THE INFLUENCE OF SME OWNERS' CHARACTERISTICS ON TECHNOLOGY ADOPTION

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ABSTRACT

Technology adoption decisions among SMEs are believed to be inextricably linked to their owners who serve as key decision-makers in managing the business. Accordingly, this study investigates the relationship between SME owners' characteristics (innovativeness, information systems (IS) knowledge and technology usage) and the adoption of technology in SMEs. Data was gathered from 544 SME owners of manufacturing and manufacturing-related companies involved in various industries scattered throughout Malaysia. The Partial Least Squares analysis revealed that owners' IS knowledge and technology usage significantly influence technology adoption. However, owners' innovativeness did not demonstrate any impact on technology adoption. Implications of the findings and suggestions for future research are further discussed in the paper.

Keywords*: Small and medium enterprises, SMEs, Technology adoption, Owner, Innovativeness, IS knowledge, Technology usage.*

Introduction:

Small and medium enterprises (SMEs) form a dynamic and vital part of a country's economy due to their role as an important generator of employment and growth. Generally, SMEs account for the largest proportion of established businesses in most of the developing nations (Marimuthu et al., 2011). In Malaysia, SMEs play a significant role in the country's economic development, particularly in the manufacturing sector. They account for about 99% of total business establishments, contributing to 31% of the nation's Gross Domestic Product (GDP), 19% to the country's total exports and 56% to total employment in the country (National SME Development Council, 2010). Since 2005, SMEs' growth in the Malaysian manufacturing sector has outperformed the overall sector, with SMEs' share to overall value added of the manufacturing sector rising from 29.3% in 2005 to 30.4% in 2009 (National SME Development Council, 2010).

As Malaysia's strength lies in its ability to attract foreign direct investments (FDI) for its manufacturing sector, it is ideal that a strong SME base be present to support the large presence of foreign multinational companies (MNCs). The success of SMEs is determined by their ability to absorb technology in their manufacturing operations. Given that MNCs with global operations are actively outsourcing most of their non-core requirements, the opportunity for SMEs to be suppliers to those MNCs will very much depend on their technological capability and ability to meet specified manufacturing standards in cost, quality and delivery. Hence, the delay in adopting new technologies could, in certain sectors, affect the very survival of these SME companies (McMillan, 1987). In addition to ensuring their longevity in the industry, the

ability of SMEs to adopt and utilize technology will enable them to be more flexible, dynamic and responsive.

Technology can help SMEs gain competitive advantage primarily in two ways – firstly by supporting the business processes to produce products or services which are cost effective; and secondly by saving time through the improvement of productive yields (Hussain & Phatak, 2002). Aside from the benefits that new technologies may provide with respect to increased manufacturing capabilities and quality of service (Lefebvre et al., 1991; Meredith, 1987), technology adoption for manufacturing SMEs can be considered as a strategic activity (Shrivastava & Grant, 1985) because of the generally large capital investments and the technically competent manpower required to acquire and implement them (Lefebvre & Lefebvre, 1992).

While large businesses have been using computers and other IT products for some time, small businesses have been relatively slower in adopting these technological innovations (Thong & Yap, 1995). Various studies have been conducted to understand the factors that drive technology adoption among organizations. Some broad generalizations were drawn from those studies, in that technology adoption among organizations could be propelled by the 1) characteristics of the firm; 2) competitiveness and management strategies of the firm; 3) influences of internal and external parties on the adoption decision process; and 4) characteristics of the technology adopted (Lefebvre et al., 1991) as well as; 5) perceived benefits and 6) organizational readiness (Iacovou et al., 1995). The factors mentioned could well be realistic predictors of technology adoption for most types of organizations including SMEs. However, when investigating technology adoption in the context of SMEs, there exists a compelling need to focus on the owner of the SME who also plays an active role in managing the business.

The link between the SME owners and their firms is inextricably close. The SME owner is usually identified as the entrepreneur because of his/her role in starting the venture, running the business, and being responsible to a large extent for its failure or success. This implies that the fate of an SME is intricately-related to the capability, skills, personality and motivation of the entrepreneur-owner. Marcati et al. (2008) stated that the role of entrepreneurs in fostering innovation is especially important since innovation-related research has consistently shown that entrepreneurs are the main locus and driver of innovation. Regarded as the source for managerial sponsorship for technological projects (Maidique, 1980) and the central figure in successful technological innovation (Roberts, 1969), the entrepreneur-owner is the one within the company who actively fosters the adoption of innovations (Lefebvre & Lefebvre, 1992). The adoption of new technologies is considered as one form of innovation (Pennings, 1987).

