**BSc Business Management (Singapore) Dissertation**

**Online Assignment Submission** Birmingham Business School

**Student ID Number: 1732466**

**Supervisor Name: Dr. Hisham Farag**

**Dissertation Title:** **An investigation of factors affecting the adoption of e-commerce by SMEs in Singapore**

**Date of Submission: 24/1/2018, 12:35pm (GMT +8)**

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University of Birmingham  
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Dissertation

An investigation of factors affecting the adoption of e-commerce by SMEs in Singapore

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Dissertation 2017-2018

Supervisor: Hisham Farag

Word Count: 7499

Appendices Word Count: 3534

# Acknowledgements

The completion of this dissertation would not be possible without the support of several people. Firstly, I would like to thank my dissertation supervisor, Hisham Farag, for his invaluable experience and guidance in completing this dissertation. His support and advices have provided me with vital stepping stones along the journey of completing the dissertation. I would also like to thank my family and friends for their continuous support, feedback, and advices throughout this journey.

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# Abstract

The growth of new web technologies and electronic commerce (e-commerce) over the years, have made it easier for Small and Medium Sized Enterprises (SMEs) to compete in the global market (Al-Qirim, 2003). The successful adoptions of e-commerce mean that SMEs have to change the way they do business (McCorkindale and DiStaso, 2012). E-commerce has the potential to provide SMEs with numerous benefits such as, lower cost and international markets. However, SMEs continue to dwindle behind larger organisation with regards to maximising their capabilities through adoption of e-commerce (Levy, Powell and Yetton, 2002). SMEs are reported to be slower adopters as compared to larger organisations, due to their limited resources and lack of expertise.

The purpose of this study is to empirically examine the factors that affects the adoption of e-commerce among SMEs in Singapore. The paper investigates various past studies to identify the literature gaps in the adoption of e-commerce among SMEs. The research used a proposed model, which was an amalgamation of Technology-Organisational-Environmental framework (TOE) (Tornatzky and Fleischer, 1990) with Diffusion of Innovation (DOI) (Rogers, 1995). The proposed model was tested using quantitative research data where a questionnaire was structured and data was collected through an online survey and in-person, generating a valid sample of 96 SMEs in Singapore. The study tested seven hypotheses on factors affecting adoption of e-commerce among Singaporean and concluded that perceived relative advantage, perceived complexity, technological resources, management support and pressure from trading partners could affect the level of e-commerce adoption among SMEs in Singapore.

The findings in this study provides an insight to the factors affecting adoption level of e-commerce among SMEs in Singapore for Singapore government, policy makers and managerial participants. This paper can also be generalised to be applied to other countries with similar conditions to Singapore.

# Introduction

## 1.1 Research background

The rapid development of information and communication technology (ICT) has fundamentally reshaped the global business environment. Firms must strive to improve themselves by creating new ways to meet their customers’ needs and demands, to cope with the increasingly competitive market (Ahmad, Rani, and Kassim, 2010). In the past decade, businesses have turned to using the internet as a medium for business activities, due to its potential benefits businesses can reap such as cost reduction, wider market reach, wider network of suppliers, customers and trading partners, creation of new ways of selling products and greater competitive advantages (Chau, 2003; Lai, 2007; Riemenschneider, Harrison and Mykytyn, 2003). Thus, it is no surprise that even small and medium-sized enterprises (SMEs) are incrementally using ICT-based electronic commerce (e-commerce) to gain competitive advantages and gain access to global markets (Al-Qirim, 2003). However, there is only a small number of literatures that focused on the adoption and usage of e-commerce among SMEs (Grandon and Pearson, 2004). Various e-commerce studies in SMEs have indicated that SMEs tend to not take proactive approaches in the adoption of e-commerce technology, which left them dwindling behind larger enterprises (Alexander, 1999; Levy, Powell and Yetton, 2002; Mcdonagh and Prothero, 2000). Although, in theory, the adoption can increase international opportunities of SMEs (Hamil and Gregory,1997; Lituchy and Rail, 2000).

Past literatures are focused on SMEs in developed countries in Europe and America and only a few are conducted in Asia-Pacific region (Teo and Ranganathan, 2004). There are only a few notable literatures that was done in Singapore (see Teo and Ranganathan, 2004; Thong, 2001). Singapore’s environment is unlike developing countries, which have weak technology advancement due to high illiteracy rates, low levels of income, cultural resistance, and poverty of development strategies (Heeks and Stanforth, 2015). Furthermore, government had introduced various programmes such as SkillsFuture, to better equip Singaporeans with new skills to prepare themselves for the everchanging market (skillsfuture.sg, 2018). However, despite being one of the most technologically advanced countries with advanced technological infrastructure and constant support from the government, level of adoption of e-commerce remains on the basic spectrum. Various researcher reported the reason of the slowness in adoption level can be broken down to three distinct contexts such as technological, organisational, and environmental contexts (Blili and Raymond, 1993; Cragg and King, 1993; Thong, 1999). Hence, as previously mentioned, it has been increasingly important to conduct this research to investigate the factors affecting the adoption of e-commerce among SMEs in Singapore.

Firstly, the paper will review relevant academic literatures in the field of ICT adoptions among SMEs. From the information derived in the literature review, the paper proposed a model which was mainly drawn from TOE framework (Tornatzky and Fleischer, 1990) and DOI (Rogers, 1995) to explain the factors affecting the adoption of e-commerce. For that purpose, the paper has identified seven distinct factors such as perceived relative advantage, perceived complexity, technological resources, management support, pressure from trading partners, external change agents and competition intensity. Consequently, a quantitative study will be carried out before presenting the findings. Finally, limitations of the study will be outlined before reaching the conclusion which presents the main findings and highlights of the paper regarding the factors affecting adoption level of e-commerce among Singapore SMEs.

## 1.2 Research questions

The purpose of this paper is to answer the following research questions:

1. What is the current level of e-commerce practices amongst SMEs in Singapore?
2. Which factors are significant in influencing the level of e-commerce adoption among SMEs in Singapore?
3. Among technological, organisational, and environmental context, which is more likely to determine the level of e-commerce adoption?

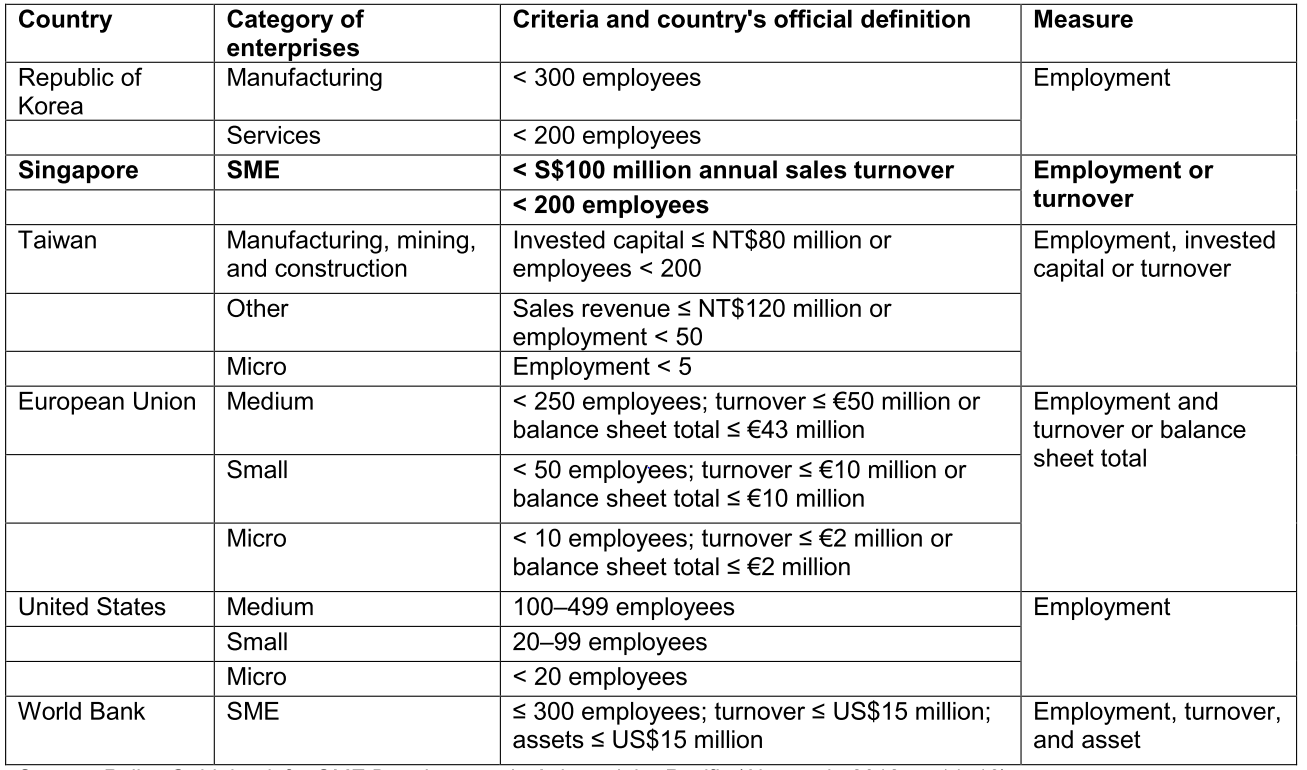
# Literature Review

## 2.1 SMEs

Definition of what constitute SMEs varies across countries as each country uses different sets of parameters. Some based on the number of employees, amount of assets, and value of turnover or a mixture of all three measurements. As shown in figure 2.1, the sets of measures chosen across countries are broadly similar and are only differentiated by the limits selected. Each of these combinations and limits are adopted based on the local economic, politics and social conditions. In Singapore, the criteria were set by the Ministry of Trade and Industry of Singapore (MTI) in 2011. MIT defined SME as an enterprise, which have annual sales turnover of less than S$100 million or an enterprise that has less than 200 employees (Abe et al., 2012). This resulted in SMEs making up of 99% of total enterprises in Singapore in 2016 (Singstat.gov.sg, 2017). SMEs play a critical role in the economy of any country regardless of their status of being developed or undeveloped. In the last decade, SMEs had become extremely important in terms of a country’s economic development, becoming the backbone the home countries as they provided various benefits. Some of the major contributions made by SMEs includes new job creation, contribution to gross domestic product (GDP) and production of innovation in technology (Kuan and Chau, 2001).

