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Understanding Electronic Commerce Adoption at Organizational Level: Literature Review of TOE Framework and DOI Theory

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Abstract:
A number of theories have been used to describe e-commerce adoption and use of technology. TAM, TPB, TRA, and UTAUT have been widely used to describe the adoption at the individual level. Conversely, at the organizational level, two popular theories have been used widely either alone or with other theories to describe the adoption and use of technologies (including e-commerce). These two theories are Roger's Diffusion of Innovation (DOI) theory (1962) and technology-organization-environment (TOE) framework (1990). Based on the available literature sources, this paper focuses on reviewing the prominent technology adoption models at the organizational level, Technology-Organization-Environmental (TOE) framework and Diffusion of Innovation (DOI) theory in order to perceive their possible future application at the organizational level. The result of this study reveals that most of the e-commerce studies preferred questionnaire method. The studies of e-commerce adoption have recently been carried out mostly in developing countries. Moreover, this paper attempts to provide a better understanding of electronic commerce adoption theories at the organizational level by conducting a literature review.

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Introduction

Information and Communication Technologies (ICTs) and electronic commerce (e-commerce) comprised excellent opportunities for organizations to be more competitive in the marketplace. Using other theoretical perspectives such as diffusion of innovations (DOI) theory with the combination of TOE framework could provide an alternative model. DOI describes the process by which an innovation is communicated through certain channels over time, among the members of a social society. As the innovation diffusion theory suggests, diffusion occurs as individuals, groups, organizations, or subsystems accept and use new ideas such as technologies. One common criticism about DOI theory is that it does not take into consideration the environmental factors where the organization conducts business, such as competition, which could work as a barrier or a motivation to technology acceptance and adoption (Lippert & Govindarajulu, 2006). Hence, using Roger's theory of DOI combined with TOE framework could provide a useful model to explain the organization adoption of e-initiatives in general, and e-commerce among industries, in particular (Arpaci et al., 2012, Al-Zoubi et al., 2011, Ramadani et al., 2009, Lippert et al., 2006). Scupola (2003) and Idris et al., (2017) found that the TOE model is very useful in investigating drivers of e-commerce adoption in SMEs and developing countries, and the empirical data have mostly supported the model.

Literature Review

Technology-Organization-Environmental (TOE)

Technology-Organization-Environmental (TOE) framework introduced by Tornatzky and Fleischer (1990), is a popular model for investigating the adoption of latest technologies in an organization. It classifies the factors that influence an organization to adopt new technology into three groups: technology, organization, and environment. The technological context refers to the existing as well as new technologies relevant to the firm. These factors play a significant role in the firm's adoption decision as it determines the ability of the firm to benefit from e-business initiative. The organizational context represents the internal factors in an organization, influencing an innovation adoption and implementation. Organizational context refers to descriptive measures about the organization such as scope, size, organization structure, financial support, managerial beliefs and top management support. The environmental context is the arena surrounding a firm, consists of its industry, technology support infrastructure and government regulation (Tornatzky and Fleischer 1990).

