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Communications of the Association for Information Systems

E-COMMERCE ADOPTION IN BRUNEI DARUSSALAM: A QUANTITATIVE ANALYSIS OF FACTORS INFLUENCING ITS ADOPTION

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ABSTRACT

This study examines the effect of five factors on the adoption of electronic commerce among small and medium enterprises in Brunei Darussalam. A review of the literature shows that owner characteristics such as lack of perceived relative advantage, lack of knowledge, and perceived lack of trust are significant inhibitors while environment characteristics such as competitive pressure and, government support are significant motivators of electronic commerce in Brunei Darussalam. A questionnaire survey was conducted in 360 small and medium enterprises. A total of 184 valid responses were obtained. Stratified random sampling was adopted over other techniques to enhance representativeness. Data analysis shows that significant relationship exists between each of the five variables and electronic commerce adoption among small and medium enterprises in Brunei Darussalam. This study concludes that the five factors explain more than fifty percent of the variation in small and medium enterprises adoption. Competitive pressure emerged as the most important factor in terms of relative importance. This factor is followed by IT knowledge, relative advantage, security and government support.

Keywords: electronic commerce, diffusion of innovation, adoption, small and medium enterprises

I. INTRODUCTION

Despite the concerted efforts made to promote electronic commerce (e-Commerce) adoption in Brunei Darussalam, statistics show that many small and medium enterprises (SMEs) are still not adopting the technology as rapidly as anticipated. The importance of SMEs stems from their increased role in job creation and economic growth in Brunei. SMEs need to adopt e-Commerce to be more competitive and to play a greater role in driving the economy.

For most of the twentieth century, the country of Brunei Darussalam enjoyed growing prosperity. This prosperity was the result of bountiful oil and gas resources relative to a small population. Brunei Darussalam's Gross Domestic Product (GDP) per capita in 1997 was estimated at US$14,800, the second highest in ASEAN and the fourth highest in Asia [Bruneipress, 2004]. With the new century, the continued prosperity of Brunei Darussalam can no longer be taken for granted. Warning signals indicate fundamental economic problems which threaten to undermine the prosperity and with it the social stability enjoyed by the people of Brunei Darussalam. Since

1994, the government incurred an annual budget deficit averaging B$1 billion[1] a year which is equivalent to an average of 15% of GDP [BDEC, 2000]. Official statistics show unemployment in 2003 to be at 5.3%. However, it is estimated that the rate could be as high as 25% for school leavers and new graduates [EIU, 2004 pp.46]. Between 1996 and 2002, with the exception of the oil and gas sector, nearly every sector declined by 20% to 50% [JPKE, 2003]. The burden on his Majesty's Government therefore remains very large. Over 75% of Brunei national workforces [EIU, 2004] are employed by the government. Government and government-related contracts account for most of domestic economic activity. This situation is increasingly unsustainable. Furthermore, the government's financial ability to undertake these burdens is sharply reduced as a result of lower oil and gas revenues and losses in the investment of Brunei Darussalam's foreign reserves.

Given these warning signs, organizations in Brunei are coming under increasing pressure to adopt e-Commerce technology as part of the need to be efficient and competitive and to play a greater role in driving the economy [BDEC [2000]. Seyal and Rahman [2003] show that number of total businesses employing web sites in Brunei is small compared to those in Singapore and Malaysia. Only 46.5% of all private companies in the country offer web sites. In comparison, in Singapore, more that 90% of all private companies have web sites. Another study [Yap 2002] indicates that only 3.7% of the SMEs use e-Commerce with annual sales of more than B$500,000. Internet use is only to attain advantage over other business in image building. It is also said that the use of the facilities is influenced by social cultural values or simply for status [Bit 2001].

II. SIGNIFICANCE OF THIS STUDY

This study is significant for two reasons.

1. It fills a knowledge gap about e-Commerce adoption in Brunei Darussalam. It aims to identify which factors are important for encouraging willingness to adopt e-Commerce. Prior research by Pricewaterhousecoopers [1999] in all twenty-one APEC member countries identified a number of perceived barriers and motivators. However, the result is a generalization for all APEC countries and did not include detailed investigations on relationships of the factors and their relative importance. This study attempts to uncover important factors affecting SME adoption of e-Commerce in Brunei Darussalam as well as to quantify their relative importance.

2. This study focuses on a relatively unexplored and important sector in Brunei – the SMEs. Little research has been conducted on this size of firm. The importance of SMEs stems from their increased role in job creation and economic growth for Brunei [Bruneipress, 2004]. It is hoped that this new knowledge will help researchers and practitioners alike to better understand e-Commerce development and implementation in Bruneian SMEs. Such an understanding will be useful for government authorities and private companies in drawing guidelines on how to encourage and motivate widespread adoption of e-Commerce.

III. LITERATURE REVIEW

A review of the literature shows that innovation diffusion theory [Rogers, 1995] has served well as the underlying theoretical framework for most research on the diffusion of innovation [Tan et al., 2003; Kendal et al., 2002; Teo et al., 1998; Akkeren and Cavaye 1999; Gregor and Jones, 2000]. Innovation is defined as any idea, practice or object that is perceived to be new by an individual. Rogers defines diffusion as the process by which an innovation is communicated over time among the members of a social system [Rogers, 1983:pp.5]. Rogers [1995], found that a technological innovation will diffuse faster if it is perceived as possessing the five attributes of an

[1] The exchange rate for 1 Brunei dollar in September 2004 was 0.5885 U.S. dollars

innovation (relative advantage, complexity, compatibility, trialability and observability). These five attributes represent the main determinants that explain 49% to 87% of the variance in the rate of adoption. Many studies use these attributes in their search for factors affecting technology adoption and found relative advantage to be one the best predictors of an innovation's rate of adoption [O'Callagham et al. 1992, Cragg and King 1993, Soh et al. 1997, Songan and Noor 1999 and Premkumar et al. 1994].