### 2.1.1 SMEs characteristics

Although e-commerce can bring various advantages to SMEs, the adoption level of e-commerce among SMEs remained relatively low despite the exponential growth of e-commerce adoption among SMEs (MacGregor and Vrazalic, 2005). The main difference between the adoption rate of SMEs and larger organisations lies in the unique characteristics of the business. SMEs face larger risk and are deemed less likely to succeed in adoption of ICT as compared to larger enterprises, due to the disadvantage gap in resources (Welsh, White and Dowell, 1982; Thong et al., 1997) and lack of ICT expertise (Cragg and King, 1993; Ein-Dor and Segev, 1978). The scarce resources may cause a chain reaction for various factors that might affect the adoption of e-commerce. For example, SMEs generally have the tendency to hire generalist instead of specialist due to the lack of financial resources, which causes the lack of skills for long-term planning; hence, may affect SMEs competitiveness and survival in the long run. SMEs also have smaller market scope and usually offers a single product or service. Furthermore, SMEs often try to reduce production cost as much as possible (Storey, 1994; Simpson and Docherty, 2004) since they are more focused on survival instead of growth, which is usually slow but steady (Bridge, O’Neill and Cromie, 2003). Murphy, Smith, and Daley (1992) noted that SMEs tend to have a small and centralised style of management team. Thus, the manager is usually the owner of the business who has high decision-making influence.

 Figure 2.1: Definition of SMEs across countries

Source: Abe, M., Troilo, M., Juneja, J. S. and Narain, S. (2012). *Policy guidebook for SME development in Asia and the Pacific*. Bangkok: United Nations.

## 2.2 E-commerce

Due to e-commerce’s virtual young life and its complexity, e-commerce has no single agreed definition. E-commerce has been defined differently by several authors depending on the context and research objectives of their paper (Grandon and Pearson, 2004). For SMEs, e-commerce is generally defined as the utilisation of ICT and applications to support business activities of a small firms (Poon and Swatman, 1999). The study followed Turban et al.’s (2010) definition of e-commerce, which defined e-commerce as a process of exchanging information between customer and suppliers that leads to the process of buying and selling through online networks.

E-commerce has revolutionised on how companies sell or market themselves. Unlike traditional businesses, selling through e-commerce allows product or services to move directly from either manufacturer or supplier straight to customer without the need to pass through other intermediaries (Korper and Ellis, 2000). This saves not only time but also the overall cost of the product, which allows reduction of the final price and consequently, improve the diffusion of it. E-commerce can greatly benefit businesses, which in turn contributes to the country’s economy and it has been found that countries that are offering e-commerce showed tremendous improvement in their respective economy (Javalgi et al., 2005; Elbeltagi, 2007).

### 2.2.1 Level of e-commerce

Innovation is often met with scepticism in their early development stage and the adoption of such innovation often occur at multiple levels (Hall et al., 1975; Brand and Huzingh, 2008). Therefore, the adoption of innovations such as the internet and e-commerce involve multi-level phenomena and not simply the case of adopting or rejecting it (Brand and Huzingh, 2008). Parish et al. (2002) mentioned that adoption of e-commerce consists of five different levels and they are as follows:

1. Messaging: using only email communication
2. Online marketing: using of website to advertise product/services
3. Online ordering: availability of offering online orders
4. Online payment: online payment
5. Order progress: tracking of orders

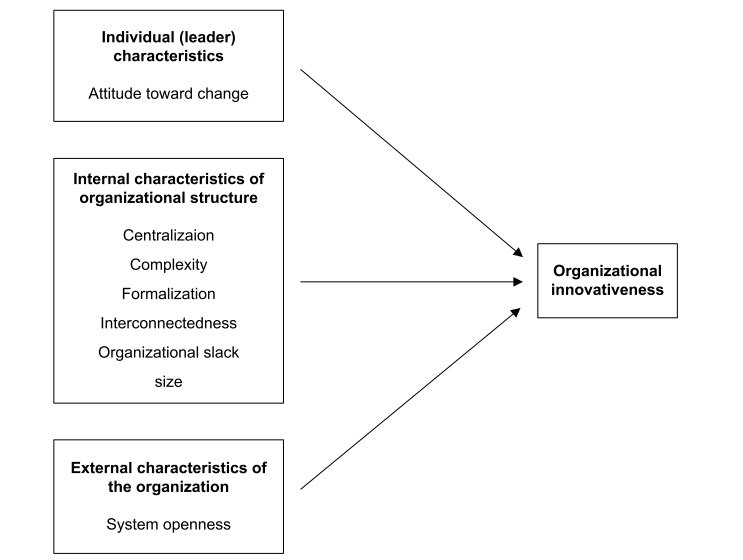
For this paper, the last three level are conjoined into number three as it is deemed to be closely related and might be misunderstood during data collection. Therefore, only 3 different levels of e-commerce adoption are simply classified in this paper as email, basic e-commerce, and advanced e-commerce.

### 2.2.2 E-commerce adoption

Various researchers have suggested the functional parallels between e-commerce adoption and technological innovation adoption (Keen and Scott-Morton, 1978; McFarlan and McKenney, 1982). Therefore, since e-commerce can be considered as a technological innovation, it may be fruitful to use the adoption theories of technological innovation for the adoption of e-commerce. The commonly used technological innovation adoption theories are the technology acceptance model (TAM) (Davis, 1986), unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003), theory of planned behaviour (TPB) (Ajzen, 1985), Diffusion of Innovation (DOI) (Rogers, 1962) and the technology organisational and environment framework (TOE) (Tornatzky and Fleischer, 1990). However, this paper focuses on using DOI and TOE framework to explain the factors that affects SMEs adoption level of e-commerce as both are the only applicable theories at the firm level, whereas the TAM, TPB, and UTAT are commonly used at individual level.

## 2.3 DOI

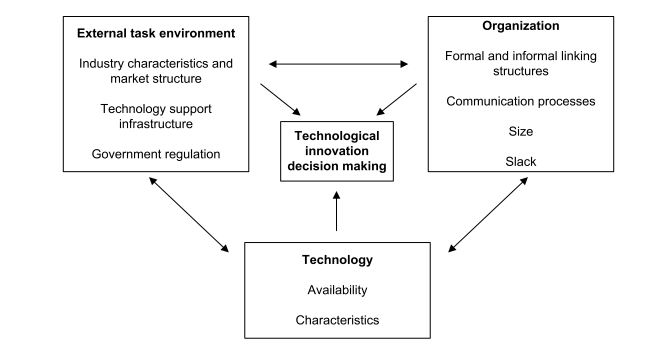
Rogers’ DOI theory (1962) is widely used to explain how, why and at what rate an innovation spreads through culture at both individual and firm level. Individuals tend to possess different degrees of willingness in adopting innovation. Thus, the adoption of innovation of a population are often distributed over time (Rogers, 1995). As shown in figure 2.2, the DOI theory at the firm level relates organisational innovativeness to independent variables such as leader’s characteristics, internal organisational structural characteristics, and external characteristics of the organisation (Rogers, 1995). The theory has been widely used by various researchers in similar studies that are focused on innovations such as collaborative commerce (Chong et al., 2009), enterprise resource planning (Bradford and Florin, 2003), material requirement planning (Cooper and Zmud, 1990), and e-business (Zhu et al., 2006; Hsu, Kremer and Dunkle, 2006). Although Rogers’ DOI is considered as one of the most applicable theories to innovations (Prescott and Conger, 1995), Prescott (1995) argues that it should not be used alone but should be used concurrently with other models to provide richer and potentially more explanatory model.

Figure 2.2: DOI at firm’s level

Source: Rogers, E.M. (1995) *Diffusion of innovations*, (4th ed.). New York, Free Press.

