The Impact of E-Commerce Security, and National Environment on Consumer adoption of Internet Banking in Malaysia and Singapore

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Abstract

One of the haunting problems of Internet banking in Malaysia is the slow in acceptance of this innovative distribution channel for banking products and services. This paper addresses the perceived e-commerce security influence on adoption of Internet banking, and the role of national environmental factors such as attitude, subjective norms, and perceived behavioral control factors towards adoption, and compares these factors with Singapore Internet banking adoption. This study based on the information collected from sample of 310 respondents drawn from individual banking customer in Malaysia and Singapore. The regression analyses suggested that consumer perceived non-repudiation, trust relative advantage Internet experience and banking needs are the most important factors that affect adoption in Malaysia. While Internet experience and banking needs were found to significantly affect Internet banking adoption in Singapore.

Keywords: **E-commerce security, interface design, national environment, Internet banking, Malaysia, Singapore.**

INTRODUCTION

Brancheau, Janz, and Wetherbe (1996) were the first to identify developing e-commerce as an important management issue facing Information Technology (IT) managers. Banks and other financial institutions today need this technology in order to survive in the competitive financial market. A rapidly changing market requires the flexibility to adapt since customers demand new features and services such as online access to accounts and products, real-time online lending, optimal loan structuring, mortgage lending, loan structuring and instant decision-making. It is, therefore, becoming mandatory for financial institutions that want to satisfy customers, reduce costs, and expand geographical reach to fully automate interactive Web-based financial transactions.

However, the initiatives taken by the banking sector in Malaysia is not well adopted by the banking customers. Many factors account for the slow growth of Internet banking, not only in Malaysia but also throughout the world (Sathye 1999). Security is often cited as one of the greatest barriers to Internet commerce (Zorkadis & Karras, 2000), due to the inherent openness of the web. The lack of security is experienced in several ways such as unauthorized use of corporate network, packet sniffing, data modification, unregistered transactions, eavesdropping, repudiation, and spoofing.

It is also important to note that to what extent a user has access and why depend on the specific legal, economic, political, and social conditions that surround that user (Wolcott et. al., 2001). In terms of social conditions, the influence of national culture has gained wide spread attention in the studies of technology adoption (Straub et. al., 1997; Anandarajan et. al., 2002). It is, therefore, expected that national culture could be one element of a complex, multi-faceted phenomenon. The contribution of this study is, therefore, to seek how these descriptors (like attitude, government ICT policies, and income) of national environment, and perceived e-commerce security, and to use these to explain differences in the adoption of Internet banking in Malaysia and Singapore.

The specific objectives of the study are therefore to:

1. identify e-commerce security influences on the adoption of Internet banking in Malaysia and Singapore
2. examine the differences in terms of national environmental characteristics such as attitude, subjective norms, and perceived behavioral control factors towards adoption of Internet banking in Malaysia and Singapore

ICT PROFILE OF MALAYSIA AND SINGAPORE

In a national context, the socio-economic conditions which affect the general income level and levels of affluence will be relevant to this innovation (Brown, et. al.2003). The availability of technological infrastructure and the ability of consumers to use this technology will also affect the level of adoption. Government ICT policies and plans are also expected to influence the adoption of Internet banking as evidence in Singapore (IDA, ITU, 2005). These three environmental dimensions – social-economic conditions, Internet diffusion and government ICT policy - would be explored to identify its relevance on e-commerce adoption and ultimately Internet banking adoption in the two countries, Malaysia and Singapore.

SELECTED ECONOMIC INDICATORS OF MALAYSIA AND SINGAPORE

The socio-economic indicators for Malaysia and Singapore are shown in Table 1. There are differences in terms of geographical area, population size and economic status. In term of geographical areas, Malaysia is 470 times more than the size of Singapore. Population wise, it is five times that of Singapore (see table 1). However, Singapore per capital income (an indicator of level of affluence) is almost three times that of Malaysia. There are similarities between the two neighbors. Both are multi-racial, multi-religion society, with relatively high literacy rate of 88.9% for Malaysia and 93.2% for Singapore (see table 1).

Table: 1 Demographic Profile of Malaysia and Singapore

ITEM	MALAYSIA	SINGAPORE
Total Geographic Area	329,750sq km	647 square km
Population	25.58 million (approximate)	4,608,595
Ethnic groups	Malay and other indigenous 58%, Chinese 24%, Indian 8%, other 10%	Chinese (76.7%); Malays (14%); Indians (7.9%); others (1.4%)
Official Language	Bahasa Melayu, English, Chinese, Tamil, and more than five others	English, Chinese, Malay, Tamil
Literacy Rates	88.9%	93.2%
Economy	Middle-Income country – transformed into emerging multi-sector economy	Highly developed and successful free-market economy
GDP	US$ 198.4 billion (CIA 2002)	US$ 112.4 billion (CIA 2002)
Per Capital	US$ 8,800	US$ 21,230
Below poverty line	8%	Nil

