

Technology Adoption among Small and Medium Enterprises (SME's): A Research Agenda

Ramayah Thurasamy, Osman Mohamad, Azizah Omar, and Malliga Marimuthu

Abstract— This paper presents the research agenda that has been proposed to develop an integrated model to explain technology adoption of SMEs in Malaysia. SMEs form over 90% of all business entities in Malaysia and they have been contributing to the development of the nation. Technology adoption has been a thorn issue among SMEs as they require big outlay which might not be available to the SMEs. Although resource has been an issue among SMEs they cannot lie low and ignore the technological advancements that are taking place at a rapid pace. With that in mind this paper proposes a model to explain the technology adoption issue among SMEs.

Keywords—Technology adoption, integrated model, Small and Medium Enterprises (SME), Malaysia

I. INTRODUCTION

THE conventional wisdom among academicians and policy makers alike state that technology is the catalyst of growth for small medium enterprises (SMEs). Chiefly, Information Technology (IT) is believed to be the main driver of the economy, ever since the industrial revolution. With the exception of IT, most technologies either provide minor changes to a broad spectrum of industry, or a significant change but limited to a specific industry. In the context of SMEs, IT facilitates the expansion of new markets, where companies can compete or act as a supply chain partner in a network that has already been designed by international conglomerates.

Given that Malaysia's strength has always been in attracting

foreign direct investments (FDI) for its manufacturing sector, it is ideal that a strong SME base is present to support the large presence of foreign multi national companies. Malaysia's once-famed competitive advantage in the manufacturing sector is perceived to have declined against lower cost-competitor nations such as China and Vietnam. In relation to research and development initiatives, Malaysia's track record against other relatively new industrial nations such as Singapore and South Korea also leaves much to be desired. The axiom: "Malaysia is no longer cost-competitive nor adequately skilled to position herself higher on the value chain" is virtually a foregone conclusion today. Therefore, the first move for Malaysian SMEs to be a global player is to be partners with global players in major markets. This is to allow technological learning to take place, in turn; preventing losses of potential income as well as knowledge and technology transfer that otherwise would allow us to achieve the same success of developed countries.

However, none of the above situation could be realized without the proper adoption of technologies among local SMEs. Global players take a shorter life cycle to innovate and work on a fast turnaround time. This places tremendous pressure on SMEs as downstream players to provide the necessary support. With the addition of the stringent requirement placed by international customers, vendor support forms a crucial aspect for SMEs. One such information technology to aid SMEs is the electronic data interchange (EDI). Recently however, Saleh and Ndubisi [1] report low levels of technological adoption and information and communications technology penetration that is plaguing the Malaysian SME industry. Therefore, the idea surrounding this research is to investigate the reasons for this lack of adoption, and whether the pattern is prevalent throughout all aspects of the SME industry. It might be that certain types of technology is highly adopted than others, in turn allowing us to capture the trend and anticipation of SMEs in the "wait and see" strategy of a particular innovation life cycle.

Many researchers had tried to elaborate on SMEs' adoption of technology. The broad generalizations that were made was that one ought to look into the 1) characteristics of the firm, 2) competitiveness and management strategies of the firm, 3) influences of internal and external parties on the adoption

T. Ramayah is with the School of Management, Universiti Sains Malaysia, 11800 Penang, Malaysia (phone: 604-653-3888; fax: 604-657-7448; e-mail: ramayah@usm.my).

Osman Mohamad is with the School of Management, Universiti Sains Malaysia, 11800 Penang, Malaysia (phone: 604-653-3888; fax: 604-657-7448; e-mail: osman@usm.my).

Azizah Omar is with the School of Management, Universiti Sains Malaysia, 11800 Penang, Malaysia (phone: 604-653-3888; fax: 604-657-7448; e-mail: aziemar@usm.my).