## 2.4 TOE framework

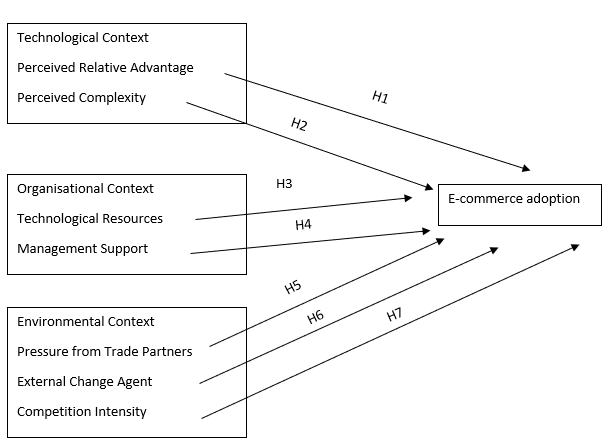
The TOE framework as shown in figure 2.3, was first developed by Tornatzky and Fleischer (1990). This framework has been widely used by past researchers in comparable studies (Chong et al., 2009; Thong, 1999; Al-Qirim, 2007; Gibbs and Kraemer, 2004; Iacovou, Benbasat and Dexter, 1995; Kuan and Chau, 2001) and have been widely accepted among social science researchers. Unlike Rogers’ DOI theory, the TOE framework identifies three aspects in an enterprise’s context and the influence of the process to the adaptation and implementation of technological innovation: *technological context, organisational context, and environmental context* (Tornatzky and Fleischer, 1990). For this research, the technological context refers to the internal and external technologies that are relevant to the firms (Tornatzy and Fleischer, 1990). The organisational context typically refers to the characteristics of the organisations such as, scope size and managerial structure (Tornatzky and Fleischer, 1990). In addition, the TOE also includes a new and important addition, environmental context. The environmental context refers to the arena in which a firm conducts their business- industry, competitors, and the dealings with the government (Tornatzky and Fleischer, 1990). However, since it was introduced, there is little to no development of TOE due to the high degree of freedom among its factors (Baker, 2012), which may explain why the framework is widely used in determining determinants of adoption of innovations.

Figure 2.3: TOE framework

Source: Tornatzky, L. and Fleischer, M. (1990) *The process of technology innovation*, Lexington, MA, Lexington Books.

## 2.5 Proposed Conceptual Model

The research model (Figure 2.4) used was an amalgamation of TOE framework (Tornatzky and Fleischer, 1990) with DOI (Rogers, 1995). The proposed independent variables were based on various empirical studies on the adoption of technological innovations, which were found significant. These independent variables are perceived relative advantage (Al-Qirim, 2007; Grandon and Pearson, 2004); Perceived complexity (Moore and Benbasat, 1991); technological resources (Lippert and Forman, 2005), management support (Thong and Yap, 1995; Rogers, 1995); pressure from trade partners (Al-Qirim, 2007; Saffu et al., 2008); external change agent (Al-Qirim, 2007; Thong, 2001), and competition intensity (Thong and Yap, 1995). The model is designed in a way that the independent variables are postulated to affect the dependent variable, e-commerce adoption without any intervening variables.

Figure 2.4: Proposed model

### 2.5.1 Technological Factors

#### 2.5.1.1Perceived Relative Advantage

The perceived relative advantage refers to the belief that a certain benefit would be obtained by performing adopting e-commerce. It is one of the most frequently used factor (Kuan and Chau, 2001; Seyal, et al., 2004) and is perceived as an important determinant of technology adoption (Al-Qirim, 2007). Thus, TOE model suggested that the higher the perceived benefits of the internet, the higher the likelihood of the organisation allocating resources to use the internet (Rogers, 1995; Tornatzky and Fleischer, 1990). Organisations that adopt the internet may obtain various benefits such as growth (Raymond, Bergeron and Blili, 2005; Qureshi, Keen and Kamal, 2010), financial gain (Johnston, Wade, and McClean, 2007), competitive advantage and cost reduction (Zhu & Kraemer, 2002; Zhu, 2004). Hence, hypothesis one is derived:

H1: Perceived relative advantage is positively related to the adoption of e-commerce by SMEs in Singapore.

#### 2.5.1.2 Perceived complexity

Perceived complexity refers to the degree of complication in the adoption of the internet. Numerous studies have found a significant relationship between perceived complexity and adoption of the internet (Jeon, Han, and Lee, 2006; Huy and Filiatrault, 2006). However, some studies (Kendall et al., 2001; Ramdani and Kawalek, 2008) have also found it to be insignificant in affecting adoption. There are various concerns that may cause technology to be complex such as security, privacy, and maintenance. These concerns might be too complex for SMEs as their employee usually lack ICT skills (Spectrum, 1997). Therefore, SMEs might perceive the adoption of the internet as a very challenging task (Hussin, King and Crag, 2002). Thus, hypothesis two is:

H2: Perceived complexity is negatively related to the adoption of the e-commerce by SMEs in Singapore.

### 2.5.2 Organisational Factors

#### 2.5.2.1 Firm Size

Many empirical studies revealed that firm size is an important determinant that affects the adaptability of the internet (Grover, 1993; Thong, 1999). Most researchers linked firm size with financial resources, which is required for firms to pay for installation, integration, employee training and maintenance (Hsu, Kraemer and Dunkle, 2006). Thus, larger firms are deemed to have higher probability of adopting the internet as compared to SMEs as they have the financial resources to spend on IT investment to ensure successful implementation of the internet (Cragg and King, 1993; Ein-Dor and Segev, 1978; Rogers, 1983; Clemons and McFarlan,1986).

#### 2.5.2.2 Technological Resources

The technological resources factor focuses on the firm’s prior experience with technology. Thus, firms with the required technological resources (hardware, software, expertise) will be more likely to adopt the usage of e-commerce (Iacovou, Benbasat and Dexter, 1995,). For example, cost of adoption of e-commerce would be significantly reduced if they already have a computer. It is expected that SMEs are more likely to adopt e-commerce if their owner or key manager and other key decision-making personnel have an acceptable level of ICT knowledge (Looi, 2005; Teo & Ranganathan, 2004). Having insufficient technological resources be it hardware, software, or expertise, is a major barrier towards the adoption of the internet (Ainin and Noorismawati, 2003). SMEs are usually lacking in technological resources. Thus, hypothesis three was derived:

H3: The knowledge of the key decision-making personnel of ICT is positively related to the adoption of e-commerce by SMEs in Singapore.

#### 2.5.2.3 Management Support

Top management’s knowledge and enthusiasm towards ICT is one of the determinants of the adoption of e-commerce among SMEs (Saffu et al., 2008). Thus, it can be expected that the more knowledge and enthusiasm the firm’s top management has towards e-commerce, the higher the tendency for them to initiate and influence e-commerce activities in the organisation. Furthermore, they are also responsible for the resources they commit towards the adoption of e-commerce (Premkumar and Roberts, 1999). Therefore, the success of e-commerce adoption is highly reliant on the management support of it and hypothesis four is postulated to reflect the relationship:

H4: The support of top management is positively related to the adoption of e-commerce by SMEs in Singapore.

### 2.5.3 Environmental Factors

#### 2.5.3.1 Pressures from trading partners

Successful adoption of e-commerce of SMEs does not only rely on their effort, but also the readiness of their customers, suppliers, and trading partners to engage in electronic transaction and interactions (Barua, Whinston and Yin, 2000). Therefore, organisations are more pressured to adopt technology if their business partners, customers, or suppliers recommend them to (Kuan and Chau, 2001). For example, if customers demand more information or sales of the organisation’s product or services, firms are more motivated to adopt e-commerce. Thus, hypothesis five is put forward as:

H5: Pressures from trading partners is positive related to the adoption of e-commerce by SMEs in Singapore.

#### *2.5.3.2 External change agents*

Various studies have investigated the availability of skilled labours and software/hardware vendors as determinants of e-commerce adoption among SMEs (Srinivasan, Lilien, and Rangaswamy, 2002; Doolin et al., 2003). Electronic, telecommunications and business environment where the firm operates can also influence the level of involvement of the firm in using the internet. For example, business that are in a new and high-bandwidth telecommunication locations such as the central business district will receive better technological services as compared to rural areas. Kuan and Chau (2001) noted that government policies are also one of the determinants that can affect the level of implementation and usage. In Singapore, the Government Technology Agency of Singapore (GovTech) and Info-communications Media Development Authority work closely to achieve Singapore’s vision as a Smart Nation. GovTech helps to provide individuals and businesses in Singapore with secure digital services and applied technology. On the other hand, IMDA focuses on developing talent, strengthening business capabilities, and enhancing Singapore’s ICT and media infrastructure. Furthermore, Singapore government provides funding for courses through their SkillsFuture scheme (skillsfuture.sg, 2018), which provides opportunities for Singaporeans to develop themselves and equip them with relevant skills for their jobs. SMEs could make use of schemes like these and send their employees for trainings required for e-commerce adoption. Thus, hypothesis six was derived:

H6: External change agents is positively related the adoption of e-commerce by SMEs in Singapore.

#### 2.5.3.3 Competition Intensity

Competition intensity refers to the degree of rivalry between competitors in the business market be it locally, domestically, or internationally (Dasgupta et al.,1999). Thus, competitive environment can influence SMEs adoption of e-commerce as they see it as a tool to stay in the competition (Dahnil et al., 2014). SMEs tend to feel pressurised when they see increasing number of their competitors adopting the internet and therefore, feeling the urgency to adopt it as well to remain competitive (Kuan and Chau, 2001). The pressure from competitors has been found to be an important factor in technological adoption (Premkumar, Ramamurthy and Nilakanta, 1994). Finally, hypothesis seven was put forward as:

H7: Competition intensity is positively related the adoption of e-commerce by SMEs in Singapore.