The technology acceptance model [Davis, 1989] and the Decomposed Theory of Planned Behaviour model [Taylor and Todd, 1995] discusses technology adoption in terms of use-related beliefs, behaviour and social influence. These models identify two such beliefs: perceived usefulness (PU) and perceived ease of use (PEOU). PU is "the degree to which a person believes that using a particular system would enhance his or her job performance" [Davis, 1989:pp.320]; while PEOU is "the degree to which a person believes that using a particular system would be free of effort" [Davis, 1989:pp.320]. Constructs used in these two models are generally based on perceptions, attitudes, beliefs, and social influence, together with psychological considerations in determining technology adoption, acceptance and usage. Limitations of these models are that they tend to ignore factors both within and outside the organization that may impact IT adoption and diffusion, for example, economic factors (cost, pressure from suppliers or customers or competitors), and characteristics of the firm (size, sector and status).

Literature on adoption of IT in small businesses and adoption of Internet provided a number of facilitating and inhibiting factors of technological adoption. These factors can be categorized into factors relating to the owner/manager, the organization, and the environment. Thong and Yap [1995] identify computer literacy of the small business owner and lack of knowledge of benefits derived from IT as important determinants for IT adoption. Reynolds et al. [1994] study confirms that owners and employees of small businesses tend to have limited skills and expertise especially when it comes to the use of IT [MacGregor, Waugh and Bunker, 1996]. Financial issues are important to owner/managers and often drive technology adoption in small firms [Pearson and Grandson, 2004; Tan and Ouyang 2003]. An innovative small business owner may recognize all the benefits to his firm in adopting IT in terms of both a short or long-term investment. However, without sufficient funding the owner cannot adopt. Many researchers raised the issue of security as an important inhibitor to Internet adoption [Phillips, 1998; Telstra, 1999]. For example, Tan and Ouyang [2003] pointed out that small businesses in China tend to be concerned about the security of payments via the Web, while McComb [1998] suggests that many businesses are worried about hackers gaining access to such data as credit card details and bank records. It is generally believed that competition increases the likelihood of innovation adoption [Kimberley and Evanisko 1981, Link and Bozeman 1991, Utterback 1974]. It is tough rivalry that pushes most businesses to be innovative. Empirical studies show that more intense competition is associated with higher adoption rates [Globerman 1975,Levin et.al. 1987]. Competition leads to environmental uncertainty and increases both the need for and the rate of innovation adoption [Ettlie 1983, Ettlie and Bridges 1982]. Government entities are among the most powerful institutional forces affecting innovation [Nelson and Soete 1988]. In a study of the importance of U.S. government policies on technology development strategy at the firm level, Crow [1988] found that as government financing or influence increases, sales of the affected products subsequently increase. Mowery and Rosenberg [1979] suggested that government policies that enhance, or appear to enhance the ability of the firm to compete in the marketplace, have a strong positive influence on technology development strategy at the corporate level.

IV. RESEARCH MODEL

Based on the literature review in Section III, the research model shown in Figure 1 was developed. The model asserts that

- relative advantage,
- IT knowledge,

- competitive pressure,
- government support and
- security

play a crucial role in influencing the adoption of e-commerce for small and medium enterprises in Brunei. Accordingly, the more abundantly these characteristics are present in an organization and its environment, the more likely e-commerce will be adopted. Adoption of e-commerce is thus the dependent variable, while the independent variables are relative advantage, IT knowledge, competitive pressure, government support and security.

Five hypotheses were formulated from the research model. The following subsections conceptualize the dependent variable and each of the five independent variables and states the corresponding hypotheses.

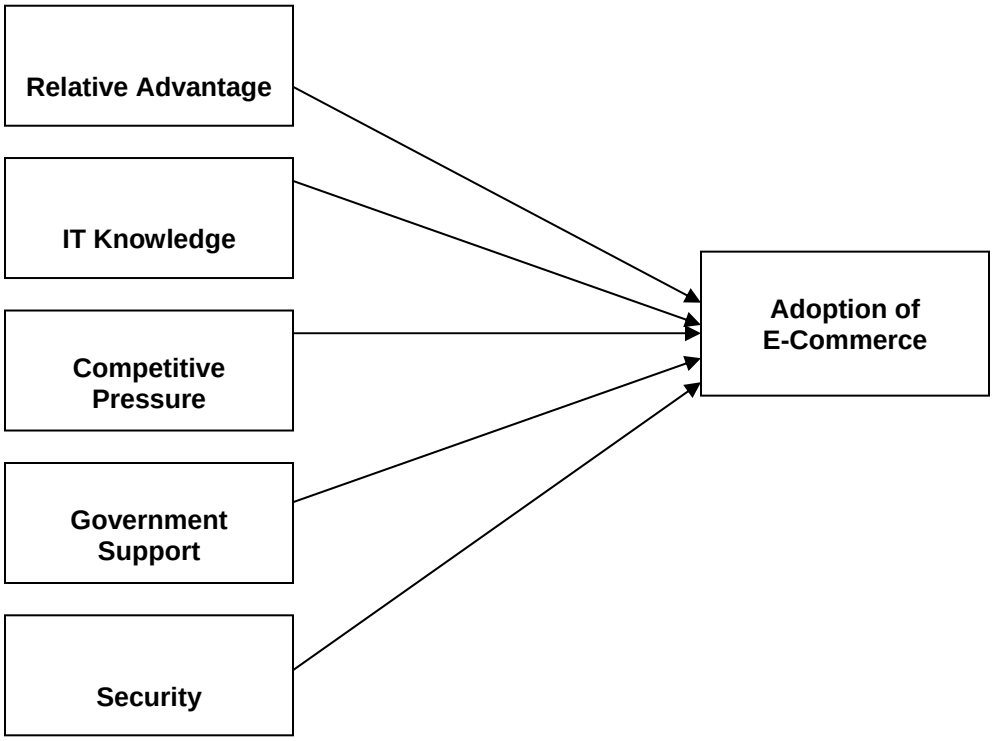


Figure 1. A Proposed Research Model for E-Commerce Adoption in Brunei Darussalam

RELATIVE ADVANTAGE

Relative advantage is the extent to which adopting an innovation is perceived as providing greater organizational benefits than maintaining the status quo [Kwon and Zmud, 1987]. Rogers [1995:p212] defined relative advantage as the extent to which an innovation is perceived as being better than "a competing or preceding idea". Sub-dimensions of relative advantage are:

- economic profitability
- low initial cost
- reduction in discomfort
- savings in time and effort
- the immediacy of the reward
- immediacy of return of investment
- cost effectiveness

The advantage can be measured in terms of greater profit potential but can also be judged on other factors like ease of use, social status, and satisfaction [Rogers 1995, p15]. The commonly acclaimed benefits of using the Internet for business include:

- the creation of a worldwide client base
- rapid information access
- global-scale information dissemination
- cost effectiveness
- profitability
- new business opportunities

Many diffusion scholars used this attribute in their search for factors affecting technology adoption. They found relative advantage to be one the best predictors of an innovation's rate of adoption. For example, O'Callagham et al. [1992] found that adoption of EDI is related to the perceived relative advantage of the technology and the level of compatibility with the existing system. Cragg and King [1993] and Cragg [1996] found that perceived relative advantage of information technology (IT) is the most important factor for IT adoption in small businesses. Other studies that support this attribute are found in the work of Soh et al. [1997], Songan and Noor [1999], and Premkumar et al. [1994]. It is possible therefore to hypothesize that a positive relationship exists between relative advantage and adoption of e-commerce. This conclusion leads to the following hypothesis:

> *Hypothesis 1: The greater the perceived relative advantage of e-commerce, the higher the probability of e-commerce adoption by enterprises.*

COMPETITIVE PRESSURE

It is generally believed that competition increases the probability of innovation adoption [Kimberley and Evanisko 1981, Link and Bozeman 1991, Utterback 1974]. It is rivalry that pushes most businesses to be innovative. Empirical studies show that more intense competition is associated with higher adoption rates [Globerman 1975,Levin et.al. 1987]. Competition leads to environmental uncertainty and increases both the need for and the rate of innovation adoption [Ettlie 1983, Ettlie and bridges 1982].

Porter and Millar [1985] identified five competitive forces: new entrants, the threat of substitute products or services, bargaining power of customers, bargaining power of suppliers, and rivalry amongst current competitors. They suggested that by adopting an innovation like information technology (IT), businesses would be able to change their competitive environment in three ways:

1. IT can change the industry structure and, in so doing, alter the rules of competition.
2. IT can also create competitive advantage by giving businesses new ways to outperform their rivals.
3. IT spawns new businesses, often from within existing operations of the business.

Therefore, a business in an environment that is more competitive would feel a greater pressure to turn to IT to gain a competitive advantage. On the other hand, a business in a less competitive environment would not face a push to be innovative. This analysis leads us to the following hypothesis:

> *Hypothesis 2: The adoption of e-commerce will increase with the amount of competitive pressure of the environment.*

IT KNOWLEDGE

Attewell [1992] conceptualized the diffusion of complex technological innovations in terms of decreasing knowledge barriers. Because of obstacles with developing the necessary skills and technical knowledge, many businesses are tempted to postpone adoption of the innovation until the barriers to adoption are lowered or circumvented. The implication of this theory is that overcoming the lack of knowledge of the innovation will lead to greater likelihood of adopting the

innovation. Ettlie [1990] also found that business owners with more knowledge of the technological innovation are significantly more likely to implement an aggressive technology adoption policy. Niedleman [1979] attributed the failure of European small businesses to utilize IT to lack of IT knowledge. In a study of Singapore small businesses, Gable and Raman [1992] found that small business owners tend to lack basic knowledge and awareness of IT. Many of them rejected the notion that IT could be of any use to their businesses, as they had no idea of the potential benefits IT offer. This finding seems to imply that, if these business owners could be educated about the benefits of IT, they would be more willing to adopt such technology. This argument leads us to the following hypothesis:

> *Hypothesis 3: The higher the level of IT knowledge possessed by the enterprise owners, the higher the likelihood of e-commerce adoption.*

GOVERNMENT SUPPORT

Government agencies play an important role as users and inducers of e-commerce practices [Tigre 2003; Chan and Al-Hawamdeh 2002; Kim 2001]. Government use of the Internet for procurement, tax filings, and other services stimulated e-commerce activity in the private sector [Tigre 2003]. Successful Internet businesses see a significant role for Government, particularly in providing information and independent advice, providing support, assistance with developing a geographically wider customer base, advice on international trade, and promotion overseas, and as a role model for the use of eCommerce and telecommunications infrastructure [Castleman, Swatman and Swatman 2000]. Evans [2002] found that central government policies relating to regulation, data protection, security and tax and marketing criteria, such as the price of Internet access, have a strong positive influence on the development of Business to business electronic commerce.

A study on the use of the Internet found that government endorsement was one of the dominant factors in Internet growth in Singapore [Goh, 1996]. This result affirms the role played by government in pushing the adopting of IT in Singapore [Toh and Low 1993]. In another related study, Wong [2003] found that continuing active government policy role contributed to Singapore's rapid electronic commerce diffusion, just as Singapore's past high rate of adoption of ICT was significantly driven by active government policies. This data leads us to the following hypothesis:

> *Hypothesis 4: The greater the government support for e-commerce, the higher the probability of e-commerce adoption.*

SECURITY

The issue of security is raised on a number of occasions in the Internet adoption literature and forms an area of serious concern for most small and medium enterprises. For example, Telstra [1999] pointed out that small business tends to be concerned with the security of payments via the Web, while McComb [1998] suggested that many businesses were worried about hackers gaining access to financial data such as credit card details and bank records.

