

The Adoption of Information and Communications Technology (ICT) for Effective Knowledge Management in the Small and Medium Industry in Malaysia

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Abstract: Many has talked about the definition of knowledge management and the world has been seeing that people are getting more and more aware of the importance of knowledge management (KM). This study will study the factors influencing ICT adoption for companies and investigate the influences of ICT on knowledge management. Questionnaire survey is conducted to study the adoption of ICT for SME's in Malaysia. ICT are classified into three types: data acquisition technologies, information technologies and system technologies. The influencing factors include technological, organizational and environmental characteristics. Effective knowledge management is measured based on tacit and explicit knowledge transfer. It can be found that adopting ICT will provide effective knowledge management and the adoption of ICT is influenced by technological, organizational and environmental characteristics.

Key words: Information and communication technology adoption, effective knowledge management, small and medium industry, Malaysia

INTRODUCTION

The world has evolved into an unpredictable, ever-changing and highly competitive environment. Business survival is therefore highly dependent on how well organizations can adapt to new knowledge that replace rapidly obsolescent ideas and there are challenges that would act as both enablers and constraints to the process of creating, disseminating and applying new knowledge^[1]. People needs to be reminded of the utmost importance of adaptability and flexibility toward new changes for the sake of self survival, it is hoped that with these enlightened self interest and survival instinct, they will be encouraged to follow the trends^[2].

In order to meet the emerging challenge of knowledge economy, organizations need to fully understand what knowledge is to be captured, processed and utilized. It is contended that knowledge can be categorized into publication e.g. books, worldwide web, etc and dialogue, namely what people communicate to each others^[3], which is much in line with the commonly acceptable definition of explicit and tacit knowledge. The creation of knowledge happens through socialization, externalization, combination and internalization according to Nonaka and Takeuchi^[4]. Tacit and explicit knowledge undergo conversion during each of the channels, where the learning process happens. Despite of the facts that organizations have been investing handsomely in technological infrastructures to support the creation,

dissemination and application of knowledge, the returns have not been up to their expectation. KM systems being defined in terms of explicit inputs, tacit variables remaining unexplored, efficacy and strategic deployment of inputs being left unattended when expected results is seen^[1], are contributors to failure in pursuing sustainable business performance in an ever changing business environment. Many companies failed because KM is seen as technical implementation^[5].

Changes that affect business environment such as globalization, transformation of industrial economy into knowledge economy and transformation of enterprise to be more ICT savvy, have brought new threats to Malaysian manufacturing firms. To achieve business excellence in the era of new economy, where globalization has become a seemingly irreversible trend, Malaysian's organizations need to adopt ICT. Therefore research questions of this study are: What are the factors affecting the adoption of ICT for SME's in Malaysia? and Can ICT improve knowledge management? The study is conducted amongst SME's in Malaysia. This industry is interesting because SME's is one of the important sources of products in the Malaysia and knowledge management is one of the key success factors of Malaysia. Moreover, due to the trend of globalization, Malaysian's government delivered several policies to make SME's become a global business center. Many SME's in Malaysia begin to adopt ICT of global business policies. The next section illustrates a summary in ICT and knowledge management,

while section three introduces the antecedents of adopting ICT. A description of the research design and data collection in section four, leads us to an analysis of the results and a discussion of the findings that are presented in section five. This is followed by the conclusions and research's implications.

INFORMATION AND COMMUNICATION TECHNOLOGY AND EFFECTIVE KNOWLEDGE MANAGEMENT

Information and Communication Technology (ICT): Hu, *et al.*,^[6] points out that technologies barrier is once a critical road block in knowledge transfer, today the main barrier is people being unable to digest the over abundance of information they have at their finger tips,^[7] agrees with this difficulty in selecting the right information and transform it into useful knowledge. This prohibits knowledge management according to Hu *et al.*,^[6] therefore ICT must help filter unrelated data and extract only those useful for decision-making at each level. The advent of ICT makes old methods of managing knowledge obsolete. Laudon and Laudon^[8] categorize adoption level of ICT according to organizational levels(Table 1). Senior managers, functional managers, knowledge workers and operational staff use different types of information technology (codification of explicit knowledge) to ease their day-to-day operational needs; while communications technology is basically used through out the organization for networking([personalization of tacit knowledge]), in line with what^[9] state, that information technologies help capture and organize explicit knowledge, while communications technologies encourage networking to transfer tacit knowledge. Arora^[10] reinforces this by asserting that the role of ICT is to facilitate knowledge transfer.

