

ICT Investment and its Contributions to Firm Performance: A Review of Literature

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Abstract: Despite the ICT's promise of improved firm performance, many ICT projects have yet to prove success. A vast literature on ICT investment has been widely discussed in previous studies however, study of the effect of ICT investment on firm performance remains unexplored especially in Malaysia. This study aims to provide a review and analysis of ICT investment literatures. The literature analysis is used to collect the data published in various fields such as management studies, economics, social sciences and information systems from the years 1987-2016. The main discussion is around the trends of ICT investment in developed and developing countries and the nature of ICT investment practices in Malaysia. The literature also points out to the importance source of technological change that can revolutionize the way business firms conduct their operational activities and contribute to better firm performance. This study contributes to the body of knowledge of ICT investment that would provide guidance and insights in helping companies to have a clear understanding of the benefits of ICT investment in generating future income.

Key words: ICT investment, firm performance, Malaysia, contribute, insights

INTRODUCTION

In the early introduction of Information Technology (IT) it commenced with the invention of computers that were used for computation and mathematical model analysis then with the advancement in software development, make IT usage became more pervasive (Abas, 2005). Due to the development of IT is changing and growing constantly, the concept of Information Technology (IT) itself may also be changed since the rapid advancement of IT was intervened by the high potential value of communication components and it ought to be addressed because of its significance. As telecommunication through networks rapidly growth, the term of Information and Communication Technology (ICT) came to replace the original term of "IT". The term of ICT is often used as an extended concept for IT but the ICT is not a single technology as it is the combination of all integration of telecommunications (telephone lines and wireless signals) computers as well as necessary enterprise software, middleware, storage and audio-visual systems which enable users to access, store, transmit and manipulate information (Abas, 2005). Therefore, the term of "ICT" and "IT" are equivalent to be applied in this study. Basically, an investment strategy is the essence in building wealth and its definition can be used in a number of contexts. In a good economic sense, doing investment

in physical capital is important for companies' growth and development. According to business theories, the transition of this strategy is seen as the process of utilization of resources, started with buying a physical or tangible asset for example, a building, technological tools or machinery and other equipment in expectation that this investment will help the business to enter the production process to prosper for the long term benefits. For example, investment in ICT is referred to the acquisition of computer hardware and software used in production for more than one year that comprises of three components: information technology equipment (computers and related hardware) communication equipment and software (OECD, 2016). Meanwhile, investment in tangible assets such as ICTs is seen as a crucial enabler in helping companies to enhance their business productivity as well as financial performance (Noor and Apadore, 2014). Despite the significant contributions of ICT investment to global economic growth (Jorgenson and Stiroh, 2000; Oliner *et al.*, 2007) and improve firm performance (Aduda and Kingoo, 2012; Adel, 2013; Arabyat, 2014) that had been discussed in the literature review, some results of the survey revealed that the effect of ICT investment has encountered some challenges. Even though there are undoubted benefits of ICT investment in enhancing firm performance, recent ICT failure cases showed that the investment has yet to prove success.

Among the cases reported in Malaysia is the case of the Health Ministry of Malaysia which has suffered a loss of up to RM2.59 million in two ICT projects software, namely, Pharmacy Enforcement Management System (PEMS) and Pharmacy Management System (PMS) and ended its contract with the company that developed the systems due to the failure to complete the projects (Bernama, 2012). Another case is about the Malaysian Ministry of Education has fined the YTL communications about RM 2.4 million due to its failure to provide 10,000 schools with the 1 BestariNet project in 2014 (Eu, 2015). The ICT failure cases were not only found in Malaysia but the failure cases were also faced by several developed countries. For instance, through the sample of 1,471 ICT projects in the US and UK companies, it was found that the average cost overrun of projects was 27% (Flyvbjerg and Budzier, 2011). However, the researchers were more alarmed by the fact that one in 6 projects had cost overruns of 200% on average and almost 70% experienced schedule over run.

Another case of ICT project failure has been reported that the UK government has wasted more than 100 million pounds on failed or cancelled IT projects including the in house system development in the Ministry of Justice, the My Benefits Online (MyBOL) project as well as in the electronic patient records development for the North Midlands and East of England for the year 2013 and 2014. Based on the accomplishment of ICT projects conducted in the US and European firms, the CHAOS Research revealed that only 39% of the projects were successful (the ICT projects were delivered on time, on budget with require features and functions) while the remaining 43 and 18% were challenged (the ICT projects were over budget, late and did not meet the required features and functions) and failed (the projects were cancelled prior to completion or delivered and never used), respectively (SGII, 2013).