Source: CIA (2002), MCMC, ITU 2004

GOVERNMENT ICT POLICY

The Malaysia government is proactive in supporting and promoting ICT usage just like its Singapore counterpart. Internet usage has been found to be relatively mature in a consumer satisfactory survey conducted by the Malaysia Communications and Multimedia Commission (MCMC) (2004a). Four out of ten Internet users access e-government services for registration and information purposes. Further more, the World Bank has classified Malaysia as an upper-middle-income country (ITU, MCMC, 2004a). Malaysia's Personal Computer (PC) penetration rate stood at 16.6 percent (ITU, 2004a). The cost of dial-up Internet access has been kept relatively low with subscribers being able to connect to a dial-up point of presence at local call rates (see table 2). Commercial broadband services were first launched by Time dotcom (TIME) in June 2001. At the end of 2003, there were a total of 110,247 subscribers. According to ITU 2004a, this translates to subscriber penetration rate of 0.44 percent or a household broadband penetration rate of 1.98 percent. Around 98 percent of all broadband connections are over direct exchange line (DSL).

Singapore on the other hand, in the 2004 World Bank rankings, Singapore's gross domestic product (GDP) per capita ranks twenty-ninth in the world, at US$ 21,230 (see table 1). Besides conventional dial-up for local access, broadband is available to home subscribers via ISDN, ADSL and cable modem. Of the top 20 economies by broadband penetration (ITU, 2004b), while South Korea ranked number one with 24.9 points (on a scale of 1 to 30) of all broadband subscribers, Singapore ranked 15th with 11.6 points of all broadband penetration (ITU, 2004b). According to IDA, ITU (2005) statistics 74% of all households in Singapore own one or more personal computer. Of those who have Internet access, 2 out of 3 are on broadband. There are also 1,600 Government services

available online, including the popular applications like income tax e-filing. The next section explores the method used in the study.

Table .2: ICT statistics: Malaysia and Singapore

ITEM	MALAYSIA	SINGAPORE
Telephone lines	15,695.7 million (ITU 2003)	5,239.8 million (ITU, 2003)
Main lines per 100	18.8 (ITU2004)	46.29 (ITU, 2003)
Internet access charges (30hrs, US$)	US$ 12.36 (Tel. & ISP charge)	US$ 10.9 (Tel. charge)
PCs per 100 people	16.6 (ITU 2004)	62.20 (ITU, 2003)
Internet hosts per 10,000	42.90 (ITU, 2003)	1,155.31 (ITU, 2003)
Internet users per 10,000inhabitant	3,453.31 (ITU, 2003)	5,043.59 (ITU, 2003)
ISPs	7 (ITU, 2003)	7 (ITU, 2003)

Source: MCMC, IDA, ITU (2003) ITU 2004

METHOD OF STUDY

Sources of Data

Internet banking service is presently offered to two sets of clients (an individual and corporate clients). Because this research examines how e-commerce security, and national environmental factors may predict the adoption of Internet banking among bank customers in Malaysia and Singapore. The population in this survey can only be individuals with bank accounts. Thus, both primary and secondary data were gathered in this study. The primary data were collected using three methods. The first method involved using hard copies of questionnaire to collect empirical data. This method was chosen because of the ease and convenience in answering the questions for the respondents. Most of the responses (231) received were from this method. It is also easy to trace, and respondents answer can be controlled and monitored compared to mailed survey method.

The second method uses online questionnaire to collect empirical data (Tan & Teo, 2000; Brown et.al., 2003). According to Tan & Teo (2000) and Brown et. al. (2003), online questionnaires are considered to be most appropriate, given that the questions were for most part directed at Internet users.

The third method, which also utilized softcopy questionnaire, was by using personal computer (notebook), which serves as a local host to bolster the number of responses. Using an apache server (open source) to host the questionnaire, this method targeted those the researcher personally met casually at public places such as coffee shops or libraries. Even though this method could be very slow in terms of the number of respondents, the respondents' answers could be considered reliable as it is more or less like a face-to-face interview, and only people with certain characteristics or background were targeted. A total of 79 (Malaysia: 43 and Singapore: 36) responses were received

from these second and third methods (soft copies). Incentives in the form of free drinks and/ souvenirs were given to some respondents upon answering the questions.

A total of 550 hard copies of the questionnaires (Malaysia 300 and Singapore 250) were distributed. 294 were received (Malaysia 175 and Singapore 119) out which 63 were rejected due to missing data or inconsistency in the response to the questions, thus, bringing the total to 310 responses available for the analysis.

The secondary data were adopted from Brown et al (2003) and it is based on three environmental dimensions – social-economic conditions, Internet diffusion and government ICT policies, presented above under the section "selected economic indicators for Malaysia and Singapore". The purpose of using secondary data is to support the result of the hypothesis drawn from the primary data.

FACTORS INFLUENCING INTERNET BANKING ADOPTION

1. *E-commerce security* is defined as the consumer's concern for the risk of financial transaction over the Internet. According to Sathye (1999), even in countries where Internet banking has long been established, one of the most important factors slowing progress of this innovation is consumers' concern for the security of financial transactions over the Internet. Hence, this study categorizes Internet banking security into four parts: *database administration*, *access control, computer physical security,* and *policies.* (see figure 1).