Feelings of insecurity can be caused by perceived risk, lack of privacy, or lack of trust for an innovation. Bauer [1960], Webster [1969], and Ostlund [1974] introduced risk as an additional dimension in diffusion and adoption. Cox and Rich [1964] referred to perceived risk as the overall amount of uncertainty perceived by a consumer in a particular purchase situation. Jacoby and Kaplan [1972] classified consumers' perceived risk into the following five types of risk: physical, psychological, social, financial, and performance (functional). Chaudhuri [1998] stated that low levels of perceived risk in products are related to high level of positive feelings during consumption. A common and widely recognized obstacle to electronic commerce adoption is the lack of security and privacy over the Internet [Bhimani 1996; Cockburn and Wilson 1996; Quelch and Klein 1996; Rhee and Riggins 1997]. These factors led many to view e-commerce as a risky undertaking. Thus, we expect that only individuals who perceive using e-commerce as a low risk undertaking would be inclined to adopt it. This expectation leads to the hypothesis:

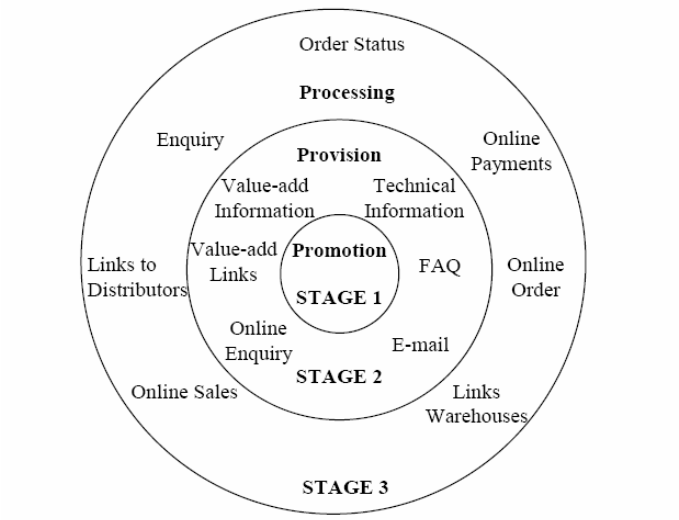
Hypothesis 5: The adoption of e-commerce will be influenced positively by the extent of security perceived by the enterprise owners.

ADOPTION OF E-COMMERCE

E-commerce can be defined as a "general term for the conduct of business with the assistance of telecommunications, and of telecommunications-based tools" (Clarke 2001). The adoption of e-commerce can be broken down into three stages according to the extent of adoption. This study is based on the Model of Internet Commerce Adoption (MICA) developed by Burgess and Cooper (1999). The model is shown in Figure 2.

The MICA model consists of three layered stages that represent the three extent of adoption (basic adoption, intermediate adoption and advanced adoption).

1. Basic Adoption. Labeled Inception in Figure 2, this stage is at the centre of the MICA model. Web sites classified as in the basic adoption level would be defined as providing basic information or having a basic web presence.



Adapted from Burgess and Cooper[1999]

Figure 2. The Model of Internet Commerce Adoption

2. Consolidation. Sites classified in the intermediate adoption level would demonstrate an extension of basic information by including E-mail, on-line inquiry and contact, frequently asked questions (FAQs), information on extended services and general value-added information. Hallmarks of the consolidation stage typically provide value-added information and non-secure value-added services provision.
3. Advanced Adoption Level. Maturity forms the outer ring of the MICA model. To be classified in the advanced adoption level, an organization would have taken its web site to a higher level of value-added services, including secure on-line transaction processing.

V. RESEARCH METHODOLOGY

RESEARCH INSTRUMENT

Data for the study was collected in June 2003 by means of the questionnaire shown in Appendix I. The questionnaire is based on the research model. As far as possible, operationalization of variables was based on standard instrument or existing instruments that are widely used. Table 1 lists each variable along with the corresponding references.

Table 1. Operationaization of Research Variables

Variables	Questionnaire Items	References
Relative Advantage	1.Doing business using the Internet & website can help our company in many ways 2.Having a website helps to advertise our services/products all over the world (in the worldwide market) 3.A business website helps us to provide better customer services by giving them quick and latest information about our products and services. 4.Presently, website/e-commerce is not useful for our business yet–apart from having to spend extra money, time and effort.	Teo et al.[1998]: Kendall et.al. [2002] Moore and Benbasat[1991]
IT Knowledge	1.We have very little knowledge how Internet and electronic commerce can help to improve my business and increase our sales 2.We will use more Internet/electronic commerce if we know more about what they can do for my business. 3.We do not have the technical knowledge and skills to start using Internet and electronic commerce 4.We have very good understanding about how Internet and e-commerce can be used to help to improve my business profit.	James Y.L.Thong [1999]; Gable and Raman[1992]
Competitive Pressure	1.Many of our business competitors are already having websites and using Internet for doing business 2.Our suppliers/trading partners are not using the Internet and do not have website and e-commerce. 3.Our customers or trading partners expect us to have a website or provide electronic commerce facilities to them. 4.Having a website and e-Commerce helps us to compete better with our competitors	Teo et al.[1998]; Grover [1993]; Utterbach and Abernathy[1975]
Government Support	1.The Brunei government is helping to lower the cost of using the Internet and setting up e-commerce facilities 2.The Brunei government is helping in giving all kinds of assistance to help to small businesses to use Internet. 3.The government often inform us about the good points of e-commerce and doing business using the Internet 4.Support from government is important to encourage us to use more of Internet in business.	Crow [1988]; Toh and low[1993]; Tan and Teo[2000]
Security	1.We are worried that our business transactions on the Internet can be read and seen by others 2.We trust that the Internet can protect the confidential data that we enter on the websites. 3.There is very little risk involved when doing businesses over the Internet. 4.Our customers are worried about privacy and security of Internet and will not use Internet to make payment	Bhimani [1996]; Cockburn and Wilson[1996]; Rhee and Riggins[1997]

The questionnaire also captured the respondent's demographic profile: industry type, number of employees, annual revenue, age, gender, and job title. All perceptual items were measured by five-point Likert scales representing a range from "strongly disagree" to "strongly agree". Prior to broader distribution, a pilot test was conducted on 20 SMEs. The aims were to refine the overall quality of the questionnaire and to assess such critical factors as questionnaire clarity, questionnaire comprehensiveness, and questionnaire acceptability. The questionnaire was then modified to reflect the feedback received.

