

An Empirical Study of Internet-Based ICT Adoption Among Malaysian SMEs

Khong Sin Tan, Multimedia University, Melaka, Malaysia, kstan@mmu.edu.my

Uchenna Cyril Eze, Multimedia University, Melaka, Malaysia, uchenna.eze@mmu.edu.my

Abstract

Small and Medium Enterprises (SMEs) are key economic sector in Malaysia and the Malaysian government have over the past decades promoted development and growth initiatives such as ICT implementation to advance their overall economic agenda. This paper, therefore, examines the factors and adoption patterns of Internet-based Information and Communication Technologies (ICTs) among SMEs in Malaysia. The Diffusion of Innovation underpins the conceptual framework in this paper. Questionnaire-based survey was used to collect data from 406 managers/owners of SMEs in the southern region of Malaysia. Data analysis indicates that Internet-based ICTs adoption among SMEs provides new business opportunities and access to market information and knowledge. Security and high ICT cost continues to be barriers to Internet-based ICTs adoption. Inferential analyses reveal that relative advantage, compatibility, complexity, observability and security are significant factors that influence Internet-based ICT adoption. The findings are discussed and interpreted to provide key implications to SMEs and Malaysian government.

Keywords: Internet, SME, ICT, and Malaysia

1. Introduction

ICTs especially the use of Internet to do online business is quickly changing the conventional way of doing business among brick and mortar companies. The Internet brings many beneficial characteristics such as speed, user-friendliness, low cost and wide accessibility. The Internet and e-commerce have become increasingly diffused globally, bringing countries together into a global networked economy [19]. Seeing the many benefits potentially available from the Internet, more and more companies especially small and medium-scaled enterprises (SMEs) are flocking towards the adoption of ICTs [33].

According to Porter [34], the Internet can be a critical factor in enhancing a firm's market reach and operational efficiency. It has been agreed by many authors that investment in, and proper utilisation of ICT is a major way of improving productivity among the vital SME sector [1][7].

In Malaysia, the Seventh Economy Plan (1996-2000) has given serious attention on the necessary development of infrastructure and environment of ICTs to ensure that they are in place to enable the

country to move rapidly into the Information Age. Consequently, the National Information Technology Agenda (NITA) was formulated in 1996 to help provide an ICT framework to orderly develop Malaysia into an information and knowledge-based society by 2020. In addition, Multimedia Super Corridor (MSC) has been conceptualised since 1996 to expedite the transformation process. In fact,

investment in ICT in Malaysia has expanded at a rate of 9.2 per cent per annum from RM 3.8 billion in 1995 to RM 5.9 billion in 2000 [16].

2. Literature Review

Diffusion of Innovation (DOI) theory is a broad social psychological or sociological theory. This theory is used to describe the patterns of adoption, explain the mechanism and assist in predicting whether and how a new invention will be successful [36]. According to Rogers [37], diffusion is a process by which an innovation is communicated through certain channels over a period of time among the members of a social system. An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption. Communication is a process in which participants create and share information with one another to reach a mutual understanding.

The important perceived characteristics of innovations in DOI [36] are:

- 1) Relative advantage is defined as the degree to which it is perceived to be better than what it supercedes;
- 2) Compatibility is defined as consistency with existing values, past experiences and needs;
- 3) Complexity is defined as difficulty of understanding and use;
- 4) Trialability is defined as the degree to which new innovation can be experimented with on a limited basis;
- 5) Observability is defined as the visibility of new innovation results.

Brancheau and Wetherbe [11] have used this model to study the adoption of spreadsheet software among

500 professionals from manufacturing and services businesses. Benham and Raymond [8] have combined determinants from Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM) and Roger's Diffusion of Innovation (DOI) Theory. They employed three constructs from Rogers' model; relative advantage, compatibility and trialability in their study.

In 2000, Tan and Teo [46] have conducted survey on factors influencing the adoption of Internet banking. They developed a research framework based on theory of planned behavior and diffusion of innovations theory is developed. Constructs from the two models are used. They felt that an important characteristic of doing banking is privacy. Moreover, risk is added as an additional dimension in diffusion and adoption.

Kendall et. al. [26] has used this model to investigate e-commerce (EC) as new innovation among SMEs in Singapore. A study of EC adoption as innovation among SMEs in Thailand by using Rogers' Model was conducted in Thailand [30]. In 2003, Teo and Pok [47] has conducted a survey on the adoption of WAP-enabled mobile phones among Internet users. WAP-enabled mobile phones were treated as a new technology and they would like to find out the interest of this technology adoption among Internet users. DOI, TRA (Theory of Reasoned Action), TAM and TPB are explored and investigated.