Figure 1 E-Commerce Security Components

Policies

Physical Security

Access Control

Database Administration
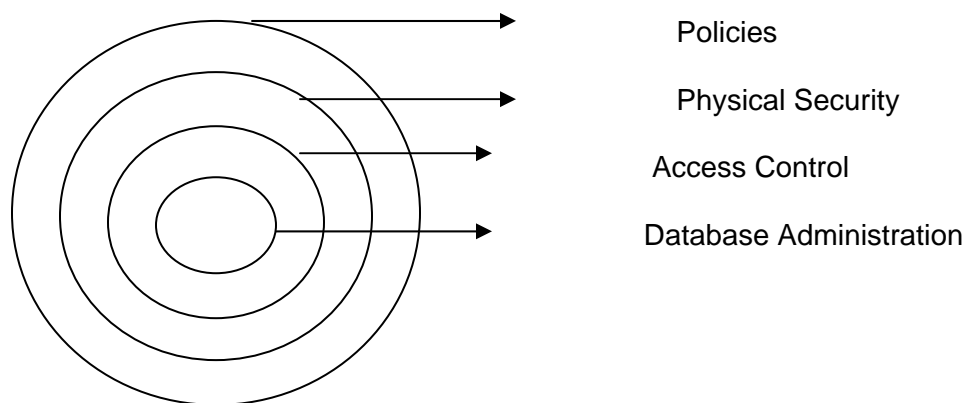
Source: Dauda et al (2002)

2. The second factor examined in this study is the *national environment* adopted from Tan & Teo (2000) and Brown et. al. (2003). The framework postulates that a person's intention to adopt Internet banking is determined by relative advantage, Internet experience, banking need, trialability, subjective norm, self-efficacy, facilitating condition, and government support. *Relative advantage* is defined as the extent to which a person
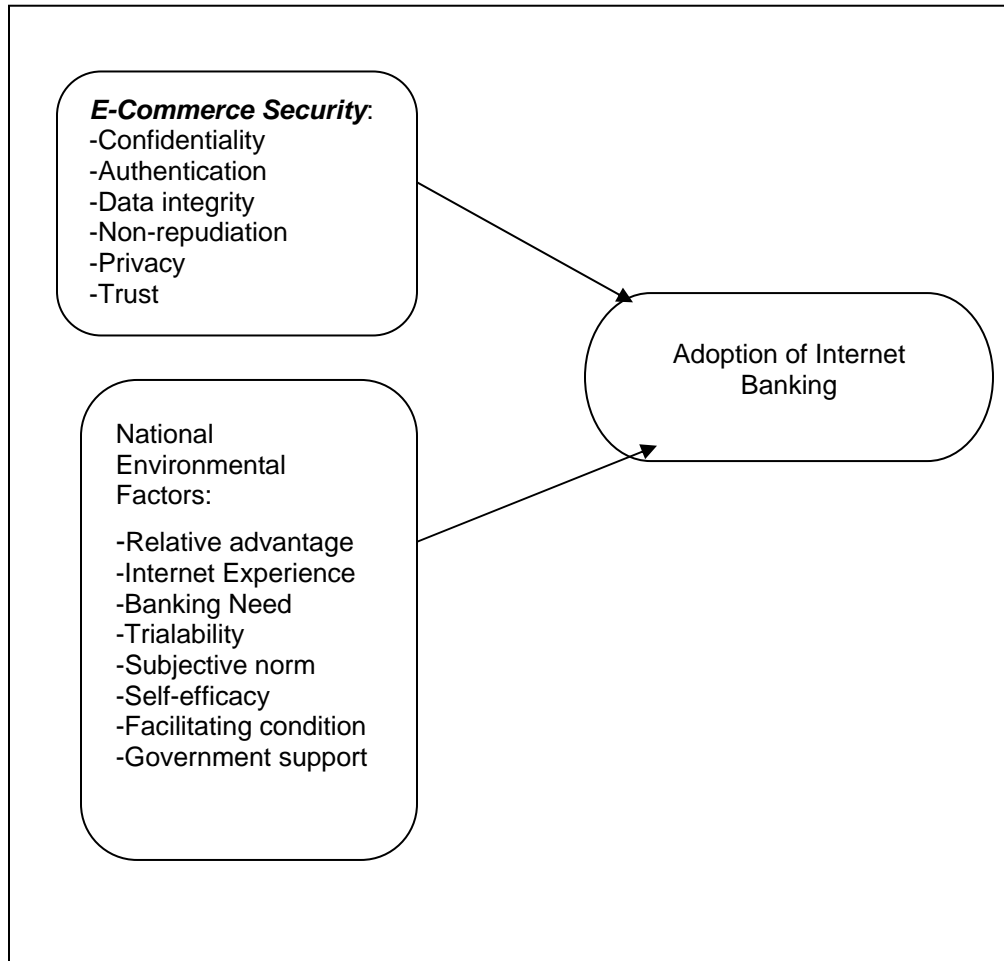
views an innovation as offering an advantage over previous ways of performing the same task (Roger, 1983; Agarwal & Prasad, 1997). *Internet experience and banking need* is defined as the degree to which an innovation is viewed as being consistent with the existing values, needs and experiences of a user (Rogers, 1983; Taylor & Todd, 1995). *Trialability* is the extent to which users would like an opportunity to experiment with an innovation prior to committing to its usage (Roger, 1983; Agarwal & Prasad, 1997). *Subjective norm* refers to a person's perception that most people who are important to him or her think he or she should or should not perform the behavior in question (Fishbein & Ajzen, 1975; Tan & Teo, 2000). *Self-efficacy* is defined as an individual's self-confidence in his or her ability to perform a behavior (Bandura, 1982; Taylor & Todd, 1995). While, *facilitating condition* refers to the easy access of technological resources and infrastructure. *Government support* is consistent with the national systems of innovation theory that posits that government policies may encourage or mandate technology development and adoption (King et. al., 1994; Wolcott et. al., 2001).