VALIDITY AND RELIABILITY OF INSTRUMENT

The psychometric properties of the research variables were examined. Measurement of a variable must be reliable to be useful and yield stable result. For each composite variable, the reliability or internal consistency was assessed by calculating the Cronbach alpha coefficient. In addition, inter-item correlation and item-total correlation were also computed to highlight certain weaknesses within a composite variable that alpha alone does not provide. Table 2 presents the standardized Cronbach alpha coefficients for the five research variables under investigation. Item 6 and item 16 were deleted for subsequent data analysis because they did not meet the minimum recommended requirement of 0.30 and 0.40 for inter-item and item-total correlations respectively. All alphas met Nunnallly's [1978] minimum requirement of 0.70, indicating that the five constructs offer more than adequate reliability for hypothesis testing.

Table 2. Cronbach's Alpha for the five Research Variables

Variables	Questionnaire Items	Cronbach's Alpha (before adjustment)	Cronbach's Alpha (after deletion of item 6 and 16)
Relative Advantage	Q1,Q2,Q3,Q4	0.9125	0.9125
IT Knowledge	Q5,Q6,Q7,Q8	0.8345	0.8880
Competitive Pressure	Q9,Q10,Q11,Q12	0.8982	0.8982
Government Support	Q13,Q14,Q15,Q16	0.6572	0.7994
Security	Q17,Q18,Q19,Q20	0.8808	0.8808

DATA COLLECTION

The target population is the 6576 SMEs in Brunei Darussalam. A random sample of 360 small and medium enterprises compiled from a key business directory of Brunei [Bruneipress 2003] was used. The size is derived from Krejele and Morgan [1970]'s recommendation and is based on the assumption of 95% confidence level and plus and minus 5% estimation error. Since the population can be classified into a number of strata or homogenous layers, it is possible to enhance representativeness by using stratified random sampling. Table 3 shows the sample size of each stratum (industry) after the proportional stratified sampling was carried out. The sample is randomly chosen from each stratum so that the proportion (between strata) to the total population, are equal. The aim is to ensure that the sample reflects the structure of the population and to help to improve the representativeness and hence inference.

Every effort was made to ensure an effective response rate; with the use of emails, covering letters, reminders and responsive questionnaires. Of the 360 questionnaires mailed out, a total of 184 valid questionnaires were received. Thus, the overall response rate was 51.11%, significantly higher than the minimum recommended rate of 30% for survey research [Owen and Jones, 1990]. The overall response is considered favorable and is sufficient for making a good assessment with respect to the intended objectives of this research.

Table 3. Sampling size using Proportional Stratified Sampling Technique

	Industry Sectors	No of SMEs	% of Total	Sampling size
1	Agriculture, Forestry and Fishing	677	10.30%	37
2	Coffeeshop, Restaurants and Hotels	590	8.97%	32
3	Community, Social and Personal Services	845	12.85%	46
4	Construction	1282	19.50%	70
5	Financial, Insurance and business Service	300	4.56%	16
6	Mining, Quarrying and Manufacturing	1142	17.37%	63
7	Transports, Storage and Communication	320	4.87%	18
8	Wholesale and Retail Trading	1420	21.59%	78
	TOTAL	6576	100%	360

Source: Brunei Darussalam Statistical Yearbook 2002 pg 42

VI. DATA ANALYSIS

DEMOGRAPHIC PROFILE OF RESPONDING ORGANIZATIONS

Table 4 presents the demographic profile of responding organizations. 'Wholesale and Retailing' is the largest industrial sector (23.37%) in the sample followed by the others listed in the table. The percentage representation corresponds closely to the national industrial representation as published in the Brunei Statistical Yearbook [2003]. This correspondence provides further confidence about the representativeness of the sample and further evidence of the generalizability of the sample.

Table 4. Demographic Profile of Responding Organizations

VARIABLE		FREQUENCY	PERCENT
Industry	Wholesale and Retail Trading	43	23.37
	Construction	30	16.30
	Mining & Manufacturing	23	12.50
	Restaurants and Hotels	22	11.96
	Community & Social Services	19	10.33
	Transports & Communication	17	9.24
	Financial & Business Services	16	8.70
	Agriculture, Forestry & Fishing	14	7.61
	Total	**184**	**100**
Employee	1-5	29	15.8
Size	6-10	34	18.5
	11-20	34	18.5
	21-50	48	26.1
	51-100	39	21.2
	Total	**184**	**100**
Adoption	Non Adopter	78	42.4
Category	Basic Adopter	64	34.8
	Intermediate Adopter	34	18.5
	Advanced Adopter	8	4.3
	Total	184	100

The table also shows that more than 50% of the respondents employ 20 or fewer people, about 26% employ 21-50 employees whilst only 21% employ 51-100 people. This representation is

consistent to the national representation [Brunei Statistical Yearbook 2003] thus providing further confidence about the representativeness of the sample and further evidence of the generalizability of the sample.

The table shows little adoption of e-commerce for business. Over 42% of the responding organizations indicated that they did not possess any e-commerce capability (including a basic static homepage and email accounts) Over 34% of the organizations were characterized by the static presence of the company's homepage in the Internet as a promotion tool. Only 18.5% indicated that they possessed intermediate e-commerce capabilities in which their web sites are capable of doing email enquiry, product search, online enquiry, order submission but not online sale and payment. Only 4.3% of the respondents indicated that they possessed advanced e-commerce applications and their web sites are capable of doing online sale, online order and online payment.

HYPOTHESES TESTING

The hypotheses about the adoption of e-commerce were tested individually by using Pearson correlation analysis. It is the appropriate statistical technique when both the dependent and independent variables are interval data. The results of the Pearson correlation computation using 95% confidence level are presented in Table 5.