In 2004, Slyke [42] has done a survey to disclose the impact of trust as factor to influence the adoption of web-based shopping. In the same year, Skyle [43] conducted a survey on influence of culture on consumer-oriented electronic commerce adoption. In 2005, Syed [45] have conducted a survey to find out perceived benefits of e-commerce adoption in Malaysian electronic manufacturing companies.

In 2005, Slyke [44] again adopted Rogers' Model as research framework to understand gender-based differences in consumer e-commerce adoption. They have added trust and ease of use as another important construct. Hussin and [23] used DOI to explore the willingness of Malaysian SMEs to adopt e-commerce.

According to Rogers [36], adoption is a decision to make full use of an innovation as the best course of action whereas rejection is a decision not to adopt an available innovation. In this study, adoption is therefore defined as the decision to use Internet-based ICT to communicate or conduct business with stakeholders. Thus, rejection means decision not to adopt Internet-based ICT in business operations.

Rogers [36] hypothesised that positive perception of the usage of innovation can lead to early use of this innovation. At the same time, negative perception on ICT adoption will lead to late use of this innovation. Applying his theory into this study, respondents that have positive perception on ICT adoption may adopt this innovation earlier than those hold negative perception about ICT adoption. The five perceived characteristics of Rogers's Model have been hypothesised for this study. Besides that, after reviewing past literature, two additional perceived characteristics; Internet-based ICT security and Internet-based ICT costs are considered necessary seeing that they may affect ICT adoption in business environment. Further, many literature studies indicate the importance of ICT security [4][9][7][10][29] [35][38] and ICT costs [4][18][22][24][25].

Relative Advantage

There are four items for this variable in the study. Tornatzky and Klein [48] found that relative advantage to be an important factor in determining adoption of new innovation. Rogers [36] found that perceived relative advantage of an innovation is positively related to its rate of adoption. According to Asia Foundation [5], SMEs are willing and able to pay for the Internet if they see immediate relevance to their businesses. Hence, the first hypothesis is:

H1: The adoption of Internet-based ICT among Malaysian SMEs is positively related to relative advantage

Compatibility

Six items are used to measure this dependant variable. Tornatzky and Klein [48] found that an innovation is more likely to be adopted if it is compatible with individuals' job responsibilities and value systems. Rogers [36] found that innovations that are perceived by individuals as having greater relative advantage will be adopted more quickly than other innovations. Much literature found that this construct is significant in their study [8][30][46]. Therefore, second hypothesis is presented.

H2: The adoption of Internet-based ICT among Malaysian SMEs is positively related to compatibility

Trialability

Four items are used for this variable. Rogers [37] found that potential adopters of an innovation are those who are allowed to experiment with an innovation. They will feel more comfortable with the innovation and are more likely to adopt the innovation. Khalifa and Cheng [27] studied adoption of mobile commerce. Assessing their research, the effects of trialability on mobile commerce is the highest significant among other

constructs. Benham and Raymond [8] employed this construct to study voice mail adoption. Their findings indicate that trialability appeared not to have any influence on perceived behavioral control. Tan and Teo [46] studied Internet banking influence among Singaporeans. Trialability with Internet banking is found to be a significant determinant. Kendall [26] revealed that trialability is found to significantly affect Singapore SMEs in adopting e-commerce. Hence, this leads to the third hypothesis.

H3: The adoption of Internet-based ICT among Malaysian SMEs is positively related to trialability

Observability

Six items are used to measure this variable. According to Rogers [37], observability is the ability to see the beneficial results of an innovation. If SMEs can perceive the benefits of ICT adoption, it is very likely that they will adopt ICT. According to Slegers [41], one of the most important barriers to accessing Internet services are lack of awareness. This leads to the fourth hypothesis.

H4: The adoption of Internet-based ICT among Malaysian SMEs is positively related to observability

Complexity

Five items are used. Rogers [36] found that innovations that are perceived by individuals as having less complexity will be adopted more rapidly than other innovations. Cooper and Zmud [14] found that an innovation with substantial complexity requires more technical skills and need greater implementation and operational efforts to increase chances of adoption. Based on the aforementioned, we developed the next hypothesis.

H5: The adoption of Internet-based ICT among Malaysian SMEs is negatively related to complexity

ICT Security or Confidentiality

Four items are used for this category. Literature shows that ICT security and confidentiality is one of the main reasons that determine innovation adoption. Bhimani [9] has mentioned that the important thing about Internet payment protocols is that the data involved in the transaction is secured, even if the medium is not. Beale [7] revealed that many consumers are reluctant to embrace e-commerce mainly because of their concerns towards security issues and lack of confidence in the current e-commerce set-up. Security and the ability of organisation to ensure confidentiality, integrity, and availability of information assets is the major barrier to wider adoption of e-commerce [38]. Companies may face security problems in many forms such as payment security problems [29]; the privacy and confidentiality of the information [10][29]; or viruses and denial-of-service attacks [29]. Ratnasingam [35] conducted a survey and found

that perceived lack of security as one of the main barriers to the adoption of e-commerce. According to Aljibri [2], small businesses may face problems with security and trust when they plan to adopt e-commerce. Jeff Hoi [25] found that Hong Kong SMEs lag far behind Singapore and Australia in adopting e-commerce to support business activities. It is found that major concerns for SMEs are data confidentiality with issues related to immature electronic payment methods, Internet security, and limitation of legal framework. Thus, literature leads to sixth hypothesis.