RESEARCH FRAMEWORK AND HYPOTHESIS

The research model is designed to examine the impact of customers' perception of e-commerce security, and national environmental factors on their acceptance of Internet banking in Malaysia and Singapore. Several models have been used to explain factors determining consumer acceptance of Internet banking (Straub et. al., 1997; Liao et. al., 1999; Sathye, 1999; Tan & Teo, 2000; Pavlou, 2003; Suh & Han, 2003; Brown et. al., 2003; Venkatesh et. al., 2003). For example: technology acceptance model (TAM) devices by Davis (1986) was used by Suh and Han (2003). According to Suh and Han (2003), one of the most widely used models for explaining the factors that affects user acceptance of information systems or information technology is TAM. Another model is Fishbein and Ajzen's (1989) theory of reasoned action (TRA), which is based on Davis's (1986) technology acceptance model (TAM). TRA model asserts that attitude towards a behavior is determined by relevant beliefs (Davis et. al., 1989). Other theories are the theory of planned behavior (TPB), the decomposed theory of planned behavior (DTPB) by Taylor and Todd (1995) and the diffusion of innovation theory, Rogers (1983). The decomposed TPB model, according to Tan and Teo (2000), uses constructs from the innovation literature such as relative advantage, compatibility, subjective norms, and perceived behavioral control by decomposing them into more specific dimensions. While, Venkatesh et. al.'s (2003) unified theory of acceptance and use of technology (UTAUT) on the other hand posits four core determinants (performance expectancy, effort expectancy, social influence and facilitating condition) and four moderators (gender, age, experience and voluntariness of use) of the key relationships of intention and usage of information technology.

To this end, the framework (figure 2) in this study derived from TAM and Decomposed TPB model, postulates that the adoption and non-adoption of Internet banking is influenced by two factors: e-commerce security, and national environment factors.

Figure 2: Research construct

E-Commerce Security:
-Confidentiality
-Authentication
-Data integrity
-Non-repudiation
-Privacy
-Trust

National Environmental Factors:

-Relative advantage
-Internet Experience
-Banking Need
-Trialability
-Subjective norm
-Self-efficacy
-Facilitating condition
-Government support

Adoption of Internet Banking

Source: Adopted from Tan & Teo (2000), Suh & Han (2003)

HYPOTHESIS

Encryption is used to give both confidentiality and authenticity to messages. It warrants that all communications between trading parties are restricted to the parties involved in the transaction. Because Internet banking facilities are delivered by financial institutions that are highly regulated and control by the central bank and other relevant agencies of the respective countries (Malaysia and Singapore) where they operates. Adopters are likely to have great confidence in these institutions. Therefore, this study assumes that with great confidence in the financial institutions, most people are expected to use the distribution channel such as Internet banking. This may also lead us to the issue of trust, which, is the belief that another person or organization on whom one depends will behave in a socially acceptable manner – honest, caring, and capable (Gefen, 2002; Giffin, 1967; Mcknight et. al., 2002) – and in doing so will fulfill the trusting party's

expectations (Gefen, 2002; Gefen, Karahanna, & Straub, 2003; Gefen et. al., 2005). Trust is crucial for economic transactions because it reduces the risk of becoming a victim to opportunistic behavior (Fukuyama, 1995; Williamson, 1985). This study is of the view that with great confidence in a system, the perceived level of trust of a web site will have a positive effect on adoption rate. Thus, the following alternative hypothesis is arrived at:

H1. Perceived strength of e-commerce security does have a significant impact on a consumer's adoption of Internet banking in Malaysia and Singapore