Table 5. Results of the Hypotheses Testing

Hypothesis	Variable	r-value	p-value	Result at 95% Confidence Level
H1	Relative Advantage	0.563**	0.000	Supported (Reject Null Hypothesis)
H2	IT Knowledge	0.556**	0.000	Supported (Reject Null Hypothesis)
H3	Competitive Pressure	0.620**	0.000	Supported (Reject Null Hypothesis)
H4	Government Support	0.244**	0.001	Supported (Reject Null Hypothesis)
H5	Security	0.545**	0.000	Supported (Reject Null Hypothesis)

*** Correlation is significant at the 0.1 level (2-tailed).*

The results suggest that all the hypotheses are supported (p-value < 0.005). The positive Pearson correlation coefficients (in "r-value" column) indicate that the variables are positively correlated with adoption of e-commerce while the low significance levels (p-values) indicate that the relationships are significant at the 95% confidence level. In other words, adoption of e-commerce is positively related to relative advantage, IT knowledge, competitive pressure, government support and security.

The results are consistent with prior studies which found that these variables significantly influence the intention to adopt new innovations [Globerman 1975; Levin et.al. 1987; Niedleman, 1979; Ettlie 1990; Soh et al. 1997; Songan and Noor, 1999; Premkumar et al., 1994; Telstra, 1999].

VII. REGRESSION ANALYSIS

While Pearson correlation is useful for testing individual hypotheses, it does not provide the means for studying the combined efforts of all independent variables and their relative importance. A regression analysis was carried out to provide meaningful interpretations of the relative importance of the five constructs. When the five independent variables were regressed on adoption of e-commerce as the dependent variable using the regression function in SPSS, the following results shown in Table 6 were obtained.

Table 6. Results of Multiple Regression Analysis

Independent Variables	Standardised Beta	p-value	Relative Importance
Relative Advantage	0.172	0.114	3rd
IT Knowledge	0.199	0.025	2nd
Competitive Pressure	0.293	0.017	1st
Government Support	0.012	0.835	5th
Security	0.092	0.271	4th

R=0.691, R Square=0.477, Adjusted R square=0.462, Durbin-Watson=1.096, F=32.135 & Sig=0.000

The table shows that multiple correlation coefficient (R), using all the predictors simultaneously, is 0.691. The coefficient of determination (R Square) is the proportion of the total variation in the SMEs adoption of electronic commerce that is explained by the regression relationship between the adoption and the variables. R Square for our multiple regression model is 0.477, indicating that nearly fifty percent of the total variation is explained by this equation. The adjusted R Square of 0.462 is used to incorporate the effect of including additional independent variables in a multiple regression equation. The adjustment is necessary because of the several number of variables used.

The high F-Statistic value of 32.25 shows that the regression equation is statistically significant (sig.<0.01) in explaining the adoption of electronic commerce. Furthermore, it indicates that one or more of the independent variables are significant predictors of adoption.

Beta Coefficients are the coefficients of the independent variables when all variables are expressed in standardised form. They are used to compare the relative importance of each independent variable directly in relation to the dependent variable. The highest Beta coefficient of 0.293 among the five attributes shows that in comparison, 'competitive pressure' is the most important variable in the adoption of electronic commerce. Competitive pressure is followed by IT knowledge (coefficient=0.199), relative advantage (coefficient=0.172), security (coefficient=0.92) and government support (coefficient=0.012).

VIII. DISCUSSION OF RESULTS

The results show a statistically significant and positive relationship between each of the independent variables and the level of e-commerce adoption within small and medium enterprises in Brunei Darussalam. The positive Pearson coefficients indicate that the level of e-commerce adoption is positively influenced by

- relative advantage,
- IT knowledge,
- competitive pressure,
- government support and
- security.

These results generally reinforce the idea that these five variables are important factors influencing e-commerce adoption. The results are consistent with prior studies which found that these variables influence intention to adopt new innovations.

The results also show that generally the research model is statistically significant in explaining the adoption of electronic commerce. The coefficient of determination indicates that the five variables explain nearly fifty percent of the variation in the SMEs adoption of electronic commerce. This research model offers better explanatory power than previous work in other areas in which other characteristics of innovation were used in their regression model to predict e-commerce adoption. In a similar study in Singapore by Kendal et al. [2002], their regression model explained only 36%

of the variation in the adoption. However, five different variables were used in their model and only three out of the five characteristics emerged to be of significance to the adoption process.

In terms of relative importance, competitive pressure emerged as the most important factor influencing e-commerce adoption among SMEs in Brunei Darussalam. This finding reinforces the belief that competition increases the likelihood of innovation adoption [Kimberley and Evanisko 1981, Link and Bozeman 1991, Utterback 1974] and that competition leads to environmental uncertainty and increases both the need for and the rate of innovation adoption [Ettlie 1983, Ettlie and Bridges 1982]. In other words, competitive pressure influences greatly an SMEs decision to adopt. An SME operating in an environment that is more competitive would feel a greater pressure to turn to e-commerce to gain a competitive advantage. On the other hand, an SME operating in a less competitive environment would not be faced with a push to be innovative. This result is in agreement with previous innovation adoption research which found that intense competition is associated with higher adoption rates [Globerman 1975, Levin et.al. 1987].

IT knowledge is found to be the next significant factor affecting the SMEs' willingness to adopt electronic commerce. Thus, (1) IT knowledge plays an important role in e-commerce adoption in Brunei Darussalam and (2) overcoming the lack of knowledge of IT will lead to greater probability of its adoption. Of those who do not adopt e-commerce, nearly 60% of the respondents described themselves as computer illiterates and had no idea on how e-commerce technology could benefit their businesses or on how it would suit their business needs. On the hand, of those who adopt e-commerce, only 15% described themselves as computer illiterates. This result is consistent with the findings of several prior studies. For example, Ettlie [1990] found that business owners with more knowledge of the technological innovation are significantly more likely to implement an aggressive technology adoption policy. In a study on the effect of knowledge barriers on the timings of adoption of the World Wide Web technology, Nambisan and Wang [2000] found that knowledge barriers delay adoption time and indicate the significant explanatory power that the learning perspective can add to the traditional technology model.