Although it has been shown that the owner-entrepreneur's influence on the adoption of new technologies is paramount (Lefebvre & Lefebvre, 1992), much remains to be proven empirically about the legitimacy of this premise across diverse contexts of study. Would this premise hold across SMEs in developing countries like Malaysia where the business culture differs from that in the United States or other European countries? In view of this need, the objective of this study is to examine the influence of owners' characteristics on the adoption of technologies in SMEs within Malaysia. Three owners' characteristics, namely, their innovativeness, information systems (IS) knowledge and technology usage which are believed to influence the adoption of technology are examined in this study.

Research Model and Hypotheses:

Researchers (e.g., Rogers & Shoemaker, 1971; Zaltman et al., 1973; Cooper & Zmud, 1990) have defined innovation as an idea, a product, a program or a technology that is new to the adopting unit. The adoption of innovation is a process that results in the introduction and use of a new product, process, or practice within an organization (Kimberly & Evanisko,1981; Damanpour & Wischnevsky, 2006). In this study, the innovation in question refers to technology used in organizations. Hence, in the context of this study, technology adoption is identified as the use of hardware and software applications to support manufacturing operations, organizational management and decision-making processes (Thong & Yap, 1995).

One factor known to be important in technology adoption decisions within organizations is the influence of the CEOs (Lefebvre & Lefebvre, 1992). The impact of the CEO is especially stronger in small businesses. This is because in SMEs, the CEO is usually the owner, founder and the entrepreneur behind the business. Such individuals are involved in all decision making in the organization, thus their characteristics impacts adoption decision processes (Hameed et al., 2012). Lefebvre et al. (1989) noted that the CEO is usually not only the first person to think of introducing information technologies but also the one who makes the actual decision to computerize the company. Roberts and Hauptman (1986) demonstrated that founders' characteristics such as professional background and experience were associated with the technological sophistication of a firm's products, thereby indicating that the founders influenced the technology adoption decisions in the companies. Thong and Yap (1995) examined CEO innovativeness, CEO attitude towards change and CEO IT knowledge amongst others in information technology adoption of small businesses. Jarvenpaa and Ives (1991) surveyed the participation and involvement of top management executives like CEOs in the management of information technology. Al-Qirim (2007) found that CEO's innovativeness determines external-email adoption while CEO's involvement determines Intranet adoption. On the other hand, Damanpour and Schneider (2006) investigated the impact of managers' background characteristics such as age, gender, education level and

tenure in position and attitude towards innovation on technology adoption decisions.

IS knowledge:

Many organizations reject the idea that technology could be useful to their business because they are unaware of the benefits that technology could potentially offer (Thong, 1999). Niedleman (1979) asserted that the lack of IT knowledge resulted in the failure of European small businesses to utilize IT. In a study of Singaporean small businesses, Gable and Raman (1992) found that CEOs in such businesses tend to lack basic knowledge and awareness of IT, thus leading to the low adoption of technology in these businesses. Though it may not be necessary for the CEO to be an expert on the "hows" of technology, he or she should at least become familiar with what the technology can do for the firm (Jarvenpaa & Ives, 1991). If these CEOs could be educated on the benefits of IT, they may be more willing to adopt such technology (Thong & Yap, 1995). CEOs with more knowledge of the technological innovation are significantly more likely to implement an aggressive technology adoption policy (Ettlie, 1990). Considering the fact that in SMEs, the CEO is usually the owner-manager of the business, therefore, it is proposed that:

H1: *SMEs with owners who are more knowledgeable about IS are more likely to adopt technology.*

Innovativeness:

Innovativeness is associated with the openness and creativity of individuals as well as their readiness to follow new ways (Marcati et al., 2008). It concerns the creativity in cognitive thinking, that is, the way by which individuals mentally process information, take decisions, and solve problems. The cognitive creativity of individuals determines their openness towards new ideas and changes in general as well as their proneness to make original decisions independently of others' opinions (Foxall, 1995; Hurt et al., 1977; Midgley & Dowling, 1978). An adaptive SME owner would seek solutions that have already been tried and understood whereas an innovative one would prefer solutions that are different, new and are therefore risky (Kirton, 1984). As a manager or CEO in the company, the owner is an important figure who is crucial in determining the innovative stance of an SME. Without the owner-manager's will to innovate, there is little that other members of the business can do to advocate the adoption of technology within the company (Thong & Yap, 1995). For this reason, it is hypothesized that:

H2: *SMEs with more innovative owners are more likely to adopt technology.*

Usage of technology:

For the successful technology adoption to take place within the company, owner-managers need to first set a good example by being users of technology themselves. According to researchers (e.g., Lederer & Mendelow, 1988; Rifkin, 1989), the CEO's personal participation in IT management contributes to the implementation of information technology in a firm. Participation is meant by the CEO's investment of some of his or her time and energy in IT-related matters (Jarvenpaa & Ives, 1991). It is said that the CEO who actively participates in and directs first hand the implementation of technology in the company can provide his or her firm with substantial competitive leverage (Lane, 1985). In his study on 93 small businesses, DeLone (1988) found that if small businesses wished to succeed in their computer use, the chief executives must be willing to commit substantial personal energy to the realization of that aim. Hence, CEOs of SMEs who are also the owner-managers of the companies should realize that their direct participation with technology usage will directly affect decisions surrounding technology adoption, prompting the following assertion:

H3: *SMEs with owners who have higher usage of technology are more likely to adopt technology.*

Methodology:

Sample:

Manufacturing is an undeniably important sector for many countries due to its significant contribution to the economy and creation of enormous job prospects. In Malaysia, it is the largest contributor to the national economy (BNM, 2011). Hence, data was gathered from owners of manufacturing and manufacturing-related services SMEs scattered throughout the country. The manufacturing and manufacturing-related services SMEs encompassed various industries such as food and beverages, electrical and electronics, wood and wood products, rubber and plastic products, machinery and equipment, transportation, textile and apparels, chemical and chemical products, metallic as well as non-metallic mineral products and others.

Out of the 1500 surveys sent out by mail, only 544 responses were completed and returned, resulting in a response rate of 36.26%. The profile of the owners who responded to the survey is listed in Table 1.

Table 1: Profile of SME Owners

Characteristic	Categories	Frequency	%
Gender	Male	326	59.9
	Female	218	40.1
Age	Below 25 years	62	11.4
	26 – 35 years	224	41.2
	36 – 45 years	186	34.2
	46 – 55 years	56	10.3
	More than 55 years	16	2.9
Race	Malay	202	37.1
	Chinese	310	57.0
	Indian	24	4.4
	Others	8	1.5
Education	PhD	4	0.7
	Masters	48	8.8
	Degree	270	49.6

	Diploma	118	21.7
	Others	104	19.1
Type of Business	Sole proprietorship	154	28.3
	Partnership	56	10.3
	Private limited	314	57.7
	Others	20	3.7

Half of the owners' SMEs (51.1%) have been in operations for around 1 to 10 years while the other half (48.9%) were long timers who have been in the industry for more than 10 years. Majority of the owners' SMEs have 1 to 50 employees (53.3%) while another 46.7% have more than 50 employees. Most of them (71.7%) operate domestically without any foreign exporting activities. The use of technology is apparent within the SMEs as a large percentage of them (86.8%) are computerized.

Measures:

The items on owner's IS knowledge were adapted from Thong (1999) whereas items on innovativeness were adapted from Thong & Yap (1995). Items of these two variables were measured on a 7-point Likert scale ranging from 1=strongly disagree to 7=strongly agree. On the other hand, items measuring the extent of the owner's technology usage were self-developed and were anchored on a 7-point Likert scale which ranged from 1=not at all to 7=to a great extent. In order to assess technology adoption among the SMEs, interviews were first conducted with 5 owner/managers of manufacturing and manufacturing-related services SMEs to generate a list of possible and relevant technologies adopted by SMEs. The interviews resulted in a list of 46 types of technologies classified as either hard technology or soft technology. For hard technology, the orchestration of technology is embedded in machinery and equipment. There were 23 items measuring this component of technology. Example of items includes computer-aided design (CAD), computer-aided manufacturing (CAM), numerical control machines, automated production line, pick and place robots, and flexible manufacturing system. In contrast, soft technology involves an active orchestration of phenomena by people.