Relative advantage is defined as the extent to which a person views an innovation as offering an advantage over previous ways of performing the same task (Roger, 1983; Agarwal & Prasad, 1997). Because Internet banking services allow customers to access their banking account from any location 24 hours a day and 7 days a week, it provides an enormous advantage and convenience to users (Tan & Teo, 2000). It also gives customers greater control over managing their finances, as they are able to check their accounts easily. Besides, a customer's Internet experience, his or her banking needs can affect his adoption. As there are more financial products and services, it is expected that individuals with many financial accounts and who subscribe to many banking services will be more inclined to adopt Internet banking. Tan and Teo (2000) has reported that potential adopters of Internet banking services are likely to own multiple banking accounts and subscribe to various banking services. Rogers argues that potential adapters, who are allowed to experiment with an innovation will feel more comfortable with the innovation and are more likely to adopt it. Thus, if customers have the opportunity to try the innovation, certain fears of the unknown may be minimized. Government policy could also aid or hinder Internet diffusion (Mbarika, 2002). This is consistent with the national systems of innovation theory that posits that government policies may encourage or mandate technology development and adoption (King et. al., 1994; Wolcott et. al., 2001). Tan and Teo (2000) suggest that the greater the extent of government support for Internet commerce, the more likely Internet banking will be adopted, thus, confirming Goh's (1995) suggestion that governments can play an interventionist and leading role in the diffusion of innovation. Potential users in turn would view new applications such as Internet banking services more favorably and hence be more like to use them. Thus, the second alternative hypothesis is:

   H2. National environmental factors do have a significant impact on a consumer's adoption of Internet banking in Malaysia and Singapore

RELIABILITY TEST

Prior to the data analysis, the research instruments were tested for reliability. This is to check the degree to which the observed variable measures the "true" value and whether they are "error free." Thus, the constructs were tested for reliability, using cronbach alpha test. The generally agreed upon lower limit for cronbach's alpha is 0.7 (Robinson, et. al.; 1991), although it may decrease to 0.6 in an exploratory research (Robinson et. al., 1991; Hair et. al., 1998). Nunally (1967) suggested that the score for each construct should be greater than 0.6 for it to be reliable. Hence, a score of 0.6 and above were accepted in this study.

After several statistical reliability tests confidentiality, data integrity, and technology support were dropped from further analysis, as they fell below the 0.6 (acceptance level). Further more, three constructs – authentication, non-repudiation, and trialability had one item, thus their cronbach's alpha could not be calculated. The remaining eight had more than one item in their respective construct and were, therefore, computed accordingly. As table 3 shows, the cronbach's alpha ranges from 0.632 to 0.985.

Table 3: Result of Reliability Test

Factor	*Variable*	*No. of Items*	*Cronbach's Alpha*
E-Commerce Security (IBS)	Authentication	1	-
	Non-Repudiation	1	-
	Confidentiality	2	0.393*
	Data Integrity	2	-0.061*
	Privacy Protection	2	0.858
	Trust	2	0.716
Attitude	Relative Advantage	3	0.884
	Government Support	2	0.769
	Internet Experience	10	0.650
	Subjective Norm	3	0.926
	Self-efficacy	2	0.867
	Banking Need	17	0.985
	Trialability	1	-
	Technology Support	2	0.394*
Dependent Variables (DP)	*Adoption of Internet Banking*	*3*	*0.632*

✉*Excluded from next data analysis as it falls below 0.6 (acceptance level)*
Source: Based on Research Construct.

VALIDITY TEST

In order to test for convergent and discriminant validity of the constructs, factor analysis with varimax rotation was used. The Kaiser-Meyer-Olkin measure of sampling adequacy (MSA) was found to be 0.795. Thus, it was deemed appropriate to apply factor analysis. According to Hair et al (1998) to determine the minimum loading necessary to include an item in its respective construct, variables with loading greater than 0.3 were considered significant; loading greater than 0.4, more important; and loadings 0.5 or greater were very significant. Thus, this study accepts items with loading of 0.4 or greater. Two rounds of factor analyses were performed. The initial solution suggested that seven factors can be extracted, thus, varimax rotation with factor loadings was then generated. See table 4 for the final result.

A total of seven factors with eigenvalues greater than 1.0 were identified. The seven factors accounted for about 62.5% of the total variance. The items measuring relative advantage (1 through 3); Trust (1 and 2); Privacy protection (1 and 2); authentication; and non-repudiation were found together in factor 1. Except for relative advantage (1, 2, and 3), the remaining four items measured Internet banking security. A possible explanation for this could be that respondents who perceived banking on the Internet as

offering an advantage over previous ways of performing the same task might view Internet banking security measures more favorably. Hence, they would be more likely to use Internet banking products and services.

Self-efficacy (1, through 3) was found to load together with those that measure Internet experience (1 through 3) in factor 2. A possible explanation for this could be that respondents with self-confidence in their ability to perform a behavior and necessary Internet experience might tend to view Internet banking adoption more favorably.