H6: The adoption of Internet-based ICT among Malaysian SMEs is positively related to security or confidentiality

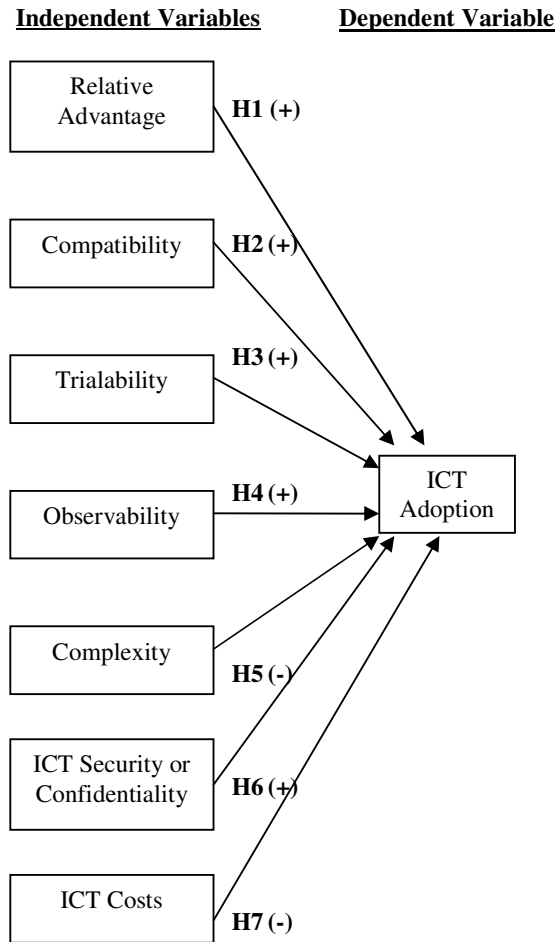
ICT Cost

Four items are used for this independent variable. ICT costs refer to the investments costs needed to implement ICT, not the monetary returns companies gain. Literature shows that the higher the investment cost, the less likely the firms adopt the innovation [18] [22] [24] [25]. According to a report by OECD [32], cost is seen as the most crucial issue for SME owner or managers when doing businesses. Hence, the seventh hypothesis is:

H7: The adoption of Internet-based ICT among Malaysian SMEs is negatively related to ICT cost

After reviewing all related literature and generating the hypotheses for this paper, we then represent the conceptual framework in diagram as follows:

Fig. 1: Conceptual Framework



Note:
 +: Positive Relation
 -: Negative Relation

3. Research Methodology

Convenient sampling is used to select the sample data for this study. The respondents of this study were obtained from Small and Medium Industries Development Corporation, Malaysia (SMIDEC). Based on the list, respondents from Melaka and Johor states are randomly selected and contacted by phone to request their permission to participate in the study. Upon receiving their consent, questionnaires with self-stamped envelope are sent to them. Only owners or managers of SMEs participated in this study because they know the future trend of their companies better.

Pilot test which involve 25 SMEs in Melaka are conducted. According to Cooper and Schindler [15] stated that the size of pilot group may range from 25 to 100 subjects, and the respondents do not have to

be statistically selected. Personal visits and interviews are made to managers and they are requested to fill in questionnaires. According to Gopal [20], interview is an important method for obtaining facts which may help to supplement personal information.

We contacted a total of 1000 companies. According to Sekaran [40], sample size of 384 is enough for population of 1 million. Therefore, a collection of 406 respondents for this study is appropriate for a total of 518,996 SMEs throughout Malaysia in year 2005. A total of 237 (58.4%) respondents from Johor state and 169 (41.6%) respondents from Melaka state participate in this study. The response rate is 40.6 percent.

4. Data Analysis

Table 1 shows the Cronbach’s alpha for all the perceived characteristics and ICT adoption are much higher than 0.6. Therefore, the constructs used in this study are deemed to have adequate reliability. Nunnally [31] also suggested that a minimum alpha of 0.6 suffice for early stages of research.