It is mostly in the form of programs/philosophies/behavioural approaches (Aggarwal, 1995). There were 23 items measuring this component of technology, which includes JIT - just-in-time, TQM – total quality management, CRM – customer relationship management and forecasting or sales analysis software. Respondents were asked if they adopted any of the hard and soft technologies in their company, by selecting either 0=no (do not adopt) or 1=yes (adopt).

Analysis & Results:

Partial least squares (PLS) technique through the SmartPLS 2.0 software (Ringle et al., 2005) was used to analyse the data collected as it can accommodate both reflective and formative measures in its analysis of the research model in question. A two-step analysis approach was applied in analyzing the data, whereby the measurement model is first estimated prior to assessing the structural model (Anderson & Gerbing, 1988). In addition, the bootstrapping method (200 resamples) was done to determine the significance levels for loadings, weights and path coefficients (Chin, 1998).

Measurement Model:

The measurement model consists of relationships among the latent variables and their (item) indicators. Construct validity which concerns the extent to which the indicators reflect their underlying constructs (latent variables) must first be established for the measurement model before analyzing the structural model. As a condition for establishing construct validity, items in the measurement model need to demonstrate sufficient convergent and discriminant validity.

Hair et al. (2006) recommends using factor loadings, composite reliability and average variance extracted (AVE) to assess convergent validity. Table 2 lists the indicator loadings/weights, reliabilities and AVE of all the items that can be used to establish convergent validity. Item loadings of all reflective indicators surpassed the required cut-off level of 0.60 suggested by Bagozzi and Yi (1988). The composite reliability values for all reflective constructs exceeded the threshold value of 0.70 recommended by Hair et al. (2006) while the AVEs for each construct were over the recommended value of 0.50 suggested by Fornell and Larcker (1981). In short, convergent validity was established.

Although indicator loadings, reliabilities and AVE are used to assess convergent validity for reflective constructs, they are not appropriate or meaningful for formative constructs (Bollen & Lennox, 1991; Diamantopoulos & Winklhofer, 2001). For formative constructs, the focus should be on the weights of each measure instead of the indicator loadings (Petter et al., 2007). The t-values of each item weight should be significant in order to achieve indicator validity, a condition that refers to the importance of each individual indicator of the related formative construct (Andreev et al., 2009; MacKenzie et al., 2005).

In this study, adoption was considered as a construct with formative indicators because both indicators, i.e. hard technology adoption and soft technology adoption define and form the essence underlying the technology adoption construct. From the bootstrapping procedure, the weights of both hard technology adoption ($t=3.456$, $p<0.01$) and soft technology adoption ($t=5.683$, $p<0.01$) were found to be significant, indicating sufficient indicator validity had been achieved.

Table 2: Convergent Validity

Item indicators	Type of Measure	Item Loadings/Weights §	Composite Reliability	Cronbach Alpha	AVE
IS Knowledge					
I consider the owner/myself as computer literate.		0.949			
I would rate my/owner's understanding of computers as very good compared with other owners of small companies in the same industry.	Reflective	0.903	0.923	0.838	0.858
Innovativeness					
The owner has original ideas.		0.921			
The owner would create something new than improve an existing thing.	Reflective	0.872	0.915	0.867	0.782
The owner often risks doing things differently.		0.857			
Technology Usage					
Owner's use of e-mail to communicate with employees.		0.772			
Owner's use of e-mail to communicate with customers.	Reflective	0.833	0.898	0.849	0.687
Owner's use of online resources to find information relevant to company.		0.884			
Owner's use of a computer in the company.		0.822			
Technology Adoption	Formative		-	-	-
Hard technology*		-1.321			
Soft technology*		1.764			

§ Loadings are for reflective items while weights are for formative items

† Item dropped as its loading did not exceed the cut-off requirement of 0.50 set by Hair et al. (2006).

* The items are summated scores of adoption according to their respective classification, HTA (hard technology adoption) and STA (soft technology adoption).

Discriminant validity is the degree to which the measures of different constructs are distinct from one another. It can be tested for both the reflective and formative constructs and is assessed by comparing the correlations between constructs with the square root of the AVE for a construct (Fornell & Larcker, 1981). Based on Table 3, the elements in the matrix diagonals, representing the square root of the AVEs, are greater in all cases than the off-diagonal elements in their corresponding row and column, indicating discriminant validity had been achieved.