Table 4: Factor Analysis

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Relative Advantage_1	0.829						
Relative Advantage_2	0.804						
Trust_1	0.766						
Relative Advantage_3	0.758						
Privacy Protection_1	-0.718						
Privacy Protection_2	-0.682						
Authentication	0.633						
Trust_2	0.615						
Non-Repudiation	0.594						
Self-Efficacy_1		0.823					
Self-Efficacy_2		0.817					
Self-Efficacy_3		0.716					
Internet Experience_1		0.676					
Internet Experience_2		0.651					
Internet Experience_3		0.649					
Subjective Norm_1			0.930				
Subjective Norm_2			0.927				
Subjective Norm_3			0.848				
Government Support_1				0.772			
Government Support_2				0.749			
Banking Need_1					0.696		
Banking Need_2					0.625		
Banking Need_3					0.602		
Banking Need_4					0.574		
Banking Need_5						0.738	
Banking Need_6						0.633	
Banking Need_7						0.543	
Trialability							-0.573
Eigenvalue	*7.556*	*4.156*	*2.323*	*1.898*	*1.641*	*1.513*	*1.396*
% of Variance	*20.422*	*11.232*	*6.278*	*5.130*	*4.435*	*4.088*	*3.772*
Cumulative %	*20.422*	*31.654*	*45.030*	*50.160*	*54.595*	*58.683*	*62.456*

Source: Computed from Primary data

Factor 3 measures subjective norms (1 through 3). Factor 4 measures government support (1 and 2). Factor 5 (1 through 4) and factor 6 (5 through 7) items measure banking needs. The item measuring Trialability was found to load in factor 7.

TEST FOR MULTICOLLINEARITY

Prior to regression analysis, the data were tested for multicollinearity. Multicollinearity refers to high correlations among the independent variables. According to Gujarati (1995) and Tan and Teo (2000), occurrences of this effect violate some of the basic assumptions for regression analyses. To test for multicollinearity, Kleinbaum et. al. (1988) suggest calculating the Variance Inflation Factor (VIF) for each independent variable. According to them, as a rule of thumb, if the (VIF) for each independent variable exceeds 10, that variable is said to be highly collinear and will pose a problem to regression analysis. As Table 5 shows, the variables together with their respective VIF values are between the range of 1.020 and 2.576, well below 10. Therefore, there was no problem of multicollinnearity.

Table 5.: Computed VIF value for Malaysia and Singapore

Variable	Malaysia	Singapore	M'sia Plus S'pore
Authentication	1.084	1.051	1.071
Non-Repudiation	1.089	1.037	1.020
Privacy	1.628	2.223	1.768
Trust	1.850	2.291	1.973
Relative Advantage	2.058	2.576	2.190
Internet Experience	1.191	2.208	1.488
Trialability	1.047	1.166	1.054
Subjective Norm	1.269	1.133	1.269
Self-efficacy	1.409	1.815	1.412
Government Support	1.419	1.263	1.237
Banking Need	1.327	1.949	1.334

Source: Computed from Primary data

SOCIO-ECONOMIC CHARACTERISTICS OF SAMPLE RESPONDENTS

A total number of 310 sampled respondents were used in the analysis. The demographic profile of respondents is shown in Table 6 for Malaysia and Singapore. With regards to gender, males dominated (67.1%) relative to females (32.9%). This domination is consistent with previous studies (Tan & Teo, 2000; Brown et. al., 2003). In terms of age, the respondents are relative young especially in Malaysia with about 53% between the age of 20 and 29years old. Overall, most Internet users are young (age between 20 and 29 years old) and young adults (30 to 39 years old) as they constitute a total of 79.7% of Internet users. This is consistent with Tan and Teo's (2000) study that reported 64.1% between 20 and 29 years old.

Table 6: Demographic Profile of Respondents

	Malaysia		Singapore		Total	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Gender						
Male	103	65.6	105	68.6	208	67.1
Female	54	34.4	48	31.4	102	32.9
Age						
Under 20	5	3.2	2	1.3	7	2.26
20-29	83	52.9	55	35.9	138	44.5
30-39	48	30.6	61	39.9	109	35.2
40-49	15	9.6	23	15.0	38	12.3
50-59	5	3.2	12	7.8	17	5.5
60 and above	1	0.6	0	0	1	0.3
Highest Education						
Primary School	0	0	0	0	0	0
Secondary School	13	8.3	10	6.5	23	7.4
College/Poly/Diploma	34	21.7	51	33.3	85	27.4
Bachelor's Degree	72	45.9	59	38.6	131	42.3
Master's Degree	25	15.9	30	19.6	55	17.7
Doctorate Degree	13	8.3	3	2.0	16	5.2
Others	0	0	0	0	0	0
Current Profession						
Student	42	26.8	27	17.6	69	22.3
Professional	14	8.9	29	19.0	43	13.9
Academic	13	8.3	6	3.9	19	6.1
Self-Employed	10	6.4	9	5.9	19	6.1
Manager	22	14.0	15	9.8	37	11.9
Executive	37	23.6	40	26.1	77	24.8
Technician	6	3.8	8	5.2	14	4.5
Retiree/Housewife	0	0	2	1.3	2	0.6
Others	13	8.3	17	11.1	30	9.7
Average Annual Income						
RM20,000 or less	66	42.0	32*	20.9*	98	31.6
RM20,001-RM40,000	46	29.3	39*	25.5*	85	27.4
RM40,001-RM60,000	22	14.0	45*	29.4*	67	21.6
RM60,001-RM80,000	11	7.0	21*	13.7*	32	10.3

| RM80,001-RM100,000 | 10 | 6.4 | 13* | 8.5* | 23 | 7.4 |
| RM100,001 or more | 2 | 1.3 | 3* | 2.0* | 5 | 1.6 |