Table 1: Coefficient Alpha Values and Number of Items for Seven Perceived Characteristics and ICT Adoption

Independent Variables	Alpha	Items
Relative Advantage	0.8046	6
Compatibility	0.8496	6
Trialability	0.7406	4
Observability	0.8115	6
Complexity	0.8328	5
Security	0.8134	4
ICT Costs	0.8136	4
ICT Adoption	0.8604	7

To uphold the validity and reliability of analysis, normal probability plot is examined. Figure 2 indicates histogram of normal P-P plot of regression standardized residual. The normal plot of regression standardized residuals for the dependent variable indicates a relatively normal distribution. Although convenient sampling belongs to non-probability sampling, the normal distribution indicates analyses method for probability sampling can be carried out for this study.

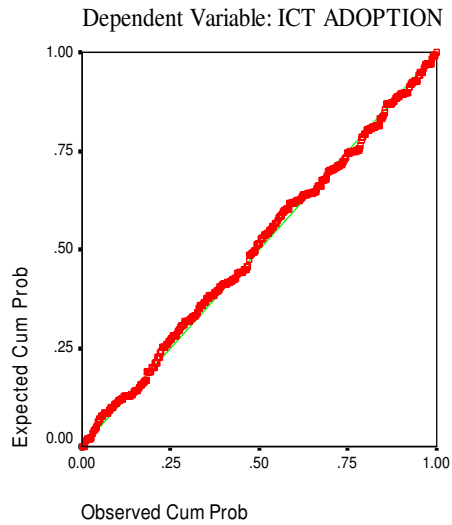


Fig. 2: Histogram of Normal P-P Plot of Regression Standardized Residual

The variance inflation factor (VIF) is the most common measure of multicollinearity. Kleinbaum [28] suggests that if the value of VIF of any variable exceeds 10, that variable is said to be highly collinear and will pose a problem to regression analysis. Usually, values larger than 10 suggest that multicollinearity may be causing estimation problems [13]. Table 2 shows that VIF values for the seven independent variables in the study. It clearly shows that the range of values is between 1.101 and 2.632 which is much lower than 10.

Table 2: Test of Collinearity

Independent Variables	Tolerance	VIF
Composite Relative Advantage	.380	2.632
Composite Compatibility	.577	1.732
Composite Trialability	.909	1.101
Composite Observability	.461	2.171
Composite Complexity	.856	1.168
Composite Security	.482	2.073
Composite ICT Costs	.693	1.444

Table 3: shows the profiles of the 406 SMEs participated in this study.

Table 3: Companies' Profiles (N = 406)								
No	Demographic Variables	No. of Resps.	%	Cum. %	Demographic Variables	No. of Resps.	%	Cum. %
1	Type of Industry							
	Manufacturing	140	34.5	34.5				
	Services	266	65.5	100				
2	No. of Full-Time Employees							
	Manufacturing industry:				Services industry:			
	<5	23	16.4	16.4	<5	130	48.9	48.9
	5-50	67	47.9	64.3	5-19	86	32.3	81.2
	51-150	50	35.7	100	20-50	50	18.8	100
	Total	140	100		Total	266	100	
3	Annual Sales Turnover							
	Manufacturing industry:				Services industry:			
	< RM 250K	27	19.3	19.3	< 200K	157	59.0	59.0
	RM 250K - < 10M	73	52.1	71.4	RM 200K - < RM1M	67	25.2	84.2
	RM 10M – RM 25M	40	28.6	100	RM 1M – RM 5M	42	15.8	100
	Total	140	100		Total	266	100	
4	Types of Company Ownership							
	Local	334	82.3	82.3				
	Government	7	1.7	84.0				
	Foreign	16	3.9	87.9				
	Joint Venture	49	12.1	100				
5	Types of Company Internet Connection							
	Streamyx	207	51.0	51.0				
	TMNet	90	22.2	73.2				
	Jaring	63	15.5	88.7				
	Leased Line (ISDN)	27	6.7	95.4				
	None	19	4.6	100				
6	Year of Business Start-Up							
	Before or on January, 1997	251	61.8	61.8				
	After January, 1997	155	38.2	100				
7	Years of Using Internet for Business Purpose							
	<= 9 years	347	85.5	85.5				
	> 9 years	40	9.9	95.3				
	None	19	4.7	100				

Table 4 shows the means and standard deviations of benefits and barriers of Internet-based ICT adoption. Respondents are asked to rate from a scale of 1 to 5 in which 1 means 'least important', 2 means 'less important', 3 means 'neutral', 4 means 'important' and 5 means 'most important'.

