



THE DYNAMIC EFFECT OF IT INFRASTRUCTURE FLEXIBILITY ON THE
SUSTAINABLE COMPETITIVE ADVANTAGE OF MALAYSIAN SMES IN THE
FURNITURE INDUSTRY

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Abstract

The aim of this paper is to examine the relationship between the critical role of IT Infrastructure flexibility (ITIF) as an enabler strategic resources and sustainable competitive advantage (SCA) among Malaysian small and medium enterprise in the furniture industry. For this reason, this paper seeks to address the research problem about the issue of sustainability advantages due to the insufficient flexibility of furniture firms IT infrastructure flexibility. Previous IT studies show little evidence about the relationship between sustainable competitive advantage and ITIF particularly within low-tech firms. Thus, this study found that IT infrastructure flexibility plays a strategic role in the sustainability of business advantages such as strengthen the transaction speed between firms and their suppliers and customers, close communications, linking business units, effective information flow, updating and re-engineering business processes and operations. Therefore, analyzing which factors (i.e., connectivity, compatibility, modularity) that are strategically contribute to the firm's sustainable competitive advantage could have a great theoretical significance and critical practical value for assisting furniture firms to effectively deploy valuable IT-intangible resources to generate and keep their advantages among their rivals for a long term. In addition, this study is the first conceptual paper that addressing the effect of IT infrastructure flexibility as an enabler factor for sustainable competitive advantage among low-tech industries which has been ignored in the previous studies.

Keywords: IT infrastructure flexibility, Sustainable competitive advantage, SMEs, Furniture industry.



I. INTRODUCTION

In the turbulent environments, firms are regarded flexibility as a critical competitive weapon and appeared as one of the most key strategic element in many modern organizations activities within operational, functional, technological and managerial aspects (Carrasco-Hernández & Jiménez-Jiménez, 2017; Schulze & Heidenreich, 2017). Scholar Pérez Pérez, Serrano Bedia, and López Fernández (2016) in management studies defined flexibility as the extent of the firm's ability to control a variety of existing and potential procedures in order to implement these procedures in accurate time and more quickly allowing them to improve the control capacity of the management and enhance the overall capability of the corporation over its environment. Flexibility, therefore, offers a corporation the capability to control both inside and outside environments more efficiently. Hence, firms that well-control and sense their competitive environments it can acquire the powerful competitive position (Brozovic, 2016).

Several researchers have viewed flexibility as one of the corporation abilities that possess considerable influence on the quickness to act or respond to outsider threats (Tiwana & Konsynski, 2010). Hence, flexibility allows firms to quick its decisions actions effectively. Actually, if IT system of the corporation is inflexible, firms it can be faster to reconfigure it along with business changes but with considerable cost to do so. To note, flexibility and agility are two distinct constructs. Flexibility is concerning malleability and the capability to assist firms to respond quickly to change requests and economically is a key antecedent of agility within a business context (Dreyer & Grønhaug, 2004). Whereas agility is regarded as the quickness to sense and detect or the ability of the responsiveness for emerging opportunities or hidden threats (Tiwana & Konsynski, 2010).

The reasons behind the importance of the flexibility is that because of its supporting and ensuring a corporation to survive and grow in a dynamic environment. Moreover, firms might need strategic flexibility to face unpredictable changes in customers' needs and expectations, rivals actions. In addition, the fundamental role of flexibility is to promote firms to reconfigure and combine its resources in line with responding and adapting with faster turbulent changes (Zhou & Wu, 2010). Researchers Duncan (1995); Byrd and Turner (2001) defined IT infrastructure as a set of shared IT resources that are a grounds of a corporation to enable communication within firms hierarchy and along with empowering the existing and future business applications. Which not only consist the technological components but also includes human resources (Chanopas, Krairit, & Ba Khang, 2006; Duncan, 1995). IT infrastructure flexibility refers the extent of the corporation IT resources are malleable (Duncan 1995).

Therefore, IT infrastructure flexibility is the capability to readily and simply support various of software and hardware of the corporation as well as facilitating communication technologies, in order to promote easily flow of information within the firm's inside-outside, also assist the development and the implementation of a heterogeneity of business applications. Duncan (1995) she is the first scholar who identified IT infrastructure flexibility dimensions as three main building blocks that are connectivity, compatibility, and modularity where several researchers they agreed with her classifications as the main foundation of ITIF and thus became the most well-known model that was applied by the most subsequent studies (Byrd & Turner, 2001b; X. Chen & Siau, 2011; Lim & Trimi, 2014).