Knowledge management: Knowledge management, by the innovative capabilities it confers to firms is crucial to their competitiveness. This message has been hammered during the 1990's in the business and information science press has now found its way in the more restrictive circle of management research. A well-established vein of

research is based on the resource theory and proposes a knowledge-centered vision of the firm^[11] An analysis of the research on the knowledge management shows that the evolution of knowledge management practices cannot be isolated from the ICT in the firm. Far from being limited to the implementation of technical tools, the capacity of organizations to manage knowledge is rather linked to human factors. The major issue is to change the individual behaviors within a favorable organizational context. The information system rather appears as a catalyst than as the core of knowledge management.

The use of ICT act an important facilitating factor in effective knowledge management. ICT allow information storage, its treatment and its circulation^[12]. For instance, the automation of tasks within a workflow system generates a flux of electronic documents that constitutes essential source for organizational memory. Thanks to knowledge databases, Intranet applications, collaborative work tools, the storage, circulation and sharing or knowledge are considerably eased. It is also important to underline the necessary adaptation of the technical tool to the organizational context^[13]. The knowledge management thus depends on the way technologies are implemented. Indeed, if a tool is to be useful and performing, it must above all take charge of the complex function of delivering a useful knowledge in an explicit form. This alchemy is only possible if the tools connect well to the tacit knowledge of the user and offers something new or interesting to this person^[13].

The knowledge management tool can only be conceived if each actor within the organization really adopts this tool, which is possible only if he/she is confident with the use of ICT within the organization. The adoption of ICT gives a good account of this preoccupation (Boynton, Zud and Jacobs, 1994). ICT adoption can be defined as: the shared, enduring perceptions of salient aspects of the ICT work environment. A favorable ICT adoption appears as an important factor in the success of a knowledge management project.

Table 1: Adoption Level of ICT

Level	Enabling technologies	Examples
Strategic	Executive support systems	5-Year Sales trend forecasting, operating plan and budget forecasting; profit planning, manpower planning, etc.
Management	Management information systems, decision support systems	sales region analysis, inventory control, production scheduling, cost analysis, etc.
Knowledge	Knowledge work systems, Office automation systems	engineering work stations, graphics work stations, word processing, etc.
Operational	Transaction Processing Systems	Order Processing/Tracking, Material Movement Controls, Cash Management, Payroll, Employee Record keeping, etc.
Company wide	Communication systems	E-Mails, Video conferencing, voice mails, internets, intranets, etc.

Relationships between Adoption Level of ICT and Knowledge Management: The world has recently been seeing that people are getting more and more aware of the importance of knowledge management and its difference with adoption of ICT. Gundry^[3] asserts that what people read, see, hear or feel is not knowledge; it is only a medium, which we rely on to transfer knowledge. The medium of transferring knowledge therefore must add value to the business. Instead of disseminating only information, the process (of relying on medium to transfer knowledge) needs to be capable of decoding the raw information and transforming it into knowledge needed. In fact computer applications have been addressing certain aspects of knowledge transfer for years before the ICT advanced^[14]. With the advancement of ICT, Arora^[10] argues that technology helps in transferring tacit to explicit (externalization) and followed by transfer of explicit to tacit (internalization). This seems to be true when people are engaging in electronic face-to-face networking to replace the traditional physical face-to-face meeting.

Due to quickening global competition and the need for cycle time reduction, competitive edge of organization depends on a more efficient knowledge transfer^[14]. To achieve this end, many organizations have been investing tremendously in technological infrastructures to support knowledge transfer. The returns have not been up to their expectation. Arora^[10] argues that these companies failed because knowledge transfer had been heavily relied on technology implementation. Malhotra^[1] perceives that technology has pacified people and reliance on it reduced their performance, these failures are due to knowledge transfer being defined in terms of explicit inputs, while tacit variables remaining unexplored and efficacy and strategic deployment of inputs being left unattended. On the role of technologies,^[15] argues that repeated and routine solutions (structured explicit knowledge) should be captured and automated through the use of ICT while unstructured solutions needs more tacit knowledge.