# Methodology

* 1. Methodological Approach

This section provides information regarding the sample, ethical consideration, and limitations of the research design. The study utilises quantitative analysis using a deductive approach to test the hypotheses put forward in the literature review.

## 3.2 Sample and Procedures

The study relies on quantitative data obtained through questionnaire (Appendix 1) that was done both online and offline. Main distribution of questionnaire was done online through social media platforms such as, Facebook, Instagram, and WhatsApp. The remaining sample went through offline data collection, which was focused on the SMEs in industrial places in the Tai Seng area. Tai Seng provides a suitable location for the data collection as it is surrounded with many industrial buildings that are used by SMEs as office spaces. A total sample of 100 responses were recorded from anonymous respondents collected through both online and face-to-face questionnaires.

To ensure the accuracy and relevance of the information derived from the survey, the respondent must either work for, manage or own a SME firm which meet the required SME guideline of having a sales turnover of less than S$100 Million and have less than 200 employees (Singstat.gov.sg, 2017). However, out of the 100 responses received, four of them were deemed invalid as they have over 199 employees leaving the study with only 96 valid samples.

### 3.2.1 Design of Questionnaire

The design of the questionnaire follows similar past researches on e-commerce adoption (Al-Qirim, 2007; Grandon and Pearson, 2004; Moore and Benbasat, 1991; Lippert Forman, 2005; Thong and Yap, 1995; Thong, 2001). The questionnaire consists of 20 questions mainly structured and with components of semi-structured questions. Furthermore, the questionnaire was designed to ensure ease of understanding by avoiding sophisticated questions and uncommon sentences or words as much as possible. The questionnaire was broken down into 4 different sections: Section A: Organisation Profile; Section B: Technological Factors; Section C: Organisational Factors; and Section D: Environmental Factors.

Section A consist of multiple choice questions which is designed to gather basic information regarding the participant’s position in the firm, firm size, firm’s industry, firm’s adoption of e-commerce and their level of e-commerce adoption. Level of e-commerce adoption was used as the dependent variable for this paper due to the high adoption rate of e-commerce with only 1 non-adopter out of 96 respondents. The level of e-commerce was asked using a multiple-choice question which was adopted from Parish et al. (2002) 5 level of e-commerce which was simplified into 3 levels to simplify the question as mentioned in the literature review.

Section B, C, and D consist of structured questions, which aims to measure the different factors (independent variables) and its determinants to adoption of e-commerce among SMEs. The section utilised the 5-point Liker-type scale (DeVellis, 1991) as follows: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree). Likert scales is defined as an interval scaled used to ask respondent to indicate the whether they agree or disagree by rating a series of mental beliefs or behavioural belief statements (Hair et al.,2016). Likert scale is widely used in related researches due to the wider range of possible scores it offers, which increases the statistical analyses that are available (Premkumar and Ramamurthy, 1995). These three sections covered the independent variables to adoption of e-commerce and they are: perceived relative advantage; perceived complexity; technological resources; top management support; buyer/supplier pressure; external change agents; and competition intensity.

A total of 14 statements were used to identify whether these factors influence firm’s ability to adopt e-commerce. As shown in appendix 3, each factor was given 2 statements for respondents to rate along with their sources.

### 3.2.2 Analytical approach

Multiple regression was used by various researches (Ghobakhloo, Arias-Aranda and Benitze-Amado, 2011; Ahmad et al., 2015) as it provides information regarding the interaction between dependent variable and independent variables or multiple intendent variables using straight forward manipulations (Kroll and Chesler, 1992). Therefore, the paper adopted multiple regression analysis to test the hypotheses regarding factors that influence the adoption level of e-commerce among SMEs in Singapore as it allows for testing of all seven hypotheses at once.

## 3.3 Ethical Considerations

Respondents have the rights to choose whether they want to participate on in the study and the rights to withdraw at any time. The nature and purpose of the study was clearly stated at the cover letter start of the questionnaire to explain the study’s objective (Jones and Kottler, 2005). The cover letter also provided a pledge of confidentiality and anonymity of their response. Thus, none of their personal information were collected except their role in the firm, which would be ensured anonymity regardless. Furthermore, an option ‘not willing to disclose’ was added for sensitive question in the questionnaire such as, annual turnover rate of the firm.

## 3.4 Critique of research design

Although questionnaires have a high response rate due to their ease of completion and distribution (Thomas, et al., 1997), there are various drawbacks of using it. Drawbacks such as social desirability bias (Brace, 2013), incorrect completion and unintended participant(s). Along with those problems, questions may be misunderstood and misinterpreted (Brace, 2013; Thomas et al., 1997) and most respondents in Singapore would not have the luxury of time for non-rewarding activates such as completion of the questionnaire (Brace, 2013). Thus, the questions are phrased simply and is limited to 20 questions to maintain participants’ full attention to gather the most accurate answers possible.

The questionnaire was primarily distributed through social media platforms such as Facebook and WhatsApp. Thus, this affects the research as majority of respondents were contacts of myself or classmates who are in university which might have caused social desirability bias among their responses (Brace, 2013). To add on, characteristics of the participants i.e. age and occupation may have been like my contacts and myself. Characteristics of the participants such as age, might affect their role in the company and reliability of answer. Furthermore, since 73 of the respondents were gathered online, this might have resulted in a higher rate of e-commerce adoption among the respondents due to their skills in using similar technology as e-commerce, in this case, social media.

# Analysis of Findings

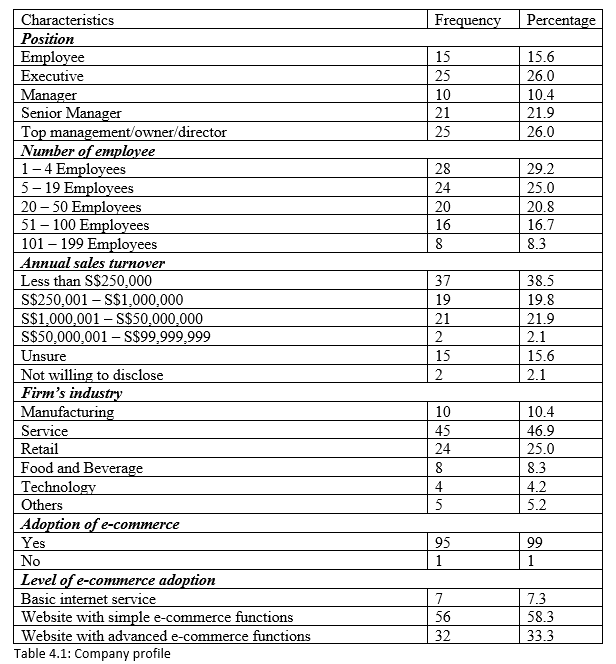
This chapter will focus on the analysis of quantitative data collected from the questionnaires. It starts by providing a descriptive analysis of the valid replies in accordance to the guidelines set by MIT for Singapore’s SMEs. Next, the study will present data analysis and testing of hypothesis constructed in the literature review. The data analysis was done using a computer statistical program, Statistical Package for the Social Sciences (SPSS), to process and analyse the data obtained.

## 4.1 Response Rate

Out of the 100 respondents received, 73 of them was received through social media and the remaining 27 was collected through face-to-face survey collection at Oxley BizHub with a response rate of 87%. However, 4 of the responses received online were deemed invalid as they have exceeded Singapore’s guideline for SMEs of having less than 200 employees. Leaving this study with only 96 valid respondents to be analysed. However, the number of response received was still significantly higher than the 42 and 58 responses received by Le and Koh (2002) and Kendall et al. (2001) respectively.

## 4.2 Company Profile

### 4.2.1 Respondent Position



As most of the respondents were direct contact of my friends and myself, they might have similar age as myself. As a result, there was a high percentage of lower ranking personnel such as employee (n= 15, 15.6%) and executive (n= 25, 26%). The remaining respondents were manager (n=10, 10.4%), senior manager (n= 21, 21.9%), top management/ owner of the firm (n= 25, 26%). Although most of the owner of the firms recorded were owners of extremely small firm mostly with less than 4 employees, they were still deemed as valid sample. Therefore, there is sufficient high ranked levels of respondents which indicates validity of responses since higher ranking officers could be expected to be more knowledgeable about their firm’s e-commerce activities.

### 4.2.3 Number of Employee

According to the guideline set by MIT for Singapore SMEs, only firms that have less than 200 employees can be considered as a SME. This invalidates 4 respondents which was removed from the analysis. As shown in table 4.1, 29.2% percent of the total respondent were from a firm with only 1-4 employees. Resulting in more than half of the sample were from a small firm with less than 19 employees (54.2%). The remaining sample (45.8%) which employed between 20-199 employees can be considered as a medium-sized enterprise.

### 4.2.4 Annual Sales Turnover

As shown in table 4.1, most firms have annual sales turnover of less than S$250,000 (n=37, 38.5%). The remaining respondent have between S$250,001 to S$1,000,000 (n=19, 19.8%), S$1,000,001 to S$50,000,000 (n=21, 21.9%) and S$50,000,001-S$99,999,999 (n=, 2.1%). The high number of respondents that are unsure of the companies’ turnover might have come from the high number of low ranking respondents (employee and executive).