Table 4: Summary Table of Means and Standard Deviations of Benefits and Barriers of Internet-Based ICT Adoption

No	Benefits of ICT Adoption	Mean	Std. Dev.
1	Business Costs Reduction	3.31	0.845
2	Speedy and Reliable Business Communications	3.58	0.904
3	Efficient Coordination Among Firms	3.38	0.779
4	Close Relationship Among Trading Partners	3.47	0.891
5	Better Customer Communications	3.58	0.909
6	New Business Opportunities	3.72	0.826
7	Access to Market Information and Knowledge	3.67	0.880
8	Business Management and Organisation Facilitation	3.54	0.805
Barriers of ICT Adoption			
1	Unsuitability for Business	3.24	0.842
2	Unavailability of ICT Personnel	3.30	0.894
3	Unavailability of Network Infrastructure	3.38	0.811
4	High ICT Cost	3.58	0.812
5	Expensive ICT Software	3.48	1.037
6	Unbalanced Investment Costs and Returned Benefits	3.43	0.834
7	Uncertainties with ICT Laws	3.32	0.887
8	Lack Confidence in ICT Security	3.85	0.944

Pearson correlation analysis (Table 5) indicates that there are 5 perceived characteristics which have significant correlation at 0.05 level in regard to ICT adoption. Perceived characteristics, namely relative advantage, compatibility, observability and security are positively correlated to ICT adoption while complexity is negatively correlated. Trialability and ICT cost have no significant correlation. Five point Likert-scale is used to rate the 7 perceived characteristics. The scales are 1-Strongly Disagree, 2-Disagree, 3-Somewhat Disagree, 4-Somewhat Agree, 5-Agree and 6-Strongly Agree. ICT adoption is scaled by using 5-point in which 1-More than 5 years, 2-Next 4-5 Years, 3-Next 2-3 Years, 4-Within 1 year and 5-Current User.

Table 5: Pearson Correlation Matrix for All Perceived Characteristics (N=406)

ICT Adoption	Relav	Compa	Trial	Obser	Compl	Secur	Cost
Pearson Corr.	.831(**)	.651(**)	.075	.641(**)	-.399(**)	.796 (**)	-.082
Sig. (2-tailed)	.000	.000	.130	.000	.000	.000	.078

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Findings from Pearson Correlation show that ICT adoption is positively related to relative advantage, compatibility, observability and ICT security. Perceived complexity is found to be negatively related. Trialability and cost have no significant relation with ICT adoption.

Table 6 indicates the value of KMO is bigger than 0.6 and Bartlett's Test of Sphericity is significant ($P < 0.05$). Thus, factoring can be conducted.

Table 6: Table KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.851
Bartlett's Test of Sphericity	Approx. Chi-Sqr	7606.262
	df	595
	Sig.	.000

Moreover, investigation of underlying constructs by using varimax rotation with Kaiser Normalization is conducted. Principle axis factoring method is carried out for extraction. According to Hair [21], variables with loadings greater than 0.3 is considered significant; greater than 0.4 is more important and loadings with value 0.5 or above are very significant. Based on these criteria, the items for the variables emerged with loadings considered significant.

The results of multivariate analysis on the seven independent variables towards Internet-based ICT adoption are shown in Table 8. The adjusted R square value is 0.761. This means that 76.1 per cent of variation in Internet-based ICT adoption among SMEs can be interpreted from the seven perceived characteristics. This percentage figures are substantiated by Rogers [36] model which claims that five innovation diffusion variables would explain 49 to 87 per cent of the variance in the rate of innovation adoption.

The influence of these seven characteristics on the ICT adoption is significant as the F-value is large (185.327) and significant (0.000) in which the p-value is less than 0.05. Therefore, there is evidence that the seven perceived characteristics in the study significantly affect the adoption of Internet-based ICT among SMEs in Malaysia.

Table 8: Aggregate Effect of the Seven Independent Variables on Internet-based ICT Adoption

R	R Sqr.	Adj. R Square	Std. Err. of the Est.	F-Value	Sig.
.875	.765	.761	.46534	185.327	.000

Table 9 shows that results of the effect of the seven independent variables on Internet-based ICT adoption among SMEs in Malaysia. The strength of individual effect of all the perceived characteristics against ICT adoption is shown.

Table 9: Influence of Seven Independent Variables on ICT Adoption

Variables	Unstd. Coeff.		Std. Coeff.	t	Sig.
	B	Std. Err.	Beta		
(Constant)	.755	.211		3.58	.000*
Relative Advantage	.289	.029	.342	10.06	.000*
Compatibility	.146	.029	.149	3.56	.000*
Complexity	-.099	.019	-.138	-5.25	.000*
Trialability	.010	.027	.010	.392	.695
Observability	.146	.036	.132	4.06	.000*
Security	.481	.031	.509	15.32	.000*
ICT Cost	-.018	.022	-.023	-.823	.411

Source: Compiled survey data

ICT security emerges as the most important characteristic that affects the willingness of SMEs to adopt ICT ($B=0.481$). Relative advantage is ranked second statistically significant ($B=0.289$). Observability and compatibility carry same weight and found significant ($B=0.146$). Complexity with negative value ($B=-0.099$) and significant p-value indicates it is an important predictor which adversely affects ICT adoption. With $p\text{-value} > 0.05$, trialability ($B=0.010$) and ICT cost ($B=-0.018$) are proven to be non-significant.