In fact, researchers in IT field have examined IT infrastructure flexibility as an independent variable Broadbent, Weill, and St. Clair (1999); Byrd and Turner (2001a); Chung, Rainer Jr, and Lewis (2003); Tiwana and Konsynski (2010); Lim and Trimi (2014) and as a moderator variable (Lin & Bush, 2010; Tallon & Pinsonneault, 2011). Yet, no published work has been investigated the direct relationship between IT infrastructure flexibility and sustainable competitive advantage. Thus, this study filling the gap emerged in the literature and hence contributing to the body of knowledge through providing significance evidence about the role of IT flexibility and how to influence the firms to create SCA. However, this study is important because it is the first empirical study that would investigate the critical role between IT infrastructure as an enabler source of the firms towards facilitating the integration of the three building blocks that are resources, capabilities, and competencies to generate SCA. Therefore, IT infrastructure flexibility has a strategic effect on the firms SCA. This study emphasizes that IT infrastructure flexibility is an enabling and contributing factor to the supporting of SCA.

II. THE REASONS BEHIND STUDYING IT INFRASTRUCTURE FLEXIBILITY (ITIF)

The first researcher who demonstrated the important role of IT infrastructure was McKay and Brockway (1989) as enabling sources that facilitate the shared IT potential where the entire firm rely on. It is debated that IT infrastructure must be flexible in order to qualify firms to face the increasing demands of customers without growing costs (Weill, 1993). The author Davenport and Linder (1994) indicates that flexibility of IT infrastructure must be regarded as a firm core competency, advocating that the better infrastructure is evaluated by its flexibility and usefulness to empower change. In addition, several empirical studies McAfee and Brynjolfsson (2008); Reddy (2006); Tallon and Pinsonneault (2011) have acknowledged that flexibility of IT infrastructure as the top concern among all IT management issues. Some authors have debated persuasively that flexibility of IT infrastructure is a critical strategic weapon, and have stressed that it is the leading source of sustained competitive advantage (Davenport & Linder, 1994; Kettinger, Grover, Guha, & Segars, 1994; Lim & Trimi, 2014).

IT infrastructure that contains hardware and software, computers, data, integrated and interconnected telecommunications is the main prerequisite for doing business globally where the sharing and transmitting of information and knowledge everywhere will allow firms to know its customer preferences and understanding markets needs and thereby facilitate them to enter and join international markets (Rockart, Earl, & Ross, 1996). Prior studies Sambamurthy, Bharadwaj, and Grover (2003); Tiwana and Konsynski (2010); Bush, Tiwana, and Rai (2010) have had shown that flexibility of IT infrastructure is a key factor for firms SCA. More importantly, based on RBV theory two main reasons can be justified for the relationship between ITIF and SCA. First, according to the RBV definition of "resources": ITIF can be a major source and resources since able to reduce a minimum operations costs, products quality, and its design, timely delivery, which resulting in establishing and maintaining competitive advantage over rivals (Gebauer & Schober, 2006; Palanisamy & Sushil, 2003; Rackoff, Wiseman, & Ullrich, 1985).



Second, RBV concentrates on how a corporation would attain diversification through effectively keeping the balance between exploitation of existing resources and the exploration of a new one (Lim, 2014). In our research flexibility of IT infrastructure leads to strengthening internal capabilities for flexible operations of furniture firms as well as assisting the dynamic formulation of value networks across the firm's hierarchy. Operationally speaking, flexible IT infrastructure provides firms the abilities to control and adapt to challenges, in line with its internal and external environments changes, where empowering a corporation to respond and control its operations under a variety of changes (Byrd & Turner, 2001a; Y. Chen, Wang, Nevo, Benitez, & Kou, 2015).

Therefore, ITIF is the ability to accommodate changes in IT and business. In the furniture industry, an organization that has established a flexible IT infrastructure should be adaptable to changes and satisfy the business needs more efficiently and effectively. Prior studies as aforementioned examined ITIF by evaluating it across industries and none has ever tried to address the ITIF focusing on furniture industry sector, thus, the understanding of ITIF in furniture industry so far poorly comprehend. This represents the first theoretical gap in the extant literature. So, the current study seeks for further deep understanding on the critical role of ITIF towards the success of IT resources and its capabilities in furniture industry considering that it has several specific attributes which distinguish it from other industries. Hence, the current study will complement existing research. Critically, based on the number of authors that examined dimensions to measure flexible IT infrastructure, yet there is no study known to the researchers that addressed the dimensions of flexible IT infrastructure particularly within the furniture industry. However, understanding this crucial issue is more important for both professionals and researchers because of it offers information about each dimension of flexible IT infrastructure for the future development of an ITIF maturity model.