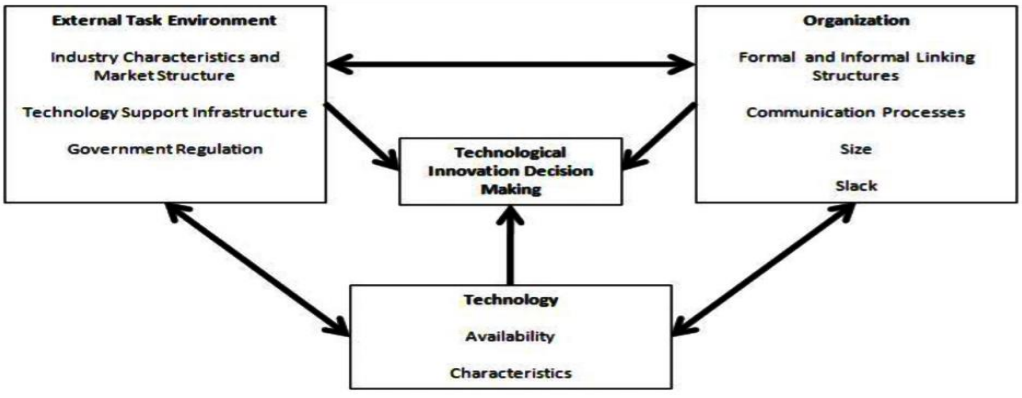

Figure Technology, Organization, Environment Model
Source: Tornatzky, L.G., and Fleischer, M. *The Processes of Technological Innovation*. Lexington Books, Lexington, Massachusetts, 1990.

DOI

A sociology professor named Everett Rogers published Diffusion of Innovation in 1962. Rogers synthesized more than 508 diffusion studies and produced theories for the adoption of innovation among individuals and organizations in his book. According to Rogers (1995), diffusion is a process in which an innovation is communicated through certain channels over a period of time between members of the social system and innovation is an idea, practice, or object that is considered new by an individual or another adoption unit. Communication is a process in which participants make and share information with each other to achieve mutual understanding. Yusuf and Derus (2013) regard this theory as a permanent theory of acceptance of innovation and suitable for the context of individuals or organizations. There are five determinants of innovation that influence adoption and acceptable behaviour in this theory. The five determinants are relative superiority, compatibility, complexity, trial ability, and observed ability. Relative advantage is the rate at which an innovation is considered better than an idea that is replaced by a particular user group, measured in terms of what is important to the user, such as economic benefits, social prestige, comfort, or satisfaction. The greater the perceived relative benefit of an innovation, the faster the rate of adoption. There is no absolute rule for what constitutes a "relative advantage". It depends on the perceptions and needs of certain user groups. Compatibility is the rate at which an innovation is considered consistent with the values, past experience, and needs of potential adopters. An idea that is not in accordance with its values, norms or practices will not be adopted as quickly as compatible innovation. Complexity is the level at which an innovation is considered difficult to understand and use. New ideas that are easier to understand are adopted faster than innovations that require adopters to develop new skills and understanding. Trialability is the rate at which an innovation can be tried on a limited basis. An innovation that can be piloted does not represent uncertainty for the individual who considers it. Observability means the easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. Results that appear to reduce uncertainty and also stimulate discussion of friends about new ideas, because friends and neighbours of adopters often ask for information about it.

Knowledge is an individual who is first exposed to innovation, but does not have information about innovation. During this stage, individuals have not been urged to find out more information about innovation. The second is persuasion, persuasion is an individual who is interested in innovation and actively seeking information. Decisions are individuals who take the concept of change and consider the advantages/disadvantages of using innovation and decide whether to adopt or reject the innovation. Because of the individualistic nature of this stage, Rogers notes that this is the most difficult stage to obtain empirical evidence. The fourth is implementation, implementation is an individual user of innovation to a level that varies depending on the situation. During this stage, individuals also determine the usefulness of innovation and can find more information about the innovation. And the last is confirmation, at this stage the individual completes his decision to continue to use the innovation. This stage is intra-personal (can cause cognitive dissonance) and interpersonal, confirmation that the group has made the right decision.