Malliga Marimuthu is with the School of Management, Universiti Sains Malaysia, 11800 Penang, Malaysia (phone: 604-653-3888; fax: 604-657-7448; e-mail: malliga@usm.my).

The authors would like to thank Universiti Sains Malaysia for providing the funding for this research under the Research University Grant (1001/PMGT/816069)

decision process, and 4) characteristics of the technology adopted [2]. In addition, perceived benefits and organizational readiness are without question the underlying factors for the adoption of the technology [3]. However, there is still a scarcity of research in IT adoption among SMEs [4]. In addition, the issues facing adoption of technology is unique to SMEs, which eventually tend to underestimate the time and effort to implement those technologies [5]. From a theoretical standpoint, the present well-established theories on technology adoption when applied to the context of SMEs do not yield superior and consistent prediction over time [6].

II. THE CONTEXT

In Malaysia, 'Small and Medium Sized Industries' (SMEs) play a significant role in the country's economic development, particularly in the manufacturing sector. As of August 2006, SMEs comprise of 99.2% of businesses in Malaysia and contributed about 47.3% of the GDP and employing 65.3% of the nation's workforce. However, these organizations are frequently neglected as they rarely get the much-needed attention from foreign investors.

The Prime Minister of Malaysia had this to say "SMEs form a dynamic and vital part of the economy. The continued development of a competitive and resilient SME sector is a key component of the Government's aim of achieving balanced economic development and higher standards of living at all levels of society." <http://www.bnm.gov.my/>. The excerpt from the Prime Minister's speech below shows the importance of technology in the future of SMEs.

SMEs may also tap the rapid growth of e-commerce to expand globally. The Internet is revolutionizing the way businesses operate and compete, as e-commerce transcends the limitation of geographical boundaries. For example, by effectively harnessing the internet, SMEs are able to search the international business community for potential partners and suppliers without the need for expensive and time-consuming travel. Moreover, high value-added services may be delivered via e-commerce at relatively low costs. On its part, the government has invested considerably in the necessary infrastructure to make e-commerce possible. SMIDEC in collaboration with technology-based institutions such as the Malaysian Technology Development Corporation, the Multimedia Development Corporation and the Malaysian Biotechnology Corporation has developed the capacity to assist SMEs in tapping into the global supply chain through the adoption of appropriate e-commerce technologies. I believe that opportunities abound if companies are willing to be innovative and fully utilize all available e-commerce avenues. It is worth noting that many of the top e-corporations such as Amazon, e-bay, and Yahoo! did not begin operations as large and well-capitalised corporations.

Source:

<http://www.pmo.gov.my/WebNotesApp/Abdullah.nsf/75b3202912e2d4f6482570c400031dbc/f28c99e1b243085e482572f2002b9d9d?OpenDocument>

The Federation of the Malaysian Manufacturers (FMM) (www.fmm.org.my, 2001) identified three factors that were deemed to be the source of SMEs' IT usage problems: (1) Lack of awareness in the importance of IT in SMEs, (2) Low distribution of IT usage in SMEs, and (3) Business associations are not good role models in state-of-the-art IT usage.

As Malaysia moves toward the IT era, SMIs in the country suffer huge setbacks simply because they are not ready to face the oncoming challenges. For example, the Malaysian SMI Association (July 17, 2001, The Star) revealed that only 30% of the local SMIs have their own Website; worse, not all of these sites are regularly updated. The implication here is that the Malaysian SMEs still lag far behind in the acceptance of this new but necessary, technology.

As a consequence, a research on the factors that affect the level of IT usage in SMEs would be crucial in determining the required strategies to elevate SMEs IT usage. Technology can be used to improve firms' ability to effectively use the information collected by contact employees. The recent proliferation technology and also self-service technology calls for customers to interact with technology-based systems rather than company personnel [7]. Also coupled with the Internet becoming the latest channel for distribution and transactions, the need for organizations to move forward is almost inevitable.