### 4.2.5 Firm’s industry

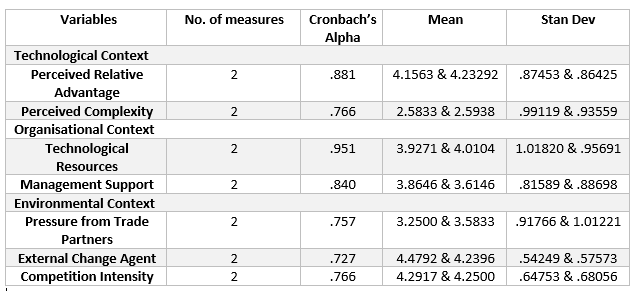
As shown in table 4.1, 46.9% of the sample were in the service industry, 25% in retail industry, 10 % in manufacturing, 8.3% in food and beverages and 4.2% in technology. The remaining 5.2% of the respondents that chose others were in the event industry (4.2%) and education industry (1%). These figures might affect the e-commerce adoption level of their firms, as e-commerce may not be as beneficial or relevant to firms in certain industries. For example, firms in the service industry may not require online checkout or order processing on their website as much as those in retail.

### 4.2.6 E-commerce Adoption

As shown in table 4.1, only 1 firm out of 96 valid responses have yet to adopt e-commerce. However, this high adoption rate is not a surprise as Singapore is considered as one of the most technologically advanced country in the world. As shown in table 4.6, most firms (n= 56, 58.9%) have a website with basic e-commerce functions such as providing goods/services information. Around 33.7% of the respondents have advanced website functions such as payment systems and form entries by users. The remaining 7.4% of the respondents remained at basic level using only email and basic internet usage. It is surprising that despite being one of the most technologically advanced country, development of the usage of e-commerce remains low. However, the adoption rate and level of e-commerce are still significantly higher as compared to Malaysia (Le and Koh, 2002).

## 4.3 Determinants of e-commerce adoption

### 4.3.1 Reliability and validity

Table 4.2: Reliability analysis of variables

The research variables must be reliable to be deemed useful and yield stable results. Thus, the variables were tested for their reliability by calculating their Cronbach alpha coefficient (Cronbach, 1951). As shown in table 4.2, the 8 variables and 16 measures were assessed for their reliability using Cronbach’s alpha (Cronbach, 1951). It is no surprise that the reliability scores are high in 3 of the dimensions and are at an acceptable rate for the rest, as the contexts were entirely taken from past studies. According to Nunnally (1978), the minimum acceptable alpha rate for scale reliability is .70. In technological context, the Cronbach’s alpha coefficient for perceived relative advantage is .880 and perceived complexity .766. For organisational context, the Cronbach alpha coefficient for technological resource is .951 and management support .840. Finally, for environmental context, the Cronbach alpha coefficient for pressure from trading partners is .757, external change agent .727 and competition intensity .766. Therefore, all the variables are deemed reliable as they met the minimum acceptable alpha rate of .70.

### 4.3.2 Data analysis

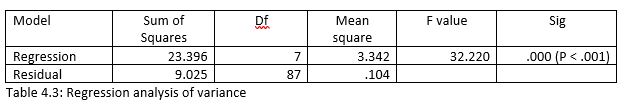
From table 4.2, it is also shown that most of the standard deviation fluctuates between 1.01820 to a low of .54249. Both the highest mean and lowest variations among the answers came from external change agent factor (4.4792 and 4.2396) which might be due to the availability of extremely advanced technological infrastructure in Singapore and various governmental support to better equip Singaporeans through programmes such as SkillsFuture (skillsfuture.sg, 2018).

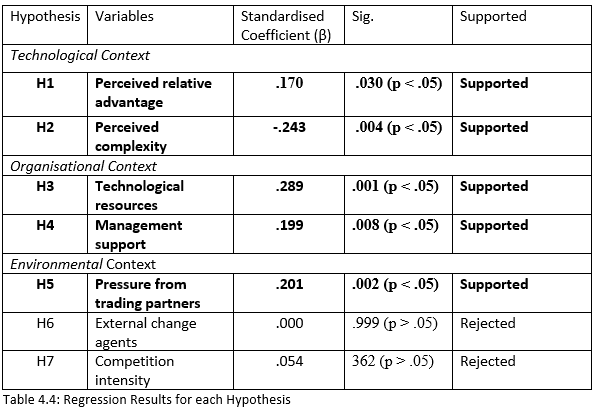
On the other hand, the lowest means came from perceived complexity after the original data was reverse coded to better fit the rest of the questions. Mean of perceived complexity (2.5833 and 2.5938) is below the neutral rate of 3, which means that average of the respondents disagrees that setting up and maintenance of e-commerce would be easy despite Singapore being one of the most technologically advanced countries.

Perceived relative advantage has means of 4.1563 and 4.2392, this means that majority of the respondents agreed that e-commerce can help increase SMEs’ profitability and market reach. The mean of competition intensity is 4.2917 and 4.2500, these figures are not surprising as competitions between SMEs are usually intense regardless the industry and firms have no means to differentiate their products. The means of the remaining factors, technological resources, management support and pressure from trade partners are just hovering between ‘neutral (3)’ and ‘agree (4)’.

### 4.3.3 Findings and analysis

This section focuses on the correlations between dependent and independents variables, which affects SMEs adoption of e-commerce. In this study, dependent variables refer to the level of e-commerce adoption (question 6) and independent variables refers to the different variables in the technological, organisational, and environmental constructs (question 7-20). Multiple regression was used to investigate the relationship between all the independent variables to the dependent variable. Level of e-commrce adoption was chosen instead of adoption because there were only one non-adopter out of the sample of 96 respondents.

 As shown in table 4.3, the overall model can explain 72.2% of variance in the level of e-commerce adoption among SMEs which was revealed to be statistically significant (F = 32.220 p < .001) which indicates a very good model fit.



As shown in table 4.4, five out (bold) of the seven adoption factors were found to be significant as a predictor in SMEs’ adoption of e-commerce. Perceived relative advantage, perceived complexity, technological resources, management support and pressure from trading partners are all found to be significant with p< .05. Out of all the factors, technological resources (β= .289) and perceived complexity (β= -.243) were found to be the two most significant factors. Both Iacovo et al. (1995) and Cragg and King (1993) states that technical knowledge and economic cost are the two most important factors in hindering IT growth in SMEs. Thus, it is no surprise that the two most significant factors were closely related to technical knowledge and means of the firm.

Apart from the two significant factors, pressure from trading partners (β = .201), management support (β = .199), and perceived relative advantage (β = .170) were also found to be significant as a determinant of e-commerce adoption among SMEs. Thus, from the results shown above, it can be deducted for research question two and three that technological and organisational context are more reliable in determining adoption of e-commerce among SMEs in Singapore as all the variables under these two contexts are significant. On the other hand, only pressure from trade partners from environmental context were deemed significant.

#### 4.3.3.1 Technological Context

Perceived relative advantage positive relationship and significance (β= .170, p= 0.30) are consistent with past studies (Premkumar and Roberts, 1999; Dedrick and West, 2004; Davis, Bagozzi and Warshaw, 1989; Gibbs and Kraemer, 2004) and disagrees with (Chau and Tam, 1997). Therefore, it is safe to assume that when firm perceived innovations which offers relative advantages, the firms is more likely to adopt the innovation (Lee, 2004). Since the adoption level of e-commerce of SMEs in Singapore tend to be on the basic end of the spectrum, it may be that respondents do not see the relative advantage that e-commerce can offer to proceed further. This implies the importance of knowledge on the benefits e-commerce can provide at both individual and firm level. Thus, Singapore government should focus on increasing the awareness of the benefits of e-commerce among Singaporeans.

In this study, perceived complexity was found to have a negative relationship and is significant (β = -.243, p= .004) in determining level of e-commerce adoption. It typically refers to the firm’s perceived difficulty in adopting e-commerce. The original value of perceived complexity was reverse coded to better fit the rest of the factors. Thus, the negative beta indicates negative relationship between perceived complexity and e-commerce adoption. This finding is consistent with those of (Grover, 1993; Thong, 1999; Riemenschneider Harrison and Mykytyn, 2003) and differ from some previous studies (Kendall et al., 2001; Ramdani and Kawalek, 2008). Therefore, firms are less likely to adopt an innovation or technology if it demands high level of skill or expertise by members of the organisation. Thus, more Singaporeans should go for trainings to equip themselves with technological knowledge and understanding.

#### 4.3.3.2 Organisational Context

The significance of technological resources (β= .289, p= .001) was consistent with past studies (Chwelos et al. 2001; Kuan and Chau, 2001; Premkumar and Roberts, 1999; Liljander et al., 2006) in discovering that the most significant factor which affect the adoption of e-commerce among SMEs, is the technical knowledge of their employees and capabilities of the firm to afford the implementation of e-commerce. The decision to adopt e-commerce is highly influenced by technological resources of the company as SMEs tend to only work within their means. Thus, business owners should focus on sending their employees for education and skills development courses to improve their knowledge and expertise in ICT to allow further adoption of e-commerce.