III. THE DYNAMIC EFFECT OF IT INFRASTRUCTURE FLEXIBILITY ON SUSTAINABLE COMPETITIVE ADVANTAGE

Even though the flexibility of IT is treated by scholars as a desirable source for an organization, IT flexibility does not give equally the same advantages for all firms (Gebauer & Lee, 2008). Actually, the sizes of the firms play a considerable role in the attractiveness of IT flexibility (Ness, 2005). Large firms that have a variety of products possess sophisticated hardware and software components better than SMEs (Levy & Powell, 1998). In fact, a flexibility of information technology is more needed in turbulent business environments (McAfee & Brynjolfsson, 2008). Empirical studies indicate that sustainable competitive advantage and growth highly depend on the flexibility of IT infrastructure because it supports firms to create and develop new initiatives faster (Bhatt, 2000; Murray & Lynn, 1997). On the contrary, inflexible IT infrastructure is the difficulty that faces developers with user demands that require IT for doing such things which it was not designed to do (Duncan, 1995). So, an infrastructure that does not help to strengthen internal business processes will result in losing considerable advantages which impeding the interaction of internal resources and capabilities (Robertson & Sribar, 2002).



In SMEs context, early studies such as Levy and Powell (1998) mentioned that IT flexibility is not necessary for SMEs because it deals with few customers and produces very few products. Also, Frazis, Herz, and Horrigan (1995) stated that SMEs not required to possess IT flexibility because cope with stable products and customers compare large firms. Whereas, other authors Ness (2005) and Terry Anthony Byrd (2000) mentioned that flexible IT infrastructure is suitable only for large firms rather than SMEs. A study by Tallon (2008) demonstrated that SMEs that provides very specific products rely on their capabilities to generate unique and valuable products based on customers preferences which in turn lead to create and sustain a close loyalty. Also, he stated that SMEs operate in turbulent environments so need for diversification strategy which required them to possess strong flexible IT infrastructure. While large firms deal with heterogeneous customer and products mix, so need also for a heterogeneous mix of hardware and software, therefore, ITIF is more beneficial in large firms rather than SMEs (Syler, Cegielski, & Byrd, 2002). In addition, he stated that SMEs tend to have a homogeneous mix of customers and products, as well as hardware and software, hence IT flexibility becomes less important in their daily operations. An empirical investigation McAfee and Brynjolfsson (2008) examined the competitive nature of the firms during the 1990s found that those firms who were able to support their IT infrastructure are effectively performed its daily operations than those who could not.

Another study Tallon and Pinsonneault (2011) found that IT flexibility play a significant role in improving firms performance that operating in volatile business environments. He mentioned that IT flexibility is a strategic resource for firms that operate in the highly dynamic environment. A study by Reddy (2006) viewed three types of IT flexibility that is (1) flexibility to quickly develop new products, (2) flexibility to adjust value chain relationships, (3) flexibility to integrate operations, where the author stressed on the role of IT flexibility in the strengthening internal firm's capabilities in order to respond accurately to business needs and changes. Technically, an organization may purchase a smaller sized piece of IT equipment which consists the capability to add processing power as well as could be used later on when needed in the future. Chung, Byrd, Lewis, and Ford (2005) clarified that firms are benefiting well from IT flexibility once they are dealing with highly personalized products in order to respond and meet with individual needs of its loyal customers. In addition, they found that IT flexibility significantly affect internal capabilities of the firm in order to provide its customers with highly personalized products in two ways. First, IT flexibility support the firm's capabilities to access a more heterogeneous customer mix. Second is that IT flexibility helps firms to adapt to both business needs and customer expectations. Findings by Reddy (2006) indicate that lack of IT flexibility impedes corporation capability to integrate business processes, hence influencing their performance relative to their rivals. An examination by Lim, (2014) of the effect of flexible IT infrastructure on four dimensions of competitive advantage among USA-SMEs indicating that ITIF positively influence all the dimensions that are the (1) quality of products, (2) fast and reliable delivery, (3) production costs, (4) flexibility of products design. Also, the study confirmed that ITIF improves the flexibility of product design, and enhancing the quality of products. Furthermore, the reasons for investigating the critical role of IT flexibility is that most of the previous assumptions might not be suitable anymore