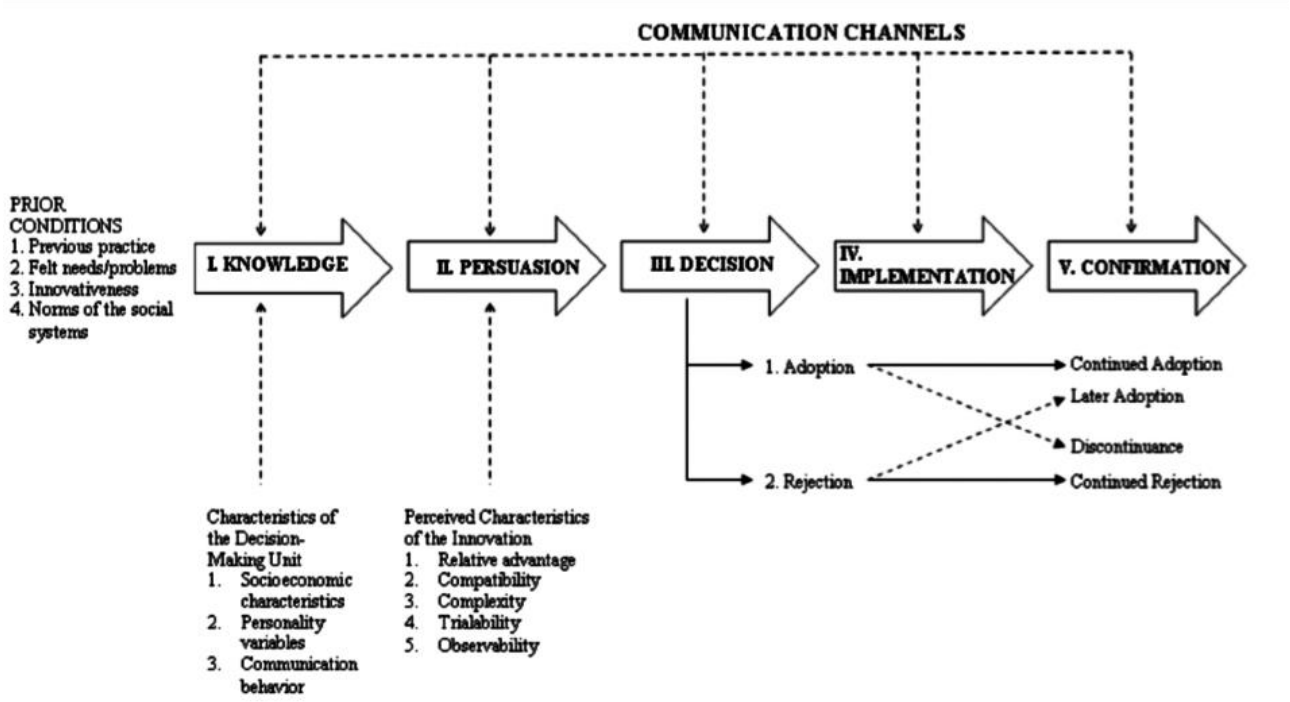

Figure A Model of Five Stages in the Innovation-Decision Process
Source: *Diffusion of Innovations, Fifth Edition* by Everett M. Rogers (2003).

In his book (2003), Rogers defines innovation as the extent to which individuals or units of adoption are relatively earlier in adopting new ideas than other members of the social system. Rogers also classified adopters in five categories:

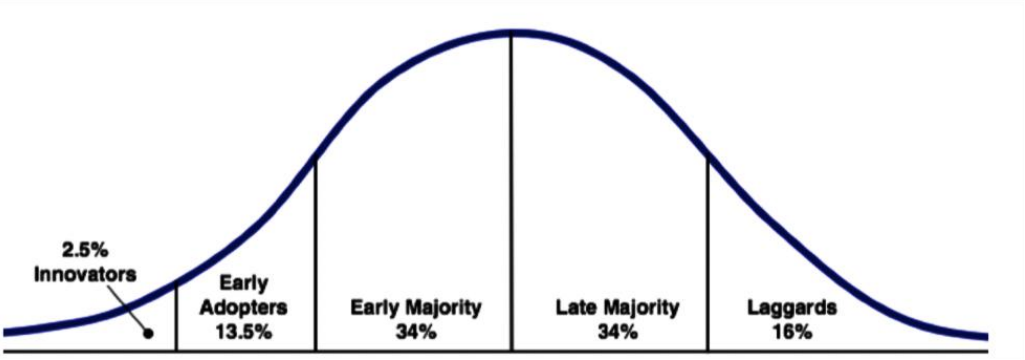

Figure Five categories of adopters
Source: *Diffusion of Innovations, Fifth Edition* by Everett M. Rogers (2003).