The positive relationship and significance of management support (β= .199, p= .008) to determine level of e-commerce adoption was in line with several studies(Tan and Teo, 1998; Premkumar and Roberts, 1999; Mirchandani and Motwani, 2001) but in contrast with some studies(Thong et al, 1993; Seyal et al., 2004). Management will only adopt e-commerce if they see the benefit that it can bring for their firm. Thus, the level of e-commerce adoption was highly reliance on the knowledge of top management on the benefit of e-commerce and their resources allocated towards the adoption of it. Typically, resources assigned and decision among SMEs are made by manager or owners. This indicates that they must have a clear understanding on the benefits of e-commerce before making the decision to adopt or allocate resources for it. Thus, more efforts are required to help highlight the benefits of e-commerce to CEOs and this could be done through seminars and workshops to encourage higher adoption.

#### 4.3.3.3 Environmental Context

The significance of pressure from trading partners (β = .201, p=.002) was consistent with Benbasat and Dexter (1995) but were unlike other study (Ahmad, et al., 2015). Ahmad et al (2015) explains that SMEs are less likely to be involved in Business-to-Business activities as compared to larger companies as they do not have many trading partners such as distributors or intermediaries and are not dependent on them. However, in Singapore being a smart nation that highly emphasised on the importance of efficiency and convenience, it is no surprise that firms might be pressured by their trading partners to adopt e-commerce to make ensure ease of transactions. Thus, to increase the adoption level among SMEs in Singapore, trade partners should try to motivate each other to adopt e-commerce to increase the efficiency and convenience of communication and transactions.

The insignificance of external change agent (β = .000, p= .999) in this study is unlike past studies (Chwelos et al., 2001; Iacovou et al., 1995) might be explained by the fact that Singapore is already considered as the most technologically advanced country which was ranked 7th in the world for having the fastest internet speed (Fastmetrics.com,2017). Furthermore, Singapore government have provided various incentives and trainings through programmes such as SkillsFuture (skillsfuture.sg, 2018) and governmental agencies such as GovTech and IMDA. Furthermore, ICT is the most popular courses among Singaporean along with language skill. However, most SMEs in singapore were still not motivated to improve their e-commerce adoption level and it might be due to the lack of awareness of the benefits e-commerce can bring to firm.

Competition intensity was found to be insignificant (β = .054, p= .362) which was consistent with several studies (Mirchandani and Motwani, 2001; Kula and Tatoglu, 2003; Teo, Tan and Buk, 1998). However, it was not surprising due to the intense rivalry between SMEs regardless the industry as they have no means of differentiating their products or services from one another.

# 5. Limitations and future directions

The results of the study should only be used with the knowledge of the study’s limitations. Firstly, only 100 respondents were recorded for the study due to time and cost constraints. Thus, majority of the responses were self-recorded on an online questionnaire which may be subject to social desirability bias or misinterpretation of questions. The remaining data was gathered from a single industrial area located in Tai Seng which may not be appropriate to generalise to the whole of Singapore. Thus, future research could use a wider sample spread across the nation to make the data collected as accurate and generalisable as possible.

Furthermore, almost half (41.9%) of the total respondent are low ranking personnel, this might have affected the results of the study as they are less knowledgeable of the current position of their firm as compared to those of higher ranking. Thus, future studies should only focus on respondents that holds high rank in their firm.

Since the questionnaires utilises the Likert scales, a common problem is that it is very subjective to individual (Trendowicz, 2013). Thus, respondent may have rounded their answer up or down, as they did not perceive it as equidistant. Furthermore, respondents might have the end-of-scale or middle-of-scale effect, which may distort the result of the data collected (Garland, 1991).

This survey follows the term ‘SME’ based on the definition set by MIT for SMEs in Singapore. They defined SMEs based on annual sales turnover and number of employees. Thus, the definition of SME will differ from other studies especially those that focuses on other countries, which made comparisons of results difficult and inaccurate.

Only two measures were tested for each factor and the research failed to include potentially important factors such as perceived compatibility and individual characteristics, which was deemed significant by various studies (Grandon and Pearson, 2004; Thong, 1999). Thus, it is important for future studies to include more measures for every variable to attain higher accuracy and reliability from the result.

This paper only focused on the usage of two adoption model, TOE framework and DOI. However, Ramdani and Kawalek (2008) suggested that IT innovations are highly differentiated and there should not be a single adoption model. Researches are also encouraged to use different theories (Williams et al., 2009; Wang et al., 2011) to describe and predict the acceptance of e-commerce. Thus, future researches could be done to introduce new theories to add to the growing body of literature on IS innovation.

# 6. Conclusion

In conclusion, the study was done to analyse the factors that may influence the adoption of e-commerce among SMEs in Singapore. The research utilised a proposed model based on the TOE framework (Tornatzky and Fleischer, 1990) and DOI (Rogers, 1995), which was developed based on previous studies. Seven distinct factors adopted from various similar paper were used as determinants of the level of e-commerce adaption among Singapore SMEs.

For this purpose, a sample of 96 SMEs derived from both online and face-to-face data collection done at Oxley BizHub was investigated. From what was shown in the data analysis, SMEs in Singapore have a high adoption rate of e-commerce. However, most of them tend to keep the level of e-commerce at the basic spectrum. The results of the independent variables were tested using multiple regression analysis. From the analysis, it is found that perceived relative advantage, perceived complexity, technological resources, management support, and pressure from trading partners are statically significant in predicting the adoption level of e-commerce.

On the other hand, external change agent and competition intensity were found to be insignificant in influencing e-commerce adoption. The insignificance of external change was unlike other previous researches and it might be due to the extremely advanced technological infrastructure in Singapore. This proved that both technological context and organisational context are more likely to influence the adoption level of e-commerce among SMEs as compared to environmental context. However, due to the limitations of the paper mentioned above, more research is needed to support the outcome of this study to ensure its accuracy and validity.

This study provides relevant insights to various groups of people such as, academicians, Singapore government, managers, and e-commerce promoters. Most of the past papers are done based on mostly developed countries in the West. Thus, this paper provided a new prospect by focusing in Southeast Asian country such as, Singapore. Furthermore, this paper used level of e-commerce as the dependent variable instead of adoption of e-commerce unlike past studies. This would provide a greater insight on to what motivates firms to further implement e-commerce. Thus, this paper provides a better understanding of the e-commerce practices in a developed Southeast Asian country, particularly in Singapore. This paper can also be generalised to be applied to other countries with similar conditions to Singapore.

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# Appendix 1

## Questionnaire

An investigation of factors affecting the adoption of e-commerce by SMEs in Singapore

Dear Sir/Madam,

I am currently pursuing a bachelor's degree in Business Management at the University of Birmingham. For my dissertation, I have chosen the topic on the factors affecting the adoption of e-commerce by SMEs in Singapore. The objective of the questionnaire is to provide a better insight on how technological, organisational, and environmental factors would act as determinants to the firms' decision to adopt e-commerce to stimulate income among SMEs in Singapore.

I would appreciate if you could take 5-10 minutes of your time to complete this questionnaire. I assure you that all information provided will be kept confidential and will be used solely for the purpose of this research.

Should you have any question(s) about the research study, please feel free to contact me [JXT666@student.bham.ac.uk](mailto:JXT666@student.bham.ac.uk)

Yours Faithfully,  
Junior Tantono

1. What is your position in the organisation? \*

* Employee
* Executive
* Manager
* Senior Manager
* Top management/owner/director
* Other:



2. What is the total number of employee(s) in your organisation? \*

* 1 - 4 employees
* 5 - 19 employees
* 20 - 50 employees
* 51 - 100 employees
* 101 - 199 employees
* More than 199

3. What is the annual sales turnover of your company? \*

* Less than S$250,000
* S$250,001 - S$1,000,000
* S$1,000,001 - S$50,000,000
* S$50,000,001 - S$99,999,999
* More than S$100 Million
* Unsure
* Not willing to disclose

4. In which industry do your firm operate in? \*

* Manufacturing
* Service
* Retail
* Food and beverage
* Technology
* Other:
* 

5. Have your firm adapted e-commerce? \*

* Yes
* No

6. Which level of e-commerce has your firm adopted?

* Basic Internet services (eg. Internet usage and Email)
* Website with simple e-commerce functions (eg. Providing information of goods & services)
* Website with advanced e-commerce functions (eg. Payment, order processing and membership)

Technological Factors

On a scale of 1-5, with 1 being strongly disagree and 5 being strongly agree, please rate the sentences below.

7. E-commerce can help to increase our profitability \*

8. E-commerce can help our firm to gain a wider market reach \*

9. We believe that setting up e-commerce would be easy \*10. We believe that learning to maintain and operate e-commerce would be easy \*

Organisational Factors

On a scale of 1-5, with 1 being strongly disagree and 5 being strongly agree, please rate the sentences below.

11. Our firm has the required technical expertise about e-commerce \*12. Our firm has the hardware required to adopt e-commerce (e.g. computer and internet service) \*13. Top managements are knowledgeable on the benefits of e-commerce \*14. The top management allocates the needed resources to develop e-commerce within the company \*

Environmental Factors

On a scale of 1-5, with 1 being strongly disagree and 5 being strongly agree, please rate the sentences below.