III. RESEARCH OBJECTIVES

In light of the concerns addressed in the research background, this study proposes a five-pronged research objective to cover an empirical study across 1500 SMEs in Malaysia, which are as follows:

1. To profile the type of technologies adopted by SMEs.
2. To profile the extent of usage of each of those technologies.
3. To develop an index for performance and technological adoption tracking of SMEs.
4. To investigate factors that encourage, as well as those that remain barriers to technology adoption.
5. To establish the extent of technology adoption and performance (financial and non-financial) plus Internationalization.

IV. RESEARCH OBJECTIVES

In light of the concerns addressed in the research background, this study proposes a five-pronged research objective to cover an empirical study across 1500 SMEs in Malaysia, which are as follows:

1. To profile the type of technologies adopted by SMEs.

2. To profile the extent of usage of each of those technologies.
3. To develop an index for performance and technological adoption tracking of SMEs.
4. To investigate factors that encourage, as well as those that remain barriers to technology adoption.
5. To establish the extent of technology adoption and performance (financial and non-financial) plus Internationalization.

V. PRELIMINARY RESEARCH MODEL

Based on the review of the existing literature a preliminary research model has been identified as shown below. This model only serves as a guide as we will be conducting interviews with the relevant people to further consolidate the model. The model serves as a guide only and the dimensions will be identified through further literature review and also through key person interviews that will be conducted.

1. CEO Characteristics
 - Dimension 1
 - Dimension 2
 - Dimension 3
2. IS Characteristics
 - Dimension 1
 - Dimension 2
 - Dimension 3
3. Organizational Characteristics
 - Dimension 1
 - Dimension 2
 - Dimension 3
4. Environmental Characteristics
 - Dimension 1
 - Dimension 2
 - Dimension 3

VI. METHODOLOGY

A population frame of all SMEs would be gathered from SMIDEC. A randomized sampling methodology will be used to select the samples through stratification along industry type, size of export market, composition across various states and type of ownership. Both focus group interview and key respondent interviews will be utilized for this study. Measures will be validated through structural equation modeling approaches. The research is scheduled to be conducted over a course of 36 months (see Gantt chart). A measure of extent of technology adoption will be developed based on [8] by getting the experts in the IT area to weight the radicalness of different types of technology that are being adopted by SMEs before calculating an index. The formula is shown below::

Degree of IT adoption = $\sum i_j \times r_j$ where $i_j = 0$ or 1 depending on adoption and r_j is the degree of radicalness of the IT.

To establish the degree of radicalness of a particular technology, a separate questionnaire will be prepared and evaluated by several experts in the IT area. They will be asked to rate each of the technology on a 7-point Likert-like scale with 1 (not at all radical) and 7 (very radical).

The research activities to be undertaken fall under a four-stage process [9]. They are briefly described below:

The research activities to be undertaken fall under a four-stage process [9]. They are briefly described below:

Stage 1: Defining the antecedents of technology adoption

A critical review of research related to technology adoption among SMEs will be conducted. Also parallel to this, we will conduct an exploratory research project to ensure comprehensiveness of the constructs and index formation. This is done by soliciting criteria from general managers/managing directors/CEOs of SMEs in three locations, two in West Malaysia which will be Penang, Kuala Lumpur and one in East Malaysia to be done in Kuching. The need for the separate three locations is because of their predominant presence in different industries, electronics and electrical manufacturing support, business outsourcing support and wood products for Penang, Kuala Lumpur and Kuching respectively. Interviews will be conducted to clarify the proposed criteria. Apart from that, a visit will also be made to interview the experts (comprising of educators, researchers, policy makers and practitioners) from the International Council for Small Business (ICSB) in Washington, USA.

Stage 2: Developing the Framework and Survey Items

Following the literature review and focus group interviews, a framework will be drawn up for this study. Scale development can either be inductive or deductive [9]. We will use both the inductive approach (literature review) and deductive approach (exploratory research) to develop the measurement (survey) items for this study.