*The figures were in Singapore Dollar (S$) during the survey (Source: Primary Data)

With regards to education, most had at least a bachelors degree or equivalent (about 65% including those with masters and doctorate degree). This is consistent with Browns' (2003) study in South Africa, which reported 68% of respondents, but slightly different from Tan and Teos' (2000) Singapore study, in which the majority had junior college or polytechnic qualifications. In terms of profession, students form the majority in Malaysia, while executives dominate Singapore respondents. Overall, executive are the majority at 24.8%, while students constitute 22.3%, followed by professionals at 13.9%. Of those who are working, 29.3% earn an average annual income of between RM20,001 to RM40,000. However, respondents in Singapore earn much higher, as 29.4% earn an average annual income of S$40,001 to S$60,000 (RM90,000 to RM135,000 at 2.25 exchange rate).

HYPOTHESIS TESTING
In order to test the hypothesis, multiple regressions were used. Fourteen factors were originally formulated for the study. They are e-commerce security (confidentiality, data integrity, authentication, non-repudiation, privacy and trust), and national environmental factors (relative advantage, Internet experience, trialability, self-efficacy, subjective norm, banking needs, government support, and facilitating condition (technology support)). The result of the reliability test as earlier stated suggest that the cronbach's alpha for confidentiality, data integrity and technology support were in the range of -0.061 – 0.394, which fall short of the acceptance level of above 0.60, suggested by Nunally (1967). They are therefore excluded from further analysis (Refer to Table 3). To this end, eleven factors were, therefore, used in the multiple regression analysis. The independent variables used for the analysis are (H1) authentication, non-repudiation, privacy protection and trust, and (H2) relative advantage, Internet experience, banking needs, trialability, subjective norm, self-efficacy, and government support. These were regressed on "adoption of Internet banking".

RESULT OF HYPOTHESIS TEST
The analogy of the multiple regressions is to estimate a single equation (Hair et al., 1998). It implies the development of relationships linking independent variables to their dependence relationship. In table 7, the multiple regression coefficients between all the predictor variables and the dependent (Internet banking adoption) variable are 0.728 (R-value) for Malaysia and 0.783 (R-value) for Singapore. This suggests that there is a great deal of variance shared by the independent variables and dependent variable for Malaysia and Singapore. The R Square, which can be used to describe the goodness-of-fit, has a value of 0.532 for Malaysia and 0.612 for Singapore, indicating that about 53% (Malaysia) and 61% (Singapore) of the variance in the dependent variable is explained by the independent variables in the models, respectively (see table 7).
Table 7: Regression Result "Malaysia" and "Singapore"

	R	R Square	Error	F	Df1	Df2	P Value	N
Malaysia	0.728	0.532	0.723	10.534	15	139	0.000	155
Singapore	0.783	0.612	0.656	14.435	15	137	0.000	153

Source: Computed from Primary Data

The null hypothesis was not true as F values (10.534 and 14.435) have a small significant level or P-value (0.000 and 0.000) for Malaysia and Singapore, respectively. Hence, the model is fit. The "t" test has been used to evaluate the null hypothesis that the unstandardized regression coefficients are fixed to zero, which is presented in table 8 as t statistic. The factors significant at p < 0.05 highlighted. The results of hypotheses testing are as follows: Internet experience (H2b) and banking needs (H2c) are accepted to significantly influence adoption of Internet banking in Malaysia and Singapore. While, non-repudiation (H1b), trust (H1d), and relative advantage (H2a) do significantly influence the adoption of Internet banking in Malaysia, but not in Singapore. However, there is no support for these hypotheses, as authentication (H1a), Privacy (H1c), trialability (H2d), subjective (H2e), self-efficacy (H2f), and government support (H2g) do not significantly influence adoption of Internet banking in Malaysia, as well as in Singapore.

Table 8: Actual Usage of Internet Banking "Malaysia and Singapore"