Over the years, the continuing increase in the number of ICT failure cases is a concern especially for businesses because the process of acquiring and implementing the ICT usually involve large initial capital investments (Melville *et al.*, 2004). The firms concern on the ICT investment risk which raises question on the potential outcome of the ICT investment to add value to the firms because the survival of the firms depends on firm's ability to fully utilize the ICT investment to ensure higher firm performance. This study intends to provide information about the trends, nature, importance and effect of ICT investment on firm performance. The literature analysis is used to collect the data. This study, mainly focused on a review of previous literature in the context of ICT investment. This study is significant because it explores the overall context of ICT investment studies comprise of ICT investment trends in developed

and developing countries, the nature of ICT investment in Malaysia, the importance of ICT investment for firm performance as well as the effect of ICT investment on firm performance. Given that studies on the effect of ICT investment on firm performance in Malaysia is still lacking, this study would provide some insights about the effect of ICT investment to the practitioners and academicians.

This study starts with a methods used for acquiring the literature. It then followed the review of the ICT investment trends in developed and developing countries. The nature practice of ICT investment in Malaysia is presented in the subsequent section followed by the importance and the effect of ICT investment for firm performance. The last section concludes the research.

MATERIALS AND METHODS

Methods for collecting and analyzing literature: This study is based solely on a review and analysis of research and data from the literature. Several types of resources including journals, reports, books, conference papers, working papers, dissertation databases and some internet sources were used to collect and analyze the literature. About 68 publication journals, 12 reports, 9 books, 7 conference papers, 3 working papers, 2 PhD dissertations and 6 internet sources were obtained from various types of fields such as management studies, economics, social sciences and information systems. Specifically, ICT studies were retrieved from various publication ICT/ information system journals such as MIS Quarterly, Information Systems Research, Journal of Information Systems, Communications of the ACM, Decision Support Systems, Harvard Business Review, Industrial Management and Data Systems, Journal of Computer Information Systems, Journal of Engineering and Technology Management, Journal of Organizational Computing and Electronic Commerce, Omega-the International Journal of Management Science, Technovation, Tsinghua Science and Technology and Journal of World Applied Sciences. The search for the literature review covered the years from 1987-2016 taken into account the matters including some empirical terms, previous evidences on the trends of ICT investment, the nature of its implementation specifically in Malaysia practice, its importance and effect on firm performance as well as issues regarding the recent failure of ICT investment.

RESULTS AND DISCUSSION

ICT Investment trends in developed and developing countries: Global investment in ICT assets started in the late 1990's and early 2000's. Historically, in the late

1990's, the ICT diffused rapidly and brought about tremendous impact on the global economic growth especially in the US economy (Jorgenson and Stiroh, 2000; Stiroh, 2002; Oliner and Sichel, 2001) and also influenced a number of developed countries such as Australia, Finland, Ireland and Sweden (Daveri, 2002; Jalava and Pohjola, 2002). For developing countries, only a few countries such as Malaysia, Thailand, Taiwan, Philippines and South Korea were found regarding the benefits derived from the technology revolution while others remained much backward.

Advancements in ICT caused a substantial increase in demand for ICT in the US economy. In the late 1990's, steep declines in semiconductor prices in the US led to the strongest increases in the production of computer hardware, computer software and telecommunication equipment which in turn led to the falling prices in these industries as well. During this period, falling prices of ICT products induced technology users to make an extraordinary investment in ICT, resulting in significant ICT capital deepening (O'Sullivan, 2003) that led to greater productivity growth in the US (Jorgenson *et al.*, 2005; Jorgenson, 2001; Oliner *et al.*, 2007). Previous studies found that this capital deepening attempted to accelerate productivity growth through better development and deployment of ICT investment in the US (Jorgenson *et al.*, 2005; Jorgenson, 2001; Oliner *et al.*, 2007) and also in the UK (Oulton, 2002). In other studies however, found that the productivity growth of UK economy was not performed due to lack of ICT producing industries and low levels of ICT investment activities (Daveri, 2002; Colecchia and Schreyer, 2002; Vjelselaar and Albers, 2002).