Table 3: Discriminant Validity

Constructs	ISK	INN	USE	ADO
IS Knowledge (ISK)	**0.926**			
Innovativeness (INN)	0.530	**0.884**		
Technology Usage (USE)	0.482	0.335	**0.829**	
Technology Adoption (ADO)	0.229	0.102	0.325	-

Note: 1) Diagonals represent the square root of the AVEs while the off-diagonal entries represent the correlations between constructs; 2) N/A – square root of the AVE is not available for formative constructs.

Structural Model:

Once the measurement model was assessed, the structural model was then analyzed. The structural model comprises of the hypothesized relationship between exogenous and endogenous variables in the model. Figure 1 depicts the results for the structural model. The R^2 value obtained from the analysis was 0.115, indicating that 11.5% of variance in technology adoption can be explained by all the exogenous variables in the model. Both IS knowledge (b=0.123, p<0.01) and technology usage (b=0.285, p<0.01) were found to have a significant effect on technology adoption. Between the two variables, technology usage was shown to exhibit a stronger influence on technology adoption in comparison to IS knowledge. However, innovativeness was not found to significantly affect technology adoption. Therefore, only H1 and H3 were supported.

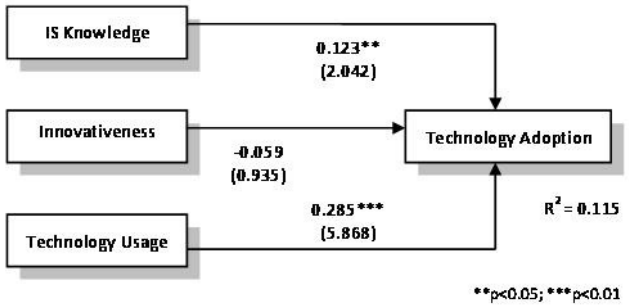

Figure 1: Results of the Structural Model

Discussion of Findings:

This objective of this study was to examine the influence of owner characteristics on the adoption of technologies in SMEs. In particular, SME owners' innovativeness, IS knowledge and technology usage were tested to determine if these three attributes could explain the decision to adopt technology within the company. As predicted, owner's IS knowledge and his/her technology usage significantly influence the adoption of technology. However, owner's innovativeness had no significant impact on technology adoption.

Owners who invest a significant portion of his or her time and energy in technology-related matters will tend to view technology as of critical importance to their firms. This importance placed on technology will most likely be reflected through their decisions to adopt technologies to improve their companies' performance. Government agencies responsible for promoting technology adoption as well as technology consultants and vendors can make use of this knowledge in their marketing programmes. For instance, their promotional efforts should be aimed at emphasizing the benefits that can be gained from the use of technological innovations in the SMEs and priming the SME owners with the basic technical know-how of technological innovations so that the owners themselves are familiar with the application of those technological innovations. Owners with more knowledge of technological innovation are significantly more open

towards implementing a technology adoption policy within their companies compared to those who are not technology-savvy

As discovered from the results of the analysis, innovativeness does not lead to the adoption of technology in an SME. This could perhaps be explained by the fact that the innovativeness quality measured in this study is more of a general innovativeness feature rather than innovativeness in a specific area. General innovativeness differs from domain-specific innovativeness as it overlooks any reference to the specific innovation domain which could comprise of a product or a technological process (Marcati et al., 2008). Personal innovativeness in the domain of technology is manifested in the willingness of an individual to try out any new information technology (Agarwal et al., 1998). Being innovative in general does not translate to the adoption of technology per se as the person may be technology-averse. That said, an owner's personal innovativeness in the domain of technology would quite possibly stand a higher chance of influencing the adoption of technology in the company.

This study's intention was to look at the impact of specific owner's characteristics on the adoption of technology. Though the scope of characteristics examined were rather diverse with one inherent quality (innovativeness), one cognitive processing trait (IS knowledge) and one behavioural activity (technology usage), nevertheless the number of characteristics covered is somewhat limited. Future studies can perhaps look at a broader range of characteristics and also explore the owner-adoption relationship at a deeper level. In particular, future studies can test whether the strength of that relationship is moderated by the complexity of operational tasks performed or the intensity of competition in the industry. In addition, as innovativeness in general was not proven to significantly influence technology adoption, future studies can perhaps assess the impact of owner's innovativeness specifically in the domain of technology on the decision to adopt technologies in the companies.

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