These literatures bring to a deduction that, extent of knowledge management is moderated by adoption of ICT; ICT may not be the absolute solutions and the former is not exclusively dependent on the latter. In other words, the role of ICT in knowledge management should be seen as facilitating, not as a pre-requisite. This argument can further be justified by^[16], who states that technologies provide human connectivity, access to knowledge and facilitate its transfer; it is especially useful for global business or a geographically scattered customer base. However Smith 2001^[7] conclusions suggest further investigation into this area: Wah concludes that there are two distinct fractions on the roles of technologies in knowledge transfer: 1) technology is

not the answer, organizational behavior and individual socialization determines extent of knowledge transfer; and contrarily, 2) technology is solutions. While Wah postulates that technologies are enablers but will not get anything out of one's head, implying that technologies are good in enhancing effectiveness of knowledge management. To complement various arguments in literatures, this study looks into the roles of ICT empirically, in relation to the effective knowledge management.

Based on the above discussions, the following hypothesis is proposed:

H1: Companies with a more favorable attitude toward the adoption of ICT will attain effective knowledge management.

ANTECEDENTS OF INFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION

Many researches study technology adoption. Classify variables affecting technology adoption into individual, task-related, innovation-related, organizational and environmental characteristics. Tornatzky and Fleischer^[17] suggest that adoption of nIT is affected by technological, organizational and environmental context. Patterson *et al.*,^[18] indicate that technology adoption is affected by organizational size, structure and performance, transaction climate, member pressure and environmental uncertainty. Scupola^[14] use technological, organizational and environmental characteristics to explain the adoption of Internet commerce. We will investigate the influence of technological, organizational and environmental characteristics on the adoption of ICT. The individual characteristic is not considered in this study.

Technological characteristics: Tsai and Ghoshal^[19] indicate that an organization will have higher innovative capability when knowledge can be shared more easily within the organization. Technological innovation can be advanced when the technology has higher transferability. The transferability of technology is determined by the explicitness of technology. It is more easily to transfer or share technological knowledge with higher explicitness^[20,21]. In addition to the explicitness of the technology, how the technology fits with the technologies that a firm already possesses will also be another important technological characteristic^[17,21,22] find that the cumulative nature of technologies will influence the innovation in technologies. Grant *et al.*,^[20-24] also conclude that an organization with rich experiences in the application or adoption of related technologies will have higher ability in technological innovation. Therefore the following hypothesis is proposed:

H2a: The more the explicitness of the ICT, the more likely that the company will adopt the ICT.

H2b: The more the accumulation of the ICT, the more likely that the company will adopt the ICT.

Organizational characteristics: Certain features of organizations themselves, including structures, climates and cultures of organizations, will influence the adoption of innovative technologies^[25,26,27]. Amabile^[27] indicate that management skills, organizational encouragement for innovation and support of innovation resources would help the improvement of organizational innovation. Tornatzky and Fleischer^[17] suggest that informal linkages among employees, human resource quality, top manager's leadership behavior and the amount of internal slack resources would significantly influence the adoption of technological innovation. A firm with higher quality of human resources such as better education or training will have higher ability in technological innovation. Therefore the following hypothesis is proposed:

H3a: The more the organizational encouragement, the more likely that the company will adopt the ICT.

H3b: The higher the human resource quality, the more likely that the company will adopt the ICT.

Environmental characteristics: Miles and Snow^[28] indicate that organizations will pay more attention on innovation when they face environments with higher instability and chaos. Kimberly and Evanisko^[25] conclude that environmental complexity and uncertainty will influence organizational innovation for hospitals. Damanpour^[29] indicate that environments with high uncertainties will have positive influence on the organizational innovation. Zhu and Weyant^[30] suggest that demand uncertainty tends to increase firm's incentive to adopt new technologies. Governmental support is another important factor for technology adoption. Government through regulation can both encourage and discourage technology adoption^[14,17]. Government can provide financial incentives, pilot projects and tax breaks to stimulate technology adoption for SME's. Therefore the following hypothesis is proposed:

H4a: The more the environmental uncertainty, the more likely that the company will adopt ICT.

H4b: The more the governmental support, the more likely that the company will adopt the ICT.

RESEARCH METHODOLOGY

Based on the above discussions, the research framework is shown in Fig. 1. The data to test our

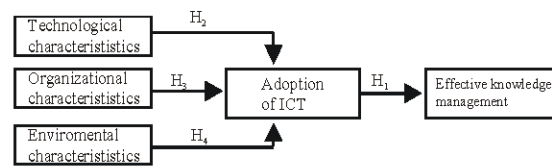


Fig. 1: Research framework

hypotheses come from a mail survey of SME's in Malaysia. The sample frame was drawn from members of the SMIDEC in Malaysia. Four hundred questionnaires were mailed to the sampled companies in 2004. Questionnaires were mailed to the general managers of the sampled SME's as these target respondents were assumed to have a good knowledge of the adoption of ICT and knowledge management of their companies. In total, 122 completed questionnaires were returned. Of these respondents, 8 uncompleted or unconfident questionnaires were excluded. The overall response rate is 28.5%.