Investment in ICT between 1995 and 2000 had shown an incredible growth on the global business which was resulted from the falling price of ICT products in the late 1990's. It has been reported that ICT products were hit hardest by slumping business and demands for ICT dropped significantly during the recession on March 2001 however, it started to recover in the late 2001's and modestly further improved until 2003. During the period of 2001-2003, the US economy as the lead country in ICT spending faced difficulties to remain stable due to dramatic declined of the entire ICT development caused by economic slowdown which also left a bad impact on the economic growth across countries. In the beginning of 2005, the US economy started improving again and regaining the trust of the public and investors started investing in ICT and moved to bolster ICT investment spending in the US in 2005 (Lauden and Lauden, 2005, 2006).

However, the financial crisis period of 2007-2009 again hit the ICT development not only in the developed

countries but also in most developing countries. Although, it was difficult for ICT sector to rapidly recover during this period, many countries have learned a lot from past economic crisis to make improvement on their best practices for better continuity of their ICT development. Previous researchers have proven that the ICT sector has continued revolutionizing and evolving its investment capacity to benefit all areas. The researchers also argued that ICT sectors remained making investment in ICT even in the crisis period in order to ensure the continuity of their product innovations for sustainability in development as well as to lessen the crisis impact on their financial outcomes. Companies reduced their expenditures including ICT in order to lessen the crisis impact on the income statement and tried not to curb their revenue either they did the same or even more but with less resources (Contreras and Tormo, 2009).

In today's era of digital age, ICTs continue to evolve and develop at fast pace. Digital users are widely exposed to more advanced technology applications such as cloud or network centric, two-way broadcasting interaction and the booming phenomenon of ICT-enabled web services such as Wikipedia, Facebook, Twitter, Google Map, YouTube, etc., ICT in the 21st century is expected to be more vibrant with various sophisticated of ICT development infrastructures with an enhanced legal and regulatory environment as well as various incentives provided by the government for instance in high speed broadband internet access, 4th Generation (4G) wireless network, multimedia content development packaged software and in technological advancements pertaining to Nanotechnology, Micro-Electro-Mechanical Systems (MEMS), Semantic Technology, Wireless Communication, Grid-Computing, Biometrics and Biotechnology in order to encourage more investments and to spur the global economic development.

The nature of ICT investment in Malaysia: ICT investment activities have started since 1980s in all industrial sectors in Malaysia. However, Malaysia began to invest aggressively in ICT in 1990's particularly after the establishment of the multimedia super corridor in 1996 with the aspiration of developing Malaysia as a global hub for ICT and to become the preferred location for ICT innovations, services and operations (Murugesan, 2010). Due to the advancement of ICT development, the trends of ICT investment today has evolved to digital components to cater the demand of current technology digital consumers. Through the announcement of the Malaysia's national budget for 2016 which is tabled in parliament on 23rd October 2015, the Malaysian government has allocated about RM1.5 billion (USD230 million in current dollars) to the Ministry of

Science, Technology and Innovation (MOSTI), RM 100 million to the Malaysian Innovation Agency and RM 35 million (USD 8.2 million) will be allocated to the Malaysian Global Innovation and Creativity Centre (MAGIC) in an effort to uplift the ICT development in Malaysia as a competitive technology hub for the region (Tao, 2015). The allocation of this budget will be the first under the 11th Malaysia plan for 2016-2020 in the effort of the Malaysian government to embark the development of ICT in the current digital era so as concomitantly with the demand of today's digital-based customers.

The 11th Malaysia plan emphasizes on the development of digital content under the content and media subsector as well as software development that gives benefits not only to all citizens but also to business companies. The Malaysian government has provided various incentives in order to attract potential investors either local or international to boost the ICT investment climate in Malaysia. For example, other than various types of tax allowance incentives (e.g., Investment Tax Allowance (ITA), Reinvestment Allowance (RA), Accelerated Capital Allowance (ACA), double deduction for Research and Development (R&D), etc.) given to the investing companies, a 100% equity ownership is also given to foreign investors and they will also be eligible for 100% income tax exemption for 10 years. Besides that, the incentives (financial and non-financial support incentives) given to the Multimedia Super Corridor (MSC) Malaysia status companies, it is seen as a platform to MSC companies to improve their products and services. Looking at the various types of incentives provided by the Malaysian government to promote ICT investment in Malaysia, the National Economic Action Council (NEAC) asserted that this effort should be considered as a useful platform to enhance the national economic recovery and sustained growth.

