enjoy the higher level of implementing management accounting systems in their business will tend to adopt knowledge management in order to create competitive advantages over their rivals (H1). Then the adoption of knowledge management in business will boost the implementation of management accounting systems to a higher level (H2).

V. CONCLUSION

Prior studies have examined the association between the implementation of management accounting systems and the adoption of knowledge management. Nonetheless, they have not investigated which factor of the two main variables “between the implementation of management accounting systems and the adoption of knowledge management” is the first factor affecting the other. This paper employs the directed acyclic graph technique to the first direction in the relationship between these two variables. The findings found that firstly the implementation of management accounting systems is the driving force leading to the adoption of knowledge management. Then, the higher adopting level of knowledge management will enhance the implementing level of management accounting systems in business to a higher level. This research offers some contributions to the management literature. It is the first one to provide a clear picture of the relationship between the implementation of management accounting systems and the adoption of knowledge management. At first, the implementation of management accounting systems is the decisive factor of adopting knowledge management, however then the adoption of knowledge management also a factor putting an effect back on the implementation of management accounting systems. This research also is helpful to business managers by providing them a better understanding of the complicated link between the implementation of management accounting systems and the adoption of knowledge management. Accordingly, they can make better decisions on the application of management accounting systems as well as knowledge management in order to develop competitive advantages, which will help them boost up their business performance.

REFERENCES

- [1] Alavi M. and Leidner. D. E., 2001. Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly*, 25(1), 107-136
- [2] Al-Omiri M. and Drury. C., 2007. A Survey of factors influencing the choice of product costing systems in UK organizations. *Management Accounting Research*, 18(4), 399-424
- [3] Bhimani A. and Roberts. H., (2003) Call for papers: Management Accounting and Knowledge Management, *Management Accounting Research*, 14(1), 75–76
- [4] Bhimani A. and Roberts. H. (2004) Management accounting and knowledge management: in search of intelligibility, *Management Accounting Research*, 15(1), 1–4
- [5] Cinquini L., Collini P., Marelli A. and Tenucci A. (2008) An exploration of the factors affecting the diffusion of Advanced Costing techniques: a comparative analysis of two surveys (1996-2005), *31st Annual Congress of the European Accounting Association*, Campus of Erasmus University, Rotterdam, Nederland
- [6] Darroch J., 2005. Knowledge management, innovation and firm performance. *Journal of Knowledge Management*, 9(3), 101 – 115
- [7] Droge C., Claycomb C. and Germain. R., 2003. Does knowledge mediate the effect of context on performance? Some initial evidence. *Decision Sciences*, 34(3), 541–568
- [8] Edwards J. S., Collier P. M. and Shaw. D., 2005. Knowledge Management and Its Impact on the Management Accountant. The Chartered Institute of Management Accountants, London, Great Britain
- [9] Fullerton R. R., and McWatters C. S. (2001) The production performance benefits from JIT implementation, *Journal of Operations Management*, 19(1), 81 – 96
- [10] Gold A. H., Malhotra A. and Segars. A. H., 2001. Knowledge management: An organizational capabilities perspective. *Journal of Management Information System*, 18(1), 185–214
- [11] Hair J. F., Black W. C., Babin B. J. and Anderson. R. E., 2010. *Multivariate Data Analysis*. New Jersey: Prentice Hall
- [12] Hyvonen J., 2005. Adoption and benefits of management accounting systems: Evidence from Finland and Australia. *Advances in International Accounting*, 18, 97–120
- [13] Johnson H. T. and Kaplan R. S. (1987) *Relevance Lost: The Rise and fall of Management Accounting*, Harvard Business School Press: Boston, USA
- [14] Kaplan R. S. (1983) Measuring manufacturing performance: a new challenge for managerial accounting research, *The Accounting Review*, 58(4), 686-705
- [15] Klein, D.A. and Prusak. L., 1994. Characterizing intellectual capital. Working Paper, Centre for Business Innovation, Ernst and Young, London, Great Britain
- [16] Kok A., 2007. Intellectual Capital Management as Part of Knowledge Management Initiatives at Institutions of Higher Learning. *The Electronic Journal of Knowledge Management*, 5(2), 181 – 192
- [17] Lakshman C., 2007. Organizational Knowledge Leadership: A Grounded Theory Approach. *Leadership and Organization Development Journal*, 28(1), 51-75
- [18] Lin H. F. and Lee. G. G., 2005. Impact of organizational learning and knowledge management factors on e-business adoption. *Management Decision*, 43(2), 171–188
- [19] Lucas M., 1997. Standard costing and its role in today's manufacturing environment. *Management Accounting: Magazine for Chartered Management Account*, 75(4), 32-35
- [20] Novas J. C., Sousa A. and Alves. M. C., 2012. On the Relations between Management Accounting Systems and Intellectual Capital: Evidence for Portuguese Companies. CEFAGE-UE, Working Paper 2012/13, Portugal
- [21] Nunnally J. C., 1978. *Psychometric Theory*. New York: McGraw-Hill
- [22] Otley D. T. (1999) Performance management: a framework for management control systems research, *Management Accounting Research*, 10(4), 363–382
- [23] Salojarvi S., Furu P., Sveiby. K. E., 2005. Knowledge management and growth in Finnish SMEs. *Journal of Knowledge Management*, 9(2), 103 - 122
- [24] Sullivan, P. H., 2000. *Value-Driven Intellectual Capital: How to Convert Intangible Corporate Assets into Market Value*. John Wiley and Sons Inc., New York, USA
- [25] Tayles, M., Bramley A., Adshead N. and Farr. J., 2002. Dealing with the management of intellectual capital: the potential role of strategic management accounting. *Accounting, Auditing and Accountability Journal*, 15(2), 251-67
- [26] Tayles M., Pike R. H. and Sofian. S., 2007. Intellectual capital, management accounting practices and corporate performance: Perceptions of managers. *Accounting, Auditing and Accountability Journal*, 20(4), 522-548
- [27] Wang D. H.M. (2010) Corporate investment, financing, and dividend policies in the high-tech industry, *Journal of Business Research*, 63(5), 486–489
- [28] Wong K. Y. and Aspinwall. E., 2005. An empirical study of the important factors for knowledge management adoption in the SME sector. *Journal of Knowledge Management*, 9(3), 64 – 82