Innovators considers innovators as those who are able to adopt innovation regardless of uncertainly of the risk level at the time of adoption. Usually, innovators have the highest financial resources and social class and are young. Early Adopters are those who are able to adopt an innovation. Early adopters have a higher leadership attitude than those of other categories, more financial recourses and education, and are younger than those of the late majority. They are more careful to make the decision of adopting an innovation than innovators. Early Majority unlike the early adopters and innovators, this group takes more time than innovators and early adopters for making the decision to adopt an innovation and seldom hold position of opinion leadership. Late Majority means the individuals here are highly cautious and hate to take the risk of adopting an innovation. In addition, individuals in

late majority adopt an innovation after most others have already adopted it. They are of a low social class, lack financial recourses, and lower opinion leadership than above categories. Laggards is the group of the conservative and the last group of adopters of an innovation. They almost have no opinion leadership, have lowest financial resources, cannot tolerate the risk of adopting an innovation that may fail and have a little or no social class. They are classified as traditional and they take the decision to adopt an innovation based on the past and previous adopted innovation.

Previous Studies of DOI and TOE

The table below is made based on previous studies of DOI and TOE in different type of industry.

Theory /Model	Author(s)	Object of Analysis	Research Methods	Type of Industry	Place of Research /Number of Sampling	Major Findings
DOI	Limthonghai & Speece (2003)	E-Commerce	Survey Questionnaire	SMEs	Thailand/ 400	All factors were significant predictors of e-commerce adoption in SMEs except trialability ,which is found insignificant.
DOI	Hussin & Noor (2005)	E-Commerce	Survey Questionnaire	Manufacturing Companies	Malaysia/ 107	The study found that DOI attributes have a significant effect on e-commerce adoption decision by owners/managers and that CEO Commitment to IT is a major factor of e- commerce adoption decision.
DOI	Tan et al. (2009)	ICTs	Survey Questionnaire	SMEs	Malaysia/ 406	Relative Advantages, Compatibility, Complexity, Observability and Security are the most significant factors in adopting e- commerce, while Trialability and ICT Cost are less significant.
DOI	Ming, Z. (2016)	E-Business	Survey Questionnaire	SMEs	China/351	The empirical evidence from this study confirms that DOI theory is applicable to e-business adoption issues for SMEs in China, with all of the four proposed elements (innovation, communication, social system and time) being found to have their relevance.

Theory /Model	Author(s)	Object of Analysis	Research Methods	Type of Industry	Place of Research /Number of Sampling	Major Findings
TOE	Teo et al. (2009)	E-Procurement	Survey Questionnaire	SMEs	Singapore / 147	Firm Size, Top Management Support, Perceived Indirect Benefits and Business Partner Influence are significant predictors in differentiating between adopters and non- adopter of e-procurement.
TOE	Hao et al. (2010)	E-Commerce	Survey Questionnaire	SMEs	China/156	IS Input, Intended IS Budget, Top Management Support, Security and Firm Size having a significant effect on e- commerce adoption while Strategy Management and Web Functionality are not significant in e-commerce adoption in SMEs.
TOE	Alamro & Tarawneh (2011)	E-Commerce	Interview	SMEs	Jordan/41	Client Pressure, Availability of ICT, CEOs and Employees' Knowledge are significant factors in adopting e-commence, while Government Support has no significant effect.
TOE	Ghobakhloo et al. (2011)	E-Commerce	Survey Questionnaire	Firms	Iran/1237	Perceived Relative Advantages, Perceived Compatibility, CEO's Innovativeness, Competition, Buyer/Supplier Pressure and Support from Technology Vendors are significant factors that affect adopting e- commerce in SMEs, while other factors were found insignificant.
TOE	Ifinedo (2011)	E-Business	Survey Questionnaire	SMEs	Canada/214	Perceived Benefits, Management Support and External Pressure were found significant predictors of adopting e-business, while other independent variables including Control Variables were found insignificant.