The important of ICT investment for firm performance:

Previous studies have documented various internal and external factors that inducing companies to invest in ICT. Investment actions are influenced by some internal factors including management's commitments and supports (Seyal *et al.*, 2007; Okechi and Kepeghom, 2013), levels of experience in conducting technology (Meyer *et al.*, 2015; Thong, 2001; Alam and Mohammad Noor, 2009), the availability of ICT infrastructures in company (Chan and Ngai, 2007; Irefin *et al.*, 2012), knowledge capacity (Hollenstein, 2002) ICT capability (Liu *et al.*, 2008) and technological improvement (Southern and Tilley, 2000). Despite the influence of internal factors, companies are primarily reactive with respect to various external environmental factors such as by competitive pressure (Bayo-Moriones

and Lera-Lopez, 2007), government support (Seyal *et al.*, 2007; Zhu and Kraemer, 2005; Pan and Jang, 2008), cultural issues (Erumban and Jong, 2006; Bruque and Moyano, 2007), key suppliers (Quayle, 2002) as well as external ICT consultant and vendors (Zhu and Kraemer, 2005; Pan and Jang, 2008; oulton, 2002). It is undeniable fact that ICT can bring benefits to companies. ICT is seen more as a support function rather than a strategic tool (Willcocks and Lester, 1996) that can help companies to streamline and optimize their business processes (Kvochko, 2013) as well as to increase their business productivity (Premkumar, 2003). Some researchers stressed that the ICT investment made is intended for the purpose of business operational improvement as an effort to reduce costs (Irefin *et al.*, 2012; Okechi and Kepeghom, 2013; Hollenstein, 2002) and increase profitability of the company (Hollenstein, 2002; Heine *et al.*, 2003; Gunasekaran *et al.*, 2001). Recent studies have shown that investment in ICT has led companies to better performance either in terms of their profitability (Jorgenson and Stiroh, 2000; Hung *et al.*, 2012; Leckey *et al.*, 2011; Makinde, 2014; Bagheri *et al.*, 2012; Shin, 2006; Jun, 2008; Arabyat, 2014; Zehir *et al.*, 2010; Liang *et al.*, 2010), productivity (Liang *et al.*, 2010), efficiency (Romdhane, 2013; Liang *et al.*, 2010; Safari and Yu, 2014) and innovation (Spyros and Euripidis, 2014; Jesudasan *et al.*, 2013).

Besides that, ICT investment through the acquisition of ICT equipment also helps companies to increase their competitive advantage (Premkumar and Roberts, 1999; Premkumar, 2003 Apulu and Latham, 2011; Voudouris *et al.*, 2012). Competitive advantage is defined as a company's ability to provide customer with greater value through lower prices and capture greater services to justify higher prices (Porter, 1990). It is argued that the need for ICT investment for companies not only for their sustainable advantage but also to improve their business operations to function more efficiently that would lead to persistent growth (Apu and Latham, 2011). However, some studies argued that depending solely on ICT is not enough to cater for the sustainable advantage unless its implementation is complemented by other strategic business resources (Chukwunonso *et al.*, 2011). As the acquisition of ICTs needs a huge amount of investment (Melville *et al.*, 2004) it is important for companies to ensure that all decisions made for ICT including its direction, strategy and investment is successfully governed so as to align with their strategic direction (Zhang and Chulkov, 2008).

The effect of ICT investment on firm performance: The transformation of ICT today has penetrated to the digital

transformation and brings a tremendous impact on every facet of human life. Due to the current digital penetration of ICT today, it is argued that four key trends of ICT such as big data analytics, cloud computing, mobile device usage and social media are believed to bring changes to today's company business operations and in turn, contribute to economic growth of a country (Hai, 2013). Thus, it is not surprising if many business organizations have spent huge amounts of money on their ICT investment to enhance their operational system (Noor and Apadore, 2014) to fulfill demand for ICT products and services which may stimulate economic growth of a country (Carlo and Santarelli, 2010). In Malaysia, previous studies have been conducted to investigate the effect of ICT investment on various contexts. For example, some researchers (Kuppusamy and Santhapparaj, 2005; Kuppusamy and Shanmugam, 2007; Kuppusamy *et al.*, 2009) found that the ICT has had positive impact on Malaysia's economic growth. In another study, some researchers found positive but weak relationship between ICT related trainings and ICT investment in the Malaysian technology-based companies (Noor and Apadore, 2014). There were many previous studies have been conducted to investigate the effect of ICT investment on firm performance however, in the Malaysian context, it remains unexplored thus far. Therefore, results from previous studies would provide better insight into how the ICT investment can affect the performance of companies in Malaysia.