'Relative advantage' (standardised beta coefficient of 0.172 in Table 6) is the third in relative importance. This coefficient implies that relative advantage was seen as an important motivator by SMEs in Brunei Darussalam. Many firms adopted e-commerce because they perceived the innovation as an exciting new opportunity with potential and benefits including economic profitability, savings in time and effort, immediacy of the return of investment, and cost effectiveness. Many previous studies [O'Callagham et al.,1992, Cragg and King 1999, Soh et al. 1997, Songan and Noor 1999 and Premkumar et al. 1994] used this attribute in their search of factors affecting technology adoption. They found relative advantage to be one the best predictors of an innovation's rate of adoption. This result simply reconfirmed their findings.

Security is the fourth most important factor affecting SMEs' willingness to adopt with a beta value of 0.092. This value indicates that the issue of security is an area of concern for most small and medium enterprises in Brunei Darussalam. Feelings of insecurity were caused by perceived risk of e-commerce use, lack of privacy and confidentiality, or lack of trust for the innovation. For example, the majority of the SMEs felt that their customers lacked trust for e-commerce and refused to conduct purchase or payment online. Some enterprises felt that their product information and prices are confidential and would not reveal them to their competitors. This result is consistent with the findings of several prior studies.

'Government Support' was the lowest ranking in terms of relative importance, with a beta coefficient of 0.012 and the poorest significance coefficient of 0.823. This finding implies that changes in the level of government support does not necessary lead to changes in the level of e-commerce adoption and that most SMEs would be willing to consider implementing e-commerce regardless of the level of support from government. In a related study by Teo et al. [1998] in Singapore, it was concluded that government support plays little significant role in the adoption in Internet among SMEs in Singapore. However, this finding is contrary to the findings of some studies that asserted that government support plays a great role in pushing for the adoption of technology. For example, a study on the use of the Internet found that government endorsement

was one of the dominant factors in Internet growth in Singapore [Goh, 1996]. This result affirms the role played by government in pushing the adopting of IT in Singapore [Toh and Low 1993].

IX. IMPLICATIONS AND CONCLUSION

The findings generated from this study have the following important implications for research and practice.

1. This study shows that the classical Rogers diffusion model is generally inadequate in explaining the factors influencing electronic commerce adoption among SMEs in Brunei Darussalam. Rogers [1995] argues that a technological innovation will diffuse faster if it is perceived as having the five attributes of an innovation and these five attributes represent the main determinants that explain 49% to 87% of the variance in the rate of adoption. The model is generally based on the characteristics of an innovation and ignores factors both within and outside an organization. The findings from the present study show that besides innovation factors, other factors, such as environment and management, are also important to help understand the adoption of electronic commerce in Brunei. Researchers need to keep this in mind when considering any study on factors influencing the adoption of an innovation.

2. Because competitive pressure emerged as the most important factor influencing e-commerce adoption in Brunei, this study highlighted the importance and appropriateness of Porter's model of competitive advantage [1980]. In Porter's view, competition (1) increases the likelihood of innovation adoption, (2) leads to environmental uncertainty, and (3) increases both the need for and the rate of innovation adoption. A business operating in an environment that is more competitive would feel a greater pressure to turn to any innovation to gain a competitive advantage. Porter identified five competitive pressures that businesses can face (new entrants, the threat of substitute products or services, bargaining power of customers, bargaining power of suppliers, and rivalry amongst current competitors) and suggested that by adopting an innovation like information technology (IT), businesses would be able to gain competitive advantage. The present study provides empirical support for competitive pressure. It implies that researchers, guided by other models that underestimated the importance of competition, should reconsider the extent to which competitive pressure affects innovation adoption in their future studies.

This study highlights the importance of understanding and knowledgeable about the potentials of e-commerce. Although many SMEs agree that e-commerce will be important for them in the future, they may not understand what e-commerce is about and its current importance to their business. This lack of understanding could have led them to discount the impact of e-commerce and led them to believe that they have plenty of time to adopt e-commerce. Not only do SMEs need to understand the new e-commerce business model, but they also need to believe that engagement will reap relative advantage. In other words, they need to perceive that benefits of e-commerce will outweigh the costs. The challenge is to ensure that this change in viewpoint happens quickly to boost the competitiveness of the SMEs and reap the benefits from increasing turnover and trade.

X. LIMITATIONS AND DIRECTION FOR FUTURE RESEARCH

This section presents the limitations of the current study and recommends studies to overcome these limitations.

1. Because this study is cross-sectional, causality of relationships cannot be demonstrated completely. Further, feedback effects cannot be investigated. Longitudinal studies are needed to confirm the direction of causality and test for feedback effects. Longitudinal studies are also needed to investigate the growth stages of e-commerce adoption across industry sectors and adoption levels.

2. E-commerce can be seen as a multi-level activity. Future studies could place more focus in examining the factors that will push adopters from one level to another (e.g., from a mere web presence to transacting on-line). This focus may serve as a guide for Internet solution providers to develop successful SME adoption plans.

3. Instead of focusing on adoption across all industries, it may be useful to examine the adoption of e-commerce by specific industry sectors. A focused understanding of particular opportunities and challenges for SME adoption within an industry would assist the Brunei government in developing policies or initiatives to encourage uptake among SMEs in critical industries like tourism, agriculture, forestry and fishing.

4. Significant percentages of the e-commerce adoption variances remain unexplained. More research on this area is needed. This study has investigated a subset of the variables found to be important determinants of e-commerce adoption among SMEs in Brunei Darussalam. Other variables that may provide explaining power include cost effectiveness, financial resources, national infrastructure, organizational readiness, and management support. Future research can examine these possibilities and the extent of their influence.