Theory /Model	Author(s)	Object of Analysis	Research Methods	Type of Industry	Place of Research /Number of Sampling	Major Findings
TOE	Al-Somali et al. (2011)	E-Commerce	Survey Questionnaire	SMEs	Saudi Arabia/450	The results showed that Organisational IT Readiness, Top Management Support, Regulatory Environment are significant factors in predicting e-commerce preliminary adoption and utilization, while Customer Support and Strategic Orientation have significant influence only on the utilisation of e-commerce.
TOE	Li, H., Dai, J., & Gershberg, T., (2018)	Audit technology adoption	Survey	Firms	US/209	Encouragement by management and regulators are the most important factors, IT complexity and firm size, do not have significant influence. Feature-level audit analytics usage is influenced by professional help, technological competence, and application-level audit analytics usage.
TOE	Lama, Pradhan, Shrestha & Beirman (2018)	E-tourism	Questionnaire	SMTEs	Nepal/198	Lack of infrastructure, market size and lack of support from the government,awareness, lack of resources, value proposition and top management support were found significant. Supporting IT industry and socio-cultural factors, security concern were found to be non-significant.
TOE+DOI	Scupola (2003)	E-Commerce	Interview	SMEs	Italy/7	Innovation Champion, Employee's IS Knowledge, External Pressure from Buyer and Supplier, Competitive Pressure, Role of Government, E-commerce Barriers and Benefits have significant influence on e- commerce adoption in SMEs.

Theory /Model	Author(s)	Object of Analysis	Research Methods	Type of Industry	Place of Research /Number of Sampling	Major Findings
TOE+DOI	Ramdani & Kawalek (2009)	Enterprise Systems	Interview	SMEs	England/102	Industry Market Scope, Competitive Pressure, External IS Support, Relative Advantages Construct, Top Management Support and Firm Size are significant predictors of adopting Enterprise Systems.
TOE+DOI	Hung et al. (2011)	E-Commerce	Survey Questionnaire	Travel Agencies	Taiwan/122	Compatibility, Centralization, Organisational Scale and Correctness of Website Transmission were significant predictors in differentiating between adopters and non-adopters.
TOE+DOI	Huy et al. (2012)	E-Commerce	Survey Questionnaire	SMEs	Vietnam/926	The results showed that Employee's E- commerce Knowledge, Organisational Readiness, Firm Size, Managerial Attitudes towards Innovation, Industry Associations' Support, Competitive Pressure, Government Support, Compatibility, Complexity and Risk are significant predictors in differentiating between adopters and non- adopters of e- commerce.
TOE+DOI	Al-Zoubi (2011)	E-Business	Survey Questionnaire	Firms	Jordan/260	Two of the four technological factors (relative advantages and IT infrastructure) were found to influence businesses‟ adoption of e-business. Three of the five organizational factors (organization adaptability and mission, organization involvement and consistency, and financial resources) were found to influence businesses‟ adoption of e-business. In addition, external factors (competition and government support) were found to influence businesses‟ adoption of e- business.

Theory /Model	Author(s)	Object of Analysis	Research Methods	Type of Industry	Place of Research /Number of Sampling	Major Findings
TOE+DOI	Alrousan (2014)	E-Commerce	Survey Questionnaire	Travel Agencies	Jordan/128	The results found that 7 of the 16 proposed hypotheses addressing e-interactivity versus e- connectivity were significant, namely: relative advantage, observability, financial barriers, power distance, business/partner pressure and government support. The results showed that 4 of the 16 proposed hypotheses were significant, distinguishing between e-interactivity and e- window. These significant factors were observability, competitive pressure, firm size and complexity.
TOE+DOI	Chiu, Chui-Yu; Chen, Shi; Chen, Chun-Liang (2017)	Mobile application	Questionnaire	Organization	Taiwan/303	Relative advantage, trialability and compatibility, Information intensity, top management support, employees' knowledge, capability, business partner, competitive pressure : significant.
TOE+DOI	Chandra, S & Kumar, K., N (2018)	E-Commerce	Survey	Firms	Asia/107	Technological competence, relative advantage, top management support, customer readiness were found significant.