Previous studies have shown that ICT investment does not only positively affect the country's economic growth (Jorgenson and Stiroh, 2000; Jorgenson *et al.*, 2005; Jorgenson, 2001; Daveri, 2002; Aduda and Kingoo, 2012; Stiroh, 2002; Oliner and Sichel, 2001; Oliner *et al.*, 2001) but also increases performance at the firm-level (Aduda and Kingoo, 2012; Adel, 2013; Liu and Farrell, 2014; Hung *et al.*, 2012; Brynjolfsson and Hitt, 1993, 2003, 1996; Leckey *et al.*, 2011; Makinde, 2014; Dandago and Usman, 2012; Anderson *et al.*, 2003; Bagheri *et al.*, 2012). Some studies found to be positive but weak effect (Gaith *et al.*, 2008). Although, the contribution of ICT is acknowledged as one of the important determinants to the firm performance (Voudouris *et al.*, 2012; Porter, 1990; Zhang and Chulkov, 2008; Hai, 2013; Carlo and Santarelli, 2010; Kuppusamy and Santhapparaj, 2005; Kuppusamy and Shanmugam, 2007; Kuppusamy *et al.*, 2009; Gaith *et al.*, 2008; Halkos and Tzeremes, 2007; Yildiz *et al.*, 2013; Shiamwama *et al.*, 2014) and proved positive effect of ICT investment on firm performance, the phenomenon of ICT productivity paradox still persist. The phenomenon of ICT productivity paradox refers to the failure of achieving good payoff from ICT investment made due to the

weaknesses of ICT management (Solow, 1987) while in other context of studies, IT productivity paradox occurs due to several causes such as measurement error, lags, redistribution and mismanagement (Solow, 1987; Brynjolfsson, 1993). There were evidences of a so-called ICT paradox that did not show any effect (Nkama, 2007; Ekata, 2011; Mahmood and Mann, 1993, 2005), negative (Francalanci and Galal, 1998; Ugwuanyi and Ugwuanyi, 2013) as well as inconsistent effect (Zehir *et al.*, 2010; Liang *et al.*, 2010; Safari and Yu, 2014; Spyros and Euripidis, 2014; Jesudasan, 2013; Apulu and Latham, 2011; Byrd and Marshall, 1997) ICT investment on firm performance.

Basically, previous studies examining the effect of ICT investment on firm performance has been widely viewed through different types of industries as well as various methods of measurement with mixed findings because the nature of ICT usage varies among industries. Besides that, the main issue is whether the ICT investment has resulted in significant productivity gains or not. There are several explanations why ICT has not shown measurably improved productivity and led to the ICT productivity paradox (Brynjolfsson, 1993) measurement errors which refer to improperly measured of outputs and inputs by non-traditional evaluation approaches; an ignorance of time lag effect while measuring the effect of ICT investment on productivity or firm performance because it took some time (several days to several months or even years, depending on the size and complexity of ICT implementation) before benefits of IT investment materialize (Devaraj and Kohli, 2002) redistribution refers to different distribution of ICT benefits, it may be beneficial to individual firms but do not contribute to the total output of an industry or the economy as a whole; and mismanagement use of ICT due to several reasons such as conflict of interest at top decision makers, political interests and poor corporate governance of ICT, lead to failure to realize efficiency gains from ICT investment.

CONCLUSION

The rapid pace of ICT has transformed the overall business processes and operations in a manner that brings tremendous value to the financial landscape. The available evidence from previous literatures has shown that ICT investment is seen as an added value that can enhance the effectiveness of firm performance. Although, studies on the effect of ICT investment are found lacking in the context of Malaysia practice, its significant contributions to firm financial performance is undeniable and would encourage firms to invest in ICT in order to

keep pace with the latest advancement of ICT offered in today's global market. Business firms must seize this opportunity to maximize the benefits of ICT investments in order to enhance firm performance.

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