5. To generalize from the research sample, the context of Brunei Darussalam, a newly independent Asian country, needs to be taken into account. The findings may not be universally true, but they are likely to be applicable to e-commerce adoption in SMEs with similar cultural contexts. Findings from this study may also be applicable to small businesses in developing countries like Indonesia, Malaysia and the Philippines.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that

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APPENDIX I. QUESTIONNAIRE

Part A: Which of the Following Categories Does Your Business Belong to?

Please tick ☑ ONE only.

- ☐ We DO NOT have emails, homepage and website in our company
- ☐ We use the emails ONLY for business purpose in our company (NO Homepage or Website)
- ☐ We have a simple HOMEPAGE/WEBSITE for advertising purpose only (NO interaction /response required)
- ☐ We have a intermediate HOMEPAGE/WEBSITE that allows for advertising, detailed display of company's products & services, searching, form-filling, on-line enquiry/ ordering/ booking/ reservation etc using emails.
- ☐ We have an advanced WEBSITE that allows for advertising, detailed display of company's products & services, on-line enquiry, on-line ordering and on-line transaction processing (e.g. .on-line sales and on-line payment all through the Internet).

Part B: What is Your Opinion About Doing Business Using Electronic Commerce in Brunei?

		Very Agree	Agree	Neutral	Disagree	Very Disagree
1	Doing business using the Internet & website can help our company in many ways	☐	☐	☐	☐	☐
2	Having a website helps to advertise our services/products all over the world (in the worldwide market)	☐	☐	☐	☐	☐
3	A business website helps us to provide better customer services by giving them quick and latest information about our products and services.	☐	☐	☐	☐	☐
4	Presently, website/e-commerce is not useful for our business yet–apart from having to spend extra money, time and effort.	☐	☐	☐	☐	☐
5	We have very little knowledge how Internet and electronic commerce can help to improve my business and increase our sales	☐	☐	☐	☐	☐
6	We will use more Internet/electronic commerce if we know more about what they can do for my business.	☐	☐	☐	☐	☐
7	We do not have the technical knowledge and skills to start using Internet and electronic commerce	☐	☐	☐	☐	☐
8	We have very good understanding about how Internet and e-commerce can be used to help to improve my business profit.	☐	☐	☐	☐	☐
9	Many of our business competitors are already having websites and using Internet for doing business	☐	☐	☐	☐	☐
10	Our suppliers/trading partners are not using the Internet and do not have website and e-commerce.	☐	☐	☐	☐	☐

11	Our customers or trading partners expect us to have a website or provide electronic commerce facilities to them.	☐	☐	☐	☐	☐
12	Having a website and e-Commerce helps us to compete better with our competitors	☐	☐	☐	☐	☐
13	The Brunei government is helping to lower the cost of using the Internet and setting up e-commerce facilities	☐	☐	☐	☐	☐
14	The Brunei government is helping in giving all kinds of assistance to help to small businesses to use Internet.	☐	☐	☐	☐	☐
15	The government often inform us about the good points of e-commerce and doing business using the Internet	☐	☐	☐	☐	☐
16	Support from government is important to encourage us to use more of Internet in business.	☐	☐	☐	☐	☐
17	We are worried that our business transactions on the Internet can be read and seen by others	☐	☐	☐	☐	☐
18	We trust that the Internet can protect the confidential data that we enter on the websites.	☐	☐	☐	☐	☐
19	There is very little risk involved when doing businesses over the Internet.	☐	☐	☐	☐	☐
20	Our customers are worried about privacy and security of Internet and will not use Internet to make payment	☐	☐	☐	☐	☐

Part C: About Your Company

1. Our business belongs to the following category or type: (Tick ☑ one only)
   ☐ Wholesaler/Retailer ☐ Coffee Shop/Restaurant/Hotel ☐ Financial/Insurance/Business Service
   ☐ Construction ☐ Transports/Storage/Communication/IT ☐ Community /Social Services
   ☐ Oil and Gas ☐ Saw Milling & Timber Processing ☐ Agriculture/Forestry/Fishing
   ☐ Mining/Quarrying and Manufacturing ☐ Others _____

2. We have the following number of employees and workers :

   ☐ 1-5 ☐ 6-10 ☐11-20 ☐ 21-50 ☐ 51-100 ☐ over 100

3. We have the following types of computer / Internet facilities in our company:
   Tick☑ as many as possible.
   ☐ Nothing ☐ Personal Computer (PC) ☐ Networking PC
   ☐ Email Accounts ☐ E-Speed ☐ Web/Internet Server
   ☐Others _____

4. The following percentage of our business come from the Internet (via emails / our website):
☐ Zero ☐ Below 10% ☐ 10-30% ☐ 30-60% ☐ More than 60%.

ABOUT THE AUTHOR

Hong Cheong Looi is a senior lecturer in the Department of Computing and Information Systems at the Institut Teknologi Brunei where he teaches information systems. He conducted extensive research on issues related to e-commerce adoption in Brunei Darussalam over the last five years.

His current research interests focus on identifying factors that are important for encouraging willingness to adopt e-Commerce and on quantifying their relative importance. His studies also focus on the relatively unexplored and important sector in Brunei – the small and medium enterprises. His work is published in international journals and proceedings of international conferences.

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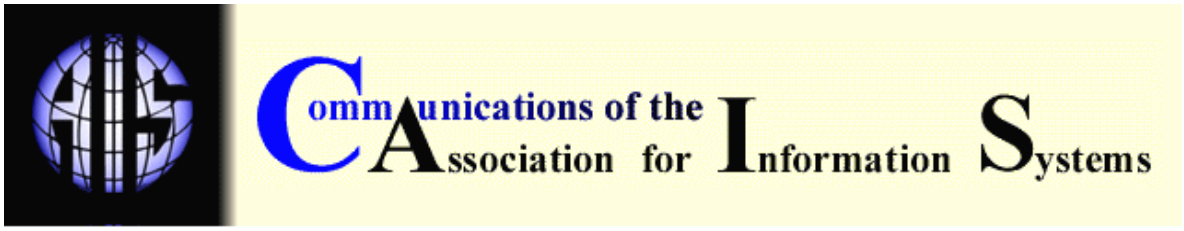

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