15. Our customers are pressuring us to adopt e-commerce \*16. Our partners’ demand for better communication are pressuring us to adopt e-commerce \*17. Singapore's internet service is fast and reliable \*18. Singapore government provides sufficient workshops/ training on the benefit and usage of e-commerce \*19. The industry that our firm is operating in is extremely competitive \*20. It is easy for our customers to switch to another company which offer similar products/services \*

# Appendix 2

## Questionnaire results

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | 1. What is your position in the organisation? \* | 2. What is the total number of employee(s) in your organisation? \* | 3. What is the annual sales turnover of your company? \* | 4. In which industry do your firm operate in? \* |  | 5. Have your firm adapted e-commerce? \* | 6. Which level of e-commerce has your firm adopted? | On a scale of 1-5, with 1 being strongly disagree and 5 being strongly agree, please rate the sentences below. | | | | | | | | | | | | | |
| 7. E-commerce can help to increase our profitability \* | 8. E-commerce can help our firm to gain a wider market reach \* | 9. We believe that setting up e-commerce would be easy \* | 10. We believe that learning to maintain and operate e-commerce would be easy \* | 11. Our firm has the required technical expertise about e-commerce \* | 12. Our firm has the hardware required to adopt e-commerce (e.g. computer and internet service) \* | 13. Top managements are knowledgeable on the benefits of e-commerce \* | 14. The top management allocates the needed resources to develop e-commerce within the company \* | 15. Our customers are pressuring us to adopt e-commerce \* | 16. Our partners’ demand for better communication are pressuring us to adopt e-commerce \* | 17. Singapore's internet service is fast and reliable \* | 18. Singapore government provides sufficient workshops/ training on the benefit and usage of e-commerce \* | 19. The industry that our firm is operating in is extremely competitive \* | 20. It is easy for our customers to switch to another company which offer similar products/services \* |
| 1 | Executive | 5 - 19 | S$250,001 - S$1,000,000 | Retail |  | Yes | Simple | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 3 | 5 | 5 |
| 2 | Executive | 101 - 199 | S$50,000,001 - S$99,999,999 | Service |  | Yes | Advanced | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 |
| 3 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Simple | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 5 | 5 |
| 4 | Senior Manager | 20 - 50 | S$1,000,001 - S$50,000,000 | Service |  | Yes | Basic | 2 | 2 | 1 | 1 | 2 | 3 | 4 | 3 | 2 | 4 | 3 | 3 | 4 | 4 |
| 5 | Employee | 20 - 50 | S$1,000,001 - S$50,000,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 5 | 3 | 4 | 4 |
| 6 | Executive | 5 - 19 | S$1,000,001 - S$50,000,000 | Service |  | Yes | Simple | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 5 | 3 | 4 | 4 |
| 7 | Top Management/Owner/Director | 1 - 4 | Not willing to disclose | Service |  | Yes | Simple | 3 | 3 | 1 | 3 | 4 | 4 | 5 | 3 | 2 | 4 | 3 | 3 | 5 | 5 |
| 8 | Executive | 101 - 199 | Unsure | Retail |  | Yes | Advanced | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 9 | Top Management/Owner/Director | 5 - 19 | S$1,000,001 - S$50,000,000 | Retail |  | Yes | Advanced | 5 | 5 | 2 | 3 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 4 |
| 10 | Employee | 101 - 199 | Unsure | Technology |  | Yes | Simple | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| 11 | Employee | 5 - 19 | Unsure | Service |  | Yes | Basic | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 |
| 12 | Senior Manager | 20 - 50 | S$250,001 - S$1,000,000 | Service |  | Yes | Advanced | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 3 | 4 | 5 | 4 | 5 | 5 |
| 13 | Manager | 5 - 19 | S$250,001 - S$1,000,000 | Service |  | Yes | Simple | 4 | 4 | 3 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 5 |
| 14 | Senior Manager | 101 - 199 | S$1,000,001 - S$50,000,000 | Manufacturing |  | Yes | Advanced | 5 | 5 | 5 | 5 | 4 | 3 | 4 | 3 | 4 | 5 | 4 | 4 | 4 | 4 |
| 15 | Top Management/Owner/Director | 1 - 4 | Not willing to disclose | Service |  | Yes | Basic | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 5 | 5 | 4 | 4 |
| 16 | Employee | 51 - 100 | Unsure | Service |  | Yes | Simple | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 2 | 5 | 5 | 4 | 4 |
| 17 | Employee | 20 - 50 | S$1,000,001 - S$50,000,000 | Service |  | Yes | Advanced | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 |
| 18 | Manager | 1 - 4 | Less than S$250,000 | Service |  | Yes | Simple | 3 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 1 | 1 | 4 | 4 | 5 | 5 |
| 19 | Senior Manager | 5 - 19 | S$250,001 - S$1,000,000 | Service |  | Yes | Simple | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 |
| 20 | Executive | 51 - 100 | Unsure | Service |  | Yes | Advanced | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 3 |
| 21 | Executive | 51 - 100 | Unsure | Service |  | Yes | Advanced | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 3 |
| 22 | Top Management/Owner/Director | 5 - 19 | Less than S$250,000 | Service |  | Yes | Simple | 5 | 5 | 3 | 2 | 3 | 4 | 5 | 4 | 3 | 3 | 5 | 5 | 5 | 5 |
| 23 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Service |  | Yes | Basic | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 |
| 24 | Executive | 5 - 19 | Unsure | Service |  | Yes | Basic | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 5 | 5 | 4 | 4 |
| 25 | Top Management/Owner/Director | 5 - 19 | Less than S$250,000 | Retail |  | Yes | Basic | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 |
| 26 | Employee | 20 - 50 | Unsure | Others | Education | Yes | Simple | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 2 | 3 | 4 | 4 | 3 | 4 |
| 27 | Executive | 101 - 199 | Unsure | Others | Events | Yes | Advanced | 3 | 3 | 4 | 5 | 5 | 5 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 3 |
| 28 | Employee | 20 - 50 | Unsure | Manufacturing |  | Yes | Simple | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 5 | 5 | 3 | 4 |
| 29 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 |
| 30 | Executive | 51 - 100 | S$1,000,001 - S$50,000,000 | Others | Events | Yes | Simple | 4 | 4 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 5 | 5 | 4 | 5 |
| 31 | Top Management/Owner/Director | 5 - 19 | Less than S$250,000 | Food and Beverage |  | Yes | Simple | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 5 | 5 | 4 | 4 |
| 32 | Employee | 101 - 199 | Unsure | Service |  | Yes | Basic | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 5 | 5 | 5 | 5 |
| 33 | Senior Manager | 20 - 50 | S$250,001 - S$1,000,000 | Manufacturing |  | Yes | Advanced | 5 | 5 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 5 | 5 |
| 34 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Advanced | 5 | 4 | 3 | 3 | 4 | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 |
| 35 | Employee | 5 - 19 | S$250,001 - S$1,000,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 5 |
| 36 | Employee | 1 - 4 | Less than S$250,000 | Technology |  | Yes | Simple | 4 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 5 | 3 |
| 37 | Executive | 5 - 19 | Less than S$250,000 | Service |  | Yes | Simple | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 5 | 5 |
| 38 | Executive | 20 - 50 | S$250,001 - S$1,000,000 | Service |  | Yes | Simple | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 5 | 5 | 4 | 4 |
| 39 | Employee | 51 - 100 | S$1,000,001 - S$50,000,000 | Service |  | Yes | Simple | 5 | 5 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 |
| 40 | Senior Manager | 20 - 50 | S$1,000,001 - S$50,000,000 | Manufacturing |  | Yes | Simple | 3 | 3 | 2 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 |
| 41 | Executive | 1 - 4 | Less than S$250,000 | Service |  | Yes | Simple | 4 | 4 | 2 | 5 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 |
| 42 | Top Management/Owner/Director | 5 - 19 | Less than S$250,000 | Food and Beverage |  | No |  | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 4 | 4 | 5 | 5 |
| 43 | Employee | 1 - 4 | Unsure | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 |
| 44 | Manager | 1 - 4 | Less than S$250,000 | Service |  | Yes | Simple | 4 | 5 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 5 | 4 | 3 | 3 |
| 45 | Top Management/Owner/Director | 5 - 19 | Less than S$250,000 | Manufacturing |  | Yes | Simple | 4 | 4 | 4 | 3 | 5 | 5 | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 4 |
| 46 | Executive | 20 - 50 | S$1,000,001 - S$50,000,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 5 |
| 47 | Executive | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 5 |
| 48 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Technology |  | Yes | Simple | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 5 | 5 | 4 | 4 |
| 49 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Service |  | Yes | Simple | 5 | 5 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 |
| 50 | Executive | 5 - 19 | Less than S$250,000 | Service |  | Yes | Simple | 5 | 5 | 3 | 3 | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 4 | 4 | 5 |
| 51 | Top Management/Owner/Director | 20 - 50 | Less than S$250,000 | Service |  | Yes | Simple | 4 | 4 | 3 | 3 | 5 | 5 | 3 | 3 | 3 | 4 | 5 | 5 | 3 | 3 |
| 52 | Senior Manager | 5 - 19 | Less than S$250,000 | Service |  | Yes | Simple | 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 |
| 53 | Executive | 1 - 4 | Less than S$250,000 | Manufacturing |  | Yes | Advanced | 5 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| 54 | Executive | 5 - 19 | Less than S$250,000 | Retail |  | Yes | Advanced | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 4 |
| 55 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Advanced | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 3 | 4 |
| 56 | Senior Manager | 5 - 19 | S$250,001 - S$1,000,000 | Technology |  | Yes | Simple | 4 | 5 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 4 | 4 | 4 | 4 |
| 57 | Executive | 20 - 50 | Less than S$250,000 | Service |  | Yes | Simple | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 5 | 5 | 5 | 5 |
| 58 | Top Management/Owner/Director | 5 - 19 | S$250,001 - S$1,000,000 | Service |  | Yes | Simple | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 2 | 5 | 5 | 5 | 5 |
| 59 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Manufacturing |  | Yes | Advanced | 4 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 |
| 60 | Executive | 20 - 50 | S$1,000,001 - S$50,000,000 | Service |  | Yes | Simple | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 2 | 3 | 4 | 4 | 5 | 5 |
| 61 | Executive | 1 - 4 | Less than S$250,000 | Service |  | Yes | Simple | 3 | 3 | 2 | 2 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 |
| 62 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Service |  | Yes | Simple | 3 | 4 | 2 | 3 | 4 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 5 | 5 |
| 63 | Employee | 5 - 19 | Unsure | Retail |  | Yes | Advanced | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 3 | 3 |
| 64 | Senior Manager | 51 - 100 | S$1,000,001 - S$50,000,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 |
| 65 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Food and Beverage |  | Yes | Simple | 4 | 3 | 3 | 2 | 4 | 5 | 4 | 3 | 3 | 2 | 5 | 4 | 4 | 4 |
| 66 | Senior Manager | 51 - 100 | S$1,000,001 - S$50,000,000 | Others | Events | Yes | Simple | 5 | 4 | 2 | 2 | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 4 | 5 | 5 |
| 67 | Manager | 51 - 100 | S$250,001 - S$1,000,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 3 | 4 | 5 | 5 | 5 | 5 | 4 |
| 68 | Senior Manager | 51 - 100 | S$1,000,001 - S$50,000,000 | Service |  | Yes | Simple | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 2 | 4 | 4 | 5 | 4 |
| 69 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Simple | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 2 | 2 |
| 70 | Executive | 1 - 4 | Less than S$250,000 | Service |  | Yes | Simple | 5 | 5 | 3 | 3 | 3 | 3 | 4 | 3 | 2 | 3 | 5 | 4 | 5 | 4 |
| 71 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Simple | 5 | 5 | 5 | 3 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 4 |
| 72 | Senior Manager | 51 - 100 | S$250,001 - S$1,000,000 | Service |  | Yes | Simple | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 5 | 5 | 4 | 4 |
| 73 | Manager | 20 - 50 | S$250,001 - S$1,000,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 3 | 2 | 5 | 4 | 5 | 4 |
| 74 | Senior Manager | 51 - 100 | S$1,000,001 - S$50,000,000 | Food and Beverage |  | Yes | Advanced | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 |
| 75 | Executive | 51 - 100 | S$250,001 - S$1,000,000 | Service |  | Yes | Advanced | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 5 | 5 | 5 | 4 | 4 |
| 76 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 |
| 77 | Executive | 5 - 19 | S$1,000,001 - S$50,000,000 | Food and Beverage |  | Yes | Simple | 3 | 3 | 3 | 2 | 4 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 |
| 78 | Employee | 20 - 50 | Unsure | Service |  | Yes | Simple | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 2 | 4 | 4 | 4 | 5 |
| 79 | Manager | 51 - 100 | S$1,000,001 - S$50,000,000 | Manufacturing |  | Yes | Advanced | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| 80 | Senior Manager | 20 - 50 | S$250,001 - S$1,000,000 | Service |  | Yes | Simple | 3 | 5 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 5 | 4 | 4 | 5 | 4 |
| 81 | Top Management/Owner/Director | 1 - 4 | Less than S$250,000 | Retail |  | Yes | Advanced | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 2 | 5 | 5 | 5 | 4 | 4 |
| 82 | Senior Manager | 1 - 4 | Less than S$250,000 | Food and Beverage |  | Yes | Simple | 5 | 4 | 3 | 2 | 5 | 5 | 4 | 4 | 3 | 2 | 4 | 4 | 4 | 4 |
| 83 | Top Management/Owner/Director | 51 - 100 | S$250,001 - S$1,000,000 | Retail |  | Yes | Advanced | 5 | 4 | 4 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 5 | 5 | 4 | 4 |
| 84 | Executive | 20 - 50 | S$250,001 - S$1,000,000 | Others | Events | Yes | Simple | 4 | 5 | 4 | 5 | 5 | 5 | 3 | 3 | 5 | 4 | 5 | 5 | 4 | 5 |
| 85 | Senior Manager | 5 - 19 | Less than S$250,000 | Food and Beverage |  | Yes | Simple | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 |
| 86 | Manager | 20 - 50 | S$1,000,001 - S$50,000,000 | Food and Beverage |  | Yes | Simple | 4 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 |
| 87 | Senior Manager | 51 - 100 | S$1,000,001 - S$50,000,000 | Retail |  | Yes | Advanced | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 |
| 88 | Manager | 20 - 50 | S$1,000,001 - S$50,000,000 | Service |  | Yes | Simple | 4 | 5 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 4 |
| 89 | Manager | 20 - 50 | S$250,001 - S$1,000,000 | Manufacturing |  | Yes | Simple | 5 | 5 | 3 | 2 | 4 | 3 | 5 | 5 | 3 | 3 | 4 | 3 | 5 | 4 |
| 90 | Senior Manager | 5 - 19 | S$250,001 - S$1,000,000 | Service |  | Yes | Simple | 5 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 2 | 4 | 4 | 5 | 4 | 4 |
| 91 | Senior Manager | 101 - 199 | S$1,000,001 - S$50,000,000 | Service |  | Yes | Simple | 5 | 5 | 3 | 2 | 4 | 4 | 4 | 2 | 3 | 2 | 5 | 4 | 4 | 4 |
| 92 | Executive | 1 - 4 | Less than S$250,000 | Service |  | Yes | Simple | 4 | 5 | 5 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 5 | 5 | 4 | 4 |
| 93 | Manager | 5 - 19 | S$250,001 - S$1,000,000 | Service |  | Yes | Simple | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 5 |
| 94 | Senior Manager | 101 - 199 | S$50,000,001 - S$99,999,999 | Service |  | Yes | Simple | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 |
| 95 | Senior Manager | 1 - 4 | Less than S$250,000 | Manufacturing |  | Yes | Simple | 3 | 5 | 3 | 3 | 5 | 4 | 5 | 4 | 3 | 4 | 5 | 4 | 4 | 4 |
| 96 | Employee | 51 - 100 | Unsure | Service |  | Yes | Simple | 5 | 4 | 4 | 3 | 5 | 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 5 |
| **97** | **Employee** | **More Than 199** | **Unsure** | **Service** |  | **Yes** | **Simple** | **5** | **5** | **1** | **3** | **5** | **5** | **5** | **3** | **5** | **5** | **4** | **4** | **5** | **5** |
| **98** | **Executive** | **More Than 199** | **Unsure** | **Others** | **Finance** | **Yes** | **Simple** | **4** | **3** | **2** | **2** | **4** | **4** | **4** | **5** | **2** | **2** | **4** | **4** | **4** | **4** |
| **99** | **Executive** | **More Than 199** | **Unsure** | **Others** | **Education** | **Yes** | **Basic** | **3** | **3** | **2** | **3** | **3** | **4** | **4** | **3** | **3** | **2** | **2** | **2** | **2** | **3** |
| **100** | **Executive** | **More Than 199** | **Unsure** | **Retail** |  | **Yes** | **Basic** | **2** | **2** | **3** | **3** | **3** | **3** | **3** | **3** | **4** | **3** | **3** | **2** | **3** | **2** |