5. Discussions

E-mail usage and information seek by Internet becomes two most important factors on ICT usage. Therefore, the statistics clearly show that business transaction through the Internet like e-commerce and e-business is still not popular among SMEs in Malaysia. Instead, they are using the Internet for basic purposes only. This is contrary to government initiatives to encourage more use of ICT in businesses like B2B and B2C.

However, not all SMEs in this study adopt Internet-based ICT. 19 SMEs do not adopt Internet-based ICT. The main reason is lacking of necessity to business. Besides that, they feel that financial constraint is a concern. These two factors become main reasons SMEs do not adopt ICT. However, this is the group of SMEs that government should pay attention to.

The benefits of ICT usage according to respondents in order are; "new business opportunities"; "access to market information and knowledge" and "speedy and reliable business communications" and "better

customer communications". Same table (Table 4) indicates barriers that hinder respondents from adopting ICT. "Lack of confidence in ICT security" is the main barrier that stops respondents from using ICT. This observation is further substantiated by Pearson correlation findings and multivariate regression analysis of this study. The second and third important barriers are "high ICT cost" and "expensive ICT software" respectively.

From the findings, it can be found that Malaysian SMEs has faced dilemma when it comes to ICT adoption. They realise ICT can create new business opportunities, access information and expedite business communications. However, they dare not venture into it because of ICT security. But actually, Malaysia has enacted cyber laws to protect business transactions in ICT environment. Therefore, SMEs either has no confidence in the ICT rules and regulations or they have no idea of their existence. Moreover, they feel that investment in ICT hardware and software are expensive. It is imperative for government to address the reasons behind SMEs' lack of confidence and ensure that strict and effective enforcement is carried out other than enactment of ICT laws. On the other hand, the costly ICT hardware and software can be reduced by reducing import tax on ICT hardware and software into Malaysia.

Findings from Pearson correlation and multivariate regression analysis indicate that relative advantage, compatibility, observability, complexity and ICT security and confidentiality are significant contributors to ICT adoption intention in Malaysian SMEs. Trialability and ICT costs are not significantly related to ICT adoption.

One possible reason that trialability is not a significant factor is trialability of software is not available in Malaysia. If SMEs need to use specific software such as Microsoft™ software, they have no choice but to purchase licensed software. Various packages with different prices are available to suit their budgets and needs. However, individuals in Malaysia can get pirated software easily from the market. Malaysia is still unable to curb with the widespread of pirated software. According to Business Software Alliance [12], 60 per cent of Malaysia's software is pirated in the year of 2005. Anis [3] stated that more than 50 per cent of 23 companies raided in Malaysia committed the offence of using pirated software in 2006 were SMEs. Moreover, in 11 raids on companies suspected of using illegal computer software in 2007, five were SMEs.

The fact in this study that ICT costs is not a significant contributor to ICT adoption is because Malaysian government has been actively providing

lots of different loans, grants and incentives to SMEs for purchasing ICT products. One good example is that government has subsidised and encouraged Malaysian SMEs to register RosettaNet [39] which is a global supply chain system. The fees charged to SMI and SMEs are cheaper in order to encourage them to use this system which connects to more than 500 companies around the world.

6. Limitations of Study

This study is conducted in Johor and Melaka stated in the southern region of Malaysia. Therefore, the generalisability of the results across all Malaysian SMEs should be taken cautiously. Moreover, the number of respondents (406 or 0.08%) participated is comparatively small to be representative all Malaysian SMEs. Moreover, this research used the definition of Malaysian SMEs. Hence, the applicability of findings to other countries may be limited.

7. Suggestions of Future Research

This study reveals five perceived characteristics of Internet-based ICT that would influence its adoption among Malaysian SMEs. However, there may have some other characteristics from the perspective of SMEs that affect the rate of Internet-based ICT adoption. For example, owners' academic qualifications, age, company's policy, ICT training, commitments to ICT, organisation readiness, firm innovativeness, and environmental characteristics such as government policies and network infrastructure. This study discloses manufacturing and services SMEs are Internet-based ICT users. Future study may help investigate types of ICT applications they adopt and their respective impacts on businesses. In addition, future research may examine the knowledge and understanding of SMEs of government's enforcement on ICT laws.

8. Conclusions and Implications

This empirical research study carries both theoretical and practical implications. Theoretically, this study has used Rogers' Diffusion of Innovation model in Malaysia context. Moreover, we included two additional factors in our framework. Results further prove that Rogers' model plus ICT security and ICT costs are compatible to innovation diffusion research.

Although findings indicate that SMEs are likely to adopt ICT in future, the pervasive use of Internet-based ICT still greatly depends on government initiatives. Although governments have emphasised the use of ICT from Seventh National Plan (1996-2000), Eight Malaysia Plan (2001-2005) and the latest Ninth Malaysia Plan (2006-1010), the results seems to be not very successful. The scale of Internet-based ICT adoption is still low.