Stage 3: Refinement and Final Item Selection

To prevent from item order bias, 2 random order versions will be created and tested. Item assessment and purification will be done after testing out the initial questionnaire with a group of respondents. The goodness of measures will be done to assess the validity and reliability and items not conforming to the minimum criteria suggested in literature will be dropped.

Stage 4: Response gathering, Analysis and Documentation of Findings

Data collection will be done to test the refined instrument as well as to gather the responses needed from the SMEs regarding their technology adoption. Six components of validity as suggested by [10][11] will be employed to validate the final instrument before proceeding to further analysis for hypothesis testing.

The six components of validity are:

- Confirmatory Factor Analysis using Structural Equation Modeling

- Internal Consistency of Items will be assessed using the Cronbach's alpha
- Discriminant validity will be tested by using the inter-correlations
- Convergent validity will be established for the items representing each individual construct.
- Nomological/Predictive Validity will be assessed by looking at the relationship between the new measure of antecedents and the technology adoption index on SME performance
- Adequacy of model fit will use four recommended indices (Vandenberg et al., 2000) which are RMSEA, SRMR, RNI and NNFI.

VII. EXPECTED OUTCOME AND BENEFIT

This research will:

- Produce a validated and reliable instrument to measure SME technology adoption and performance across industries.
- Indicate the extent of technology adoption and firm performance.
- Highlight areas that require greater facilitation for technology adoption to occur.
- Uncover reasons behind the unwillingness to adopt a particular technology.
- Model whether IT adoption leads to better organizational outcomes.

REFERENCES

- [1] A. S. Saleh, and N. O. Ndubisi, "An evaluation of SME development in Malaysia," *International Review of Business Research Papers*, vol. 2, no. 1, pp. 1-14, 2006.
- [2] L. Lefebvre, J. Harvey, and E. Lefebvre, "Technological experience and the technology adoption decisions in small manufacturing firms," *R&D Management*, vol. 21, no. 3, pp. 241-249, 1991.
- [3] C. L. Iacovou, I. Benbasat, and A. Dexter, "Electronic data interchange and small organizations: adoption and impact of technology," *MIS Quarterly*, vol. 19, no. 4, pp. 466-485, 1985.
- [4] P. Palvia, "A model and instrument for measuring small business user satisfaction with information technology," *Information & Management*, vol. 31, pp. 151-163, 1996.
- [5] C. K. Riemenschneider, D. A. Harrison, and P. P. Mykytyn, "Understanding IT adoption decision in small business: integrating current theories," *Information & Management*, vol. 40, pp. 269-285, 2003.
- [6] P. Simpson, and P. Swatman, "An exploratory study of small business internet commerce issues," *Information & Management*, vol. 35, no. 1, pp. 9-18, 1999.
- [7] M. L. Meuter, M. J. Bitner, A. L. Ostrom, and S. W. Brown, "Choosing Among Alternative Service Delivery Modes: An Investigation of Customer Trial of Self-Service Technologies," *Journal of Marketing*, vol. 69, no. 2, pp. 61-83, 2000.
- [8] L. A. Lefebvre, R. Mason, and E. Lefebvre, "The Influence Prism in SMEs: The Power of CEO's Perceptions on Technology Policy and its Organizational Impacts," *Management Science*, vol. 43, no. 6, pp. 856-877, 1997.
- [9] E. T. Loiacono, R. T. Watson, and D. L. Goodhue, "WebQual: A measure of website quality", in *Proc. of the American Marketing Association's 2000 Conference*, New York, 2000, pp. 432-438.
- [10] R. P. Bagozzi, *Causal Models in Marketing*. New York: John Wiley, 1980.
- [11] R. P. Bagozzi, and L. Phillips, "Representing and testing organizational theories: A holistic Construal," *Administrative Science Quarterly*, vol. 27, no. 3, pp. 459-490, 1982.