# Appendix 3

## Questionnaire origin

|  |  |
| --- | --- |
| Construct | Source |
| **Technological** | |
| *Perceived Relative Advantage*  E-commerce can help to increase our profitability  E-commerce can help our firm to gain a wider market reach | Al-Qirim (2007) and Grandon and Pearson (2004) |
| *Perceived Complexity*  We believe that setting up e-commerce would be easy  We believe that learning to maintain and operate e-commerce would be easy | Moore and Benbasat (1991) |
| **Organisational** | |
| *Technological resources*  Our firm has the required technical knowledge about e-commerce  E-commerce is a familiar type of technology to use | Lippert and Forman (2005) |
| *Top management support*  Top managements are knowledgeable on the benefits of e-commerce  The top management allocates the needed resources to develop e-commerce within the company. | Thong and Yap (1995) |
| **Environmental** | |
| *Pressure from Trading Partners*  Our customers are pressuring us to adopt e-commerce  Our partners’ demand for better communication are pressuring us to adopt e-commerce | Al-Qirim (2007) and Saffu et al. (2008) |
| *External Change agent*  Singapore's internet service is fast and reliable  Singapore government provides sufficient workshops/ training on the benefit and usage of e-commerce | Al-Qirim (2007) and Thong (2001) |
| *Competition Intensity*  The industry that our firm is operating in is extremely competitive  It is easy for our customers to switch to another company which offer similar products/services | Thong and Yap (1995) |