Government need to double up effort to encourage more usage of Internet-based ICT like e-commerce and e-business.

In fact, government plays significant role in promoting Internet-based ICT in the country. Good network infrastructure in the nation, healthy competition among wireless network providers, ease of loans, schemes and programmes application are some of the initiatives government can adopt to encourage more ICT usage. SMEs' main concerns in any investments are about budget, manpower and return on investments. They are definitely in need of assistance from government to reduce their burdens or risks when they adopt Internet-based ICT. All in all, Malaysia needs viable and strong SMEs to continue contributing to the country's GDP, employment and exports.

9. References

- [1] Abouzeedan, A. and Busler, M. "Information Technology (IT) Impact on Performance of Small and Medium Enterprises (SMEs)," *Proceedings of RENT XVI, Research in Entrepreneurship and Small Business*, 2002, pp. 127-156.
- [2] Aljitri, H. A., Pons, A. and Collins, D. "Global E-Commerce: A Framework For Understanding And Overcoming The Trust Barrier," *Information Management*, (11:3), 2003, pp. 130-138.
- [3] Anis, M. N. *SMEs among Main Pirated Software Users*, TheStar Online, 17 April 2007.
- [4] Asia Pacific Economic Cooperation. *SME Electronic Commerce Study*, 1999.
- [5] Asia Foundation. Regional Survey of SMEs' Use of eCommerce in Indonesia, the Philippines, Sri Lanka, and Thailand, 2000, from://www.asiafoundation.org/ICT/surveys.html
- [6] Beal, T. "Government Promotion and Facilitation of ICT Use by SMEs: APEC and New Zealand," *Asia Small Business Review*, (4:1), 2001, pp. 85-109.
- [7] Beale, M. W. *Consumer concern over e-commerce security*, E-Commerce Times, 1999.
- [8] Benham, H. C. and Raymond, B. C. "Information Technology Adoption: Evidence from a Voice Mail Introduction," *ACM SIGCPR Computer Personnel*, (7:1), 1996, pp. 3-25.
- [9] Bhimani, A. "Securing the Commercial Internet," *Communications of the ACM*, (39:6), 1996, pp. 29-35.
- [10] Bird, J. "E-Commerce Is Safety," *Management Today*, 1997, pp. 54-57.
- [11] Brancheau, J. C. and Wetherbe, J. C. "The Adoption of Spreadsheet Software: Testing Innovation Diffusion Theory in the Context of End-User Computing," *Information Systems Research*, (1), 1990, pp. 115-143.
- [12] Business Software Alliance (BSA). from://www.bsa.org/malaysia/
- [13] Chatterjee, S., Hadi, A. S., and Price, B. *Regression Analysis by Example (3rd ed.)*, John Wiley and Sons, Inc., New York, NY, 2000.
- [14] Cooper, R. B. and Zmud, R. W. "Information Technology Implementation Research: A Technological Diffusion Approach," *Management Science*, (36:2), 1990, pp. 123-139.
- [15] Cooper, R. C. and Schindler, P. S. *Business Research Methods (8th ed.)*, McGraw Hill, 2003, p. 86.
- [16] Economic Planning Unit. *Eighth Malaysian Plan 2001-2005*, Publication and DISTR, Putrajaya, 2001, p. 364.
- [17] Economic Panning Unit. *Ninth Malaysian Plan 2006-2010*, Publication and DISTR, Putrajaya, 2006, p. 140.
- [18] Ernst and Young. *Advancing with E-Commerce*, 2001 from://www.noie.gov.au
- [19] Gibbs, J. L. and Kraemer, K. L. "A cross-country investigation of the determinants of scope of e-commerce use: an institutional approach," *Electronic Markets*, (14:2), 2004, 124-137.
- [20] Gopal, M. H. "An Introduction of Research Procedure in Social Science," *Asia Publishing House, Bombay*, 1970, p. 142.
- [21] Hair, J. F., Anderson, R. E., Tatham, R. L. and Black, W. C. *Multivariate Data Analysis (5th ed.)*, Prentice Hall International, Englewood Cliffs, 1995.
- [22] Hill, C. W. L. and Jones, G. R. *Strategic Management – An Integrated Approach (5th ed.)*, Houghton Mifflin Company, Boston, 2001.
- [23] Hussin, H. and Noor, R. M. "Innovating Business through E-Commerce: Explore the Willingness of Malaysian SMEs," *Proceedings of the Second International Conference on Innovation in IT*, 2005.