The measured scales were submitted to factor analysis and technological characteristics are factorized by explicitness of technology and accumulation of technology; organizational characteristics are factorized by organizational encouragement and human resource quality; environmental characteristics are factorized by environmental uncertainty and governmental support; knowledge management are factorized by tacit knowledge transfer and explicit knowledge transfer. The reliability analysis was also conducted and the smallest value of Cronbach's α for this study is 0.6742. This implies that the sampling results are reliable.

RESULTS AND DISCUSSIONS

The method of regression analysis was used to examine the influence of adopting ICT on effective knowledge management. Company history, number of employee and capital size are taken as control variables in the regression analysis. Based on the results shown in Table 1, it can be found that control variables do not affect the knowledge management; however, the adoption of ICT exhibits significantly positive influences on knowledge management this means that the hypothesis H1 is not rejected. SME's with a more favorable attitude toward adopting ICT will attain effective knowledge management.

In order to find the influence of technological, organizational and environmental characteristics on the adoption of ICT, the method of regression analysis was also used. Company history, number of employee and capital size are also taken as the control variables in the regression analysis. Based on the results shown in Table 2, it can be found that control variables do not have

Table 2: Standardized regression results for the knowledge management

Predictors	Dependent variables: effective knowledge management			
	Model 1		Model 2	
	Coefficient	t	Coefficient	t
Company history	0.027	0.901	0.017	0.898
Number of employee	0.021	0.628	0.025	0.706
Capital size	0.039	0.857	0.031	0.634
ICT adoption			0.192	4.052**
R ²	0.093		0.503	
adj R ²	0.089		0.447	
F	0.914		6.279**	

+ p<0.1 * p<0.05 ** p<0.01

Table 3: Standardized regression results for the antecedents of ICT adoption

Predictors	Dependent variables: Adoption of ICT			
	Model 1		Model 2	
	Coefficient	t	Coefficient	t
Company history	0.021	0.992	0.014	0.813
Number of employee	0.039	1.015	0.033	0.922
Capital size	0.044	1.371	0.039	1.325
Explicitness of technology			0.178	3.685**
Accumulation of technology			0.152	1.687*
Organizational encouragement			0.193	2.409*
Human resource quality			0.171	2.214*
Environmental uncertainty			0.127	1.017
Governmental support			0.186	2.512*
R ²	0.103		0.615	
adj R ²	0.098		0.524	
F	1.048		8.438**	

+ p<0.1 * p<0.05 ** p<0.01

significant influences on the ICT adoption; however, explicitness of technology, accumulation of technology, organizational encouragement, human resource quality and governmental support exhibit significant influence on the ICT adoption. This means that hypotheses, H2a, H2b, H3a, H3b and H4b, are not rejected, but the hypothesis H4a is rejected. Because most SME's in Malaysia is small and medium size, providing knowledge management for employees varying requirements is their major competence and environmental uncertainty is also common to them. Therefore environmental uncertainty does not significantly influence the adoption of ICT for SME's in Malaysia.

It can be concluded that higher explicitness and accumulation of technology can help the transfer of technological knowledge within the organization and raise the capability of technological innovation. Organizational encouragement can give employees motivation and support to adopt ICT. High quality of human resources means that employees are capable of implementing new technologies. Governmental support can encourage and guide SME's to innovate in technologies. The government can draw up public policies to encourage private sector performance improvements through trade and intermodal policies, infrastructure investment and

development, creative financing arrangements, tax incentives, safety regulation, public/private partnerships and special programs and projects^[31].

CONCLUSIONS

This study has investigated the adoption of ICT in SME's in Malaysia. Many SME's in Malaysia begin to place emphases on adopting ICT. It is found that SME's with a more favorable attitude toward adopting ICT will attain effective knowledge management. The factors affecting technology adoption can be divided into technological, organizational and environmental characteristics and they have positive influences on the adoption of ICT. Moreover, it is found that higher explicitness and accumulation of technology can help the transfer of technological knowledge within the organization and can raise the capability to adopt ICT. SME's can increase their technology adoption abilities by encouraging or supporting their employees to adopt ICT as well as by training and educating their employees to become intelligent workers. Technology adoption will also be reinforced if the government can provide various supports and resources and continuous encouragement policies. The government can provide financial incentives, pilot projects and tax breaks to stimulate SME's to adopt ICT.

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