For technological factors, Rogers (1995) found that relative advantage (perceived e-commerce benefits and impact), compatibility (both technical and organizational), trialability (the degree to which e-commerce can be pilot tested), complexity (ease of use or learning e-commerce) and observability (the extent to which relative advantage or gains are clear) of the technological innovation are important technological factors influencing the adoption decision. Grandon and Pearson (2004) examined the impact of relative advantage, complexity and included compatibility as a significant factor for e-commerce adoption. Relative advantage, compatibility, and complexity have been examined in previous studies, and have been shown to be significant. According to some studies (Kendall et al., 2001; Limthongchai and Speece, 2003; Seyal and Rahman, 2003; and Li et al., 2010), relative advantages are related to the degree to which potential adopters perceive the innovation to be preferable to

existing conditions. The positive perception of the advantages of e-commerce provides an incentive to adopt e-commerce. The degree of relative advantage is often expressed in terms of profitability, cost reduction or transaction acceleration. Generally, a positive relationship exists between the advantages and the relative adoption behaviours (Le et al, 2012). Relative advantage is not only involved with money, but also involved in saving effort and time and reducing inconvenience and anything else that brings a benefit for e-commerce (Al-Ghaith, Sanzogni & Sandhu 2010). There are potential opportunities and benefits of e-commerce for SMEs. These include strengthening customer relationships, reaching new markets, optimising business processes, reducing costs, improving business knowledge, attracting investment, and creating new products and services. Also, e-commerce represents an opportunity for SMEs to compensate for their traditional weaknesses in areas such as access to new markets and gathering and diffusing information on an international scale, which improve communication and creates greater job flexibility (Scupola, 2001). Rahayu and Day (2015) also found in their study that the relative advantage has a positive and significant correlation with e-commerce adoption in Indonesia, which means that the relative advantage is one of determining factors of e-commerce adoption by SMEs.

Compatibility is the degree to which an innovation is perceived to be in keeping with previous experience and existing values, and with the needs of possible adopters (Grover, 1993; Teo & Tan, 1998). Enterprises choose forms of e-commerce conforming to certain internal values and experience and which enable them to reduce the perceived risks while making minimal adjustments and changes, making these choices in turn leads to lower resistance to adoption (Le et al., 2012). Ramadani et al. (2013) study also confirmed the findings of previous TOE studies. In the technological context, relative advantage, compatibility, and complexity have been confirmed to be significant. Previous studies found a positive and significant relationship between compatibility and e-commerce (Tan and Teo, 2000; Limthongchai and Speece, 2003; Ramdani and Kawalek, 2009; Tan and Eze, 2008; Alam et al., 2009; Kamaroddin et al., 2009). Recent studies also found a significant positive relationship between compatibility and e-commerce adoption in SMEs (Ghobakhloo et al., 2011; Adewale et al., 2013; Mndzebele, 2013).

Complexity on the other hand, refers to the degree to which an innovation is perceived as being difficult to use. The technical know-how required for e-commerce can prevent its adoption. One would expect that a high degree of perceived complexity of e-commerce would negatively influence the decision to adopt it (Seyal & Rahman, 2003; Grover, 1993). Based on the literature review, some SMEs found that since E-commerce is a high technology, they have limited resources to support it. For example, SMEs frequently feel that they have limited knowledge of technology in their organizations, especially knowledge of this new business model. It is difficult to attract employees and experienced in-house IT staff with the right skill sets for e-commerce. Forty percent of SMEs in UK felt they are not really sure how to make best use of technology that they currently have. In addition, some SME business owners also found that they lack appropriate education, information, and knowledge. They do not have the competencies to understand the full implications of e-commerce (Scupola, 2001). Previous studies also found that complexity has a negative relationship with e-commerce adoption in SMEs (Limthongchai and Speece, 2003; Alam et al, 2009; Almoawi and Mahmood, 2011; Poorangi et al., 2013).