Factor	Hypothesis	Variable	Malaysia				Singapore			
			Beta	Std. Error	T	P-Value	Beta	Std Error	t	P-Value
E-Commerce Security	H1a	Authentication	0.047	0.060	0.781	0.436	0.043	0.054	0.798	0.426
	H1b	Non-Repudiation	-0.164	0.063	-2.589	**0.011**	-0.003	0.056	-0.052	0.959
	H1c	Privacy	0.108	0.075	1.445	0.151	-0.012	0.079	-0.148	0.883
	H1d	Trust	0.188	0.079	2.367	**0.019**	-0.106	0.081	-1.319	0.189
National Environmental Factor	H2a	Rel. Advantage	0.182	0.084	2.163	**0.032**	0.023	0.085	0.267	0.790
	H2b	Internet Experience	0.388	0.064	6.095	**0.000**	0.575	0.079	7.280	**0.000**
	H2c	Banking Need	0.317	0.067	4.724	**0.000**	0.308	0.074	4.152	**0.000**
	H2d	Trialability	0.084	0.066	1.270	0.206	-0.057	0.063	-0.907	0.366
	H2e	Subjective Norm	-0.006	0.065	-0.098	0.922	0.008	0.057	0.146	0.884
	H2f	Self-Efficacy	0.016	0.069	-0.229	0.819	0.069	0.072	0.967	0.335
	H2g	Govt. Support	0.080	0.070	1.140	0.256	-0.083	0.060	-1.384	0.169

Source: Computed from Primary Data

Chow Statistic

To test for differences in regression functions across the groups "Chow statistic" (F statistic) was used. Wooldridge (2003) suggests the use of chow statistics in testing the null hypothesis of two populations or groups that follow the same regression function, against the alternative or more of the slopes, which differ across the groups. In the present study, this computation was used to test whether the same regression model describes Internet banking adoption for Malaysia and Singapore. The following equation is suggested:

Equation: 1

$$F = [SSRp - (SSR1 + SSR2)] / (SSR1 + SSR2) * [n - 2 (k + 1)] / (k + 1)$$

Where: SSR1 (Sum square residual for Malaysia); SSR2 (Sum square residual for Singapore); SSRp (Sum square residual for Malaysia and Singapore); n (Number of observations); and k + 1 (df regression).

Thus:

$$F = [182.357 - (72.643 + 58.904)] / (72.643 + 58.904)] * [310 - 2 (15)] /15$$
$$\circlearrowright 7.21$$

The null hypothesis thus:

H3: There is a significant difference between the determinant of Internet banking in Malaysia and Singapore

The estimated "F" value is significant at 5% level, hence the null hypothesis is rejected. It can be inferred that there is a significant difference between Malaysia and Singapore. Thus, the chow test output calculated suggests that there is a significant difference between Malaysia and Singapore regression functions.

CONCLUSIONS

The findings in the present study show that in both Malaysia and Singapore, Internet banking adoption is predicted by Internet experience and banking needs. The strong influence of Internet skill and experience could reflect their importance to technology adoption across culture. As banking needs greatly influence Internet banking usage. It is, therefore, suggested that banks should concentrate on providing innovative and value added products in their Internet banking services. Furthermore, banks should target the youths and young adults who are more likely to be risk takers and love the comfort that Internet banking provides. Another target group could be the more affluent in the society, as this group is more likely to own multiple banking accounts, subscribe to various banking services and hence, would have high needs for convenient and easily accessible delivery channels such as Internet banking and be more likely to use them.

The strong influence of relative advantage in Malaysia suggests that the perceived compatibility of Internet banking with its value and working condition could be the reason for the adoption of this innovation.

The security reasons for adoption or non-adoption of Internet banking in Malaysia are perceived non-repudiation and trust in this mode of delivery channel. Certification by

publicly trusted control system, such as SET protocol should be obtained by banks and its availability and function be communicated to consumers (Tan & Thoen, 2001; Suh & Han, 2003). SET protocol was developed to address issues like non-repudiation because it uses public-key cryptography. Banks should also consider the use of trust seals such as DigiCert, VeriSign, BBB Online. MayBank's privacy seal is displayed on its web site, compared to most other Malaysia banks that do not have or display such web assurance seal in their web site. It is, therefore, no surprise that over 30% of those surveyed used MayBank for their Internet banking transactions in Malaysia. Banks should also launch an awareness campaign to explain to consumers the control system in use in their electronic banking site. The results of this study also suggest that more than 78% of the respondents do not know what a web assurance seal is. About 15% have no knowledge of web seal and more than 66% are not sure of web seal, even if they see one.

Furthermore, an indemnification policy (whereby a bank promises a refund for unauthorized transactions under certain conditions) among Malaysian banks might go a long way to improve consumer confidence in Internet transactions.

The advantage and convenience of Internet banking could be enhanced in Malaysia through the following means:
- Introduction of innovative products like debit card Visits to some banks in Malaysia revealed that this debit card is not available, yet. On the other hand, banks in Singapore (e.g. DBS bank, POSBank, UOB and others) offer this innovative product to their clients. Thus, with the number of cardholders likely to increase and more transactions as well as adoption of Internet banking is expected.
- The cost of Internet access is relatively higher in Malaysia than in Singapore. This might have effect on Internet adoption rate and availability of such infrastructure in the country, considering the per capita income between the two countries. Furthermore, the result of the study shows that about 51% Malaysian surveyed said their banks charge for some Internet banking transactions, compared to only 6.1% in Singapore.
- Household broadband penetration rate in Malaysia ranks very low, at 0.44% among Asia-Pacific countries. The slow deployment of broadband access has been an area of concern highlighted by the government and industry observers (ITU, MCMC, 2004a).

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