- [24] James, J. "Sustainable Internet access for the rural poor? Elements of an emerging Indian model," *Futures*, (35:5), 2003, pp. 76-88.
- [25] Jeff Hoi, Y.Y, Shim, J.P. and Andy, Yin K.L. "Current Progress of E-Commerce Adoption: Small and Medium Enterprises in Hong Kong," *Communication of the ACM*, (46:9), 2003, pp. 226-232.
- [26] Kendall, J. D., Tung L, Chua K, Ng D and Tan S. "Receptivity of Singapore's SMEs to Electronic Commerce Adoption," *Journal of Strategic Information Systems*, (10), 2001, pp. 223-242.
- [27] Khalifa, M. and Cheng, S. K. N. "Adoption of Mobile Commerce: Role of Exposure," *Proceedings of the 35th Hawaii International Conference on System Sciences*, 2002.
- [28] Kleinbaum, D. G., Kupper, L.L., and Muller, K. E. *Applied Regression Analysis and Other Multivariate Methods*, PWS, Boston, 1988.
- [29] Light, D.A. "Sure, You Can Trust Us," *Sloan Management Review*, (43:1), 2001, pp. 17-18.
- [30] Limthongchai, P. and Speece, M. W. "The Effect of Perceived Characteristics of Innovation on E-Commerce Adoption by SMEs in Thailand," *Proceedings of the Seventh International Conference on Global Business and Economic Development, Bangkok, Thailand*, 2003.
- [31] Nunnally, J. C. *Psychometric Theory (2nd ed.)*, McGraw Hill, New York, 1978.
- [32] Organisation for Economic Corporation and Development. "Enhancing the Competitiveness of SMEs in the Global Economy: Strategies and Policies," *Statistical Papers for the Bologna Conference*, 2000.
- [33] Organisation for Economic Corporation and Development. "ICT, e-Business and SMEs," *Paris*, 2004.
- [34] Porter, M. E. "Strategy and the Internet," *Harvard University Review (79:3)*, 2001, pp. 63-78.
- [35] Ratnasingam, P. "Electronic Commerce Adoption in Australia and New Zealand," *Malaysia Journal of Computer Sciences (14:1)*, 2001, pp. 223-242.
- [36] Rogers, E.M. *Diffusion of Innovations (3rd ed.)*, The Free Press, New York, 1983.
- [37] Rogers, E.M. *Communication Technology: The New Media Society*, New York, Free Press, 1996.
- [38] Rose, G., Khoo, H., and Straub, D. "Current Technological Impediments to Business-to-Consumer Electronic Commerce," *Communications of the Association for Information Systems*, (1:16), 1999.
- [39] RosettaNet. [from://www.rosettanet.org.my/](http://www.rosettanet.org.my/)
- [40] Sekaran, U. *Research Methods for Business: A Skill Building Approach (4th ed.)*, John Wiley & Sons, 2003, pp. 176, 203, 407.
- [41] Slegers, C., Singh, S and Hall, J. "Small Business and Electronic Commerce: An Australian Survey," *Center for International Research on Communication and Information Technologies, RMIT University*, 1998, p. 22.
- [42] Slyke, C. V., Lou, H, Belanger, F. and Sridhar, V. "The Influence of Culture on Consumer-Oriented Electronic Commerce Adoption," *Proceedings of the 7th Annual Conference of the Southern Association for Information Systems*, 2004, pp. 310-315.
- [43] Slyke, C. V., Belanger, F. and Comunale, C. L. "Factors Influencing the Adoption of Web-Based Shopping: The Impact of Trust," *Database for Advanced in Information Systems*, (35:2), 2004, pp. 32-49.
- [44] Slyke, C. V., Belanger, F. and Hightower, R. "Understanding Gender-Based Differences in Consumer E-Commerce Adoption", *Proceedings of the 2005 Southern Association of Information Conference*, 2005, pp. 24-29.
- [45] Syed S.A, Ali, K, Hishamuddin, B.I. and Ismail, A. "Perceived Benefits of E-Commerce Adoption in the Electronic Manufacturing Companies in Malaysia," *Journal of Social Sciences (1:3)*, 2005, pp. 188-193.
- [46] Tan, M. and Teo, T. S. H. "Factors Influencing the Adoption of Internet Banking," *Journal of the Association for Information Systems (1:5)*, 2000, pp. 1-42.
- [47] Teo, T. S. H. and Pok, S. H. "Adoption of WAP-enabled mobile phones among Internet users," *The International Journal of Management Science (31:6)*, 2003, pp. 483-498.
- [48] Tornatzky, L. G. and Klein, K. J. "Innovation Characteristics and Innovation-Implementation: A Meta-Analysis of Findings," *IEEE Transactions on Engineering Management (29:1)*, 1982, pp. 28-45.

Copyright © 2008 by the International Business Information Management Association. All rights reserved. No part or all of this work should be copied or reproduced in digital, hard, or any other format for commercial use without written permission. To purchase reprints of this article please e-mail: admin@ibima.org