Trialability is defined as "the degree to which an innovation may be experimented with on a limited basis". New ideas that can be tried on the installment plan are generally adopted more rapidly than innovations that are not divisible (Rogers, 1995). Kendall (2001) revealed that trialability is found to significantly affect Singapore SMEs in adopting e-commerce. Previous studies also found that trialability has a significant effect in adopting e-commerce in SMEs (Poorangi et al., 2013; Tan and Teo, 2000; Limthongchai and Speece, 2003; Kamaroddin et al., 2009; Hussin et al., 2008). Azam and Quaddus (2009)and Alam et al. (2009) found that trialability has no significant effect on e-commerce adoption by SMEs in Bangladesh and Malaysia, respectively.

Observability is the ability to see the beneficial results of an innovation (Roger, 1995). From Chong (2008) research on e-commerce adoption in Australia and Singapore regarding observability, he found that ICT success observed by SMEs in other companies such as trading partners and competitors may increase the chance of adopting similar technologies by themselves. The few studies that have examined the effect of observability on innovation adoption found mixed results indicating either a positive or a non-significant relationship (Chong, 2008; Black et el., 2001). In addition to the factors that were tested in previous TOE studies, Ramadani et al. (2013) study found trialability, observability, industry and market scope to be significant factors of e-commerce adoption by SMEs. Previous researchers found a significant positive relationship between observability and e-commerce adoption (Poorangi et al., 2013; Tan et al., 2009; Limithongchai and Speece, 2003; Hussin and Noor, 2005; Tan and Tze, 2008; Alam et al., 2009).

According to Premkumar (2003), many studies of SMEs use the characteristics in organizational contexts as the main focus. What hinders the adoption of internet technology is the small size of an organization because there is often a lack of resources, such as costs, experts, and also a lack of sensitivity to external forces in small companies. On the other hand, large companies have facilities such as infrastructure and resources for innovation adoption (Ling, 2001; Thong, 1999; Teo & Tan, 1998; Thong & Yap, 1995a). And the employees' IT knowledge is crucial to a firm's ability to adopt and make use of technology, adapting to new technologies may require changes in the working attitudes of employees, as well as their qualifications, their level of performance and the extent of their knowledge of e-commerce technology (Le et al., 2012). As long as the employees already have some knowledge of e-commerce, the organization may be more disposed to adopt e-commerce (Looi, 2005; Molla & Licker, 2005). Technical knowledge and expertise are important aspect in the measurement of a successful adoption of e-commerce. The more knowledge or expertise one has, the less complex e-commerce is perceived to be, thus the faster the process of e-commerce adoption. Other than IT infrastructure and technical knowledge, firm's innovativeness also can be seen as a factor that may influence the adoption of E-commerce in an organization (Lee and Runge, 2001).

The findings of Al-Somali et al. (2011) also suggest that strategic orientation has a significant positive influence on the utilization stages of e-commerce adoption. Firms with a well-developed strategic rationale in regards to new markets, products and technologies are found to assimilate and routinize e-commerce more extensively for purposes of communication or information, and transaction or collaboration with business partners. In the case of SMEs in particular, even if the managers perceive the adoption of new technologies and e-commerce to be important, the enterprises often do not have sufficient resources to adopt them (Le et

al., 2012). Several studies found that top management support has an important influence on e-commerce adoption by SMEs (Ifinedo, 2011; Heung, 2003; Hao et al., 2010; Scupola, 2009). Mpofu et al. (2009), Seyal & Rahman (2003) and To and Ngai (2006) found that e-commerce adoption in SMEs is positively and significantly driven by managers' attitude toward the use of information technology.

Tan and Wu (2003), Lawson et al. (2003), and Pearson and Grandon (2004) showed that financial matters are vitally important to owners and managers and such issues often drive adoption of e-commerce in small businesses. According to Rahayu and Day (2015), cost is found not to have a significant correlation with e-commerce adoption. A possible explanation for this finding is because the price of hardware and software related to e-commerce technology is not really expensive for SMEs. Usually, the less expensive the cost of a certain technology, the more likely it will be quickly adopted and implemented in an organization (Premkumar & Roberts, 1999; Tornatzky & Klein, 1982). Organizational readiness refers to the firm's readiness in term of knowledge of the key personnel and facilities to adopt the technology. In order to apply the E-commerce technology, a firm must have adequate computer systems within the firms to access and use the Internet without major problems (Hussin and Noor, 2005). As an application of the Internet, e-commerce depends on Information and Communication Technologies (ICTs) for its development (Rodriguez et al., 2008). According to Al-Somali (2011), successful exploitation of e-commerce requires having a well defined strategy for e-commerce that links between organization's strategy and the technology that supports it.

The environmental context is the arena surrounding a firm, consists of its industry, technology support infrastructure and government regulation (Tornatzky and Fleischer 1990). The government can contribute to e-commerce adoption and implementation by conducting informational campaigns to increase awareness, giving financial subsidies, but also and especially by increasing the knowledge of English and facilitating the access to related technologies on the local market (Scupola, 2003). Seyal et al. (2004) analyzed the determinants of e-commerce in Pakistan SMEs. In their study, government support were significant in determining e-commerce adoption among SMEs. However, they believe from the basis of the result that, with different policies, the government could influence these SMEs to promote adoption to a different extent. Therefore, the government should select policies that fit the specific institutional and business environment. Seyal et al. (2004) study investigated government's involvement and support in e-commerce adoption in SMEs. By establishing a governmental body, Ministry of Information Technology and Telecommunications, the government of Pakistan has further shown its commitment in providing a legitimate and positive leadership role in developing an infrastructure to digitize its economy. Al-Somali et al. (2011) study findings also suggest that the government should increase awareness and organize technology resource centers to inform and educate managers and owners about the innovative potential of new technologies such as e-commerce. Indeed, a lack of awareness of the use and potential benefits of Internet technologies and IT can hinder the growth of e-commerce. The emphasis of public policies shifted from promoting the diffusion of the Internet to the instrumental role of ICTs in doing business and creating value. This indicates, from a policymakers' view, that the adoption of e-commerce plays an important part in making existing businesses more efficient and effective.

Discussion and Conclusion

With the advancement and growth of technology, many researchers have studied extensively about e-commerce adoption at the organizational level using the TOE framework and DOI theory in recent years. Many hypotheses based on the Technology, Organization, Environment (TOE) framework and the Diffusion of Innovation (DOI) theory have been found to be significant and positive. However, we need to understand that each organization has different factors and needs to recognize certain conditions in the organization. Further studies are necessary in order to analyze e-commerce adoption in certain sectors, to provide a better explanation about e-commerce adoption in the sector. It is also possible that the TOE framework is better when combined with other theories, depending on the condition of the organization. The limitation of this study, most of the research in this study is only based on a single perspective. Moreover, this study might not cover all existing TOE and DOI studies, there are still many studies on e-commerce that can be analyzed in the future. The author also concerns the gap between e-commerce in developing and developed countries. The results of this study indicate that the latest electronic adoption studies have been conducted in developing countries. Conversely, developed countries focus more on increasing and improving their e-commerce applications. The author suggests that future research could analyze the comparison between e-commerce adoption in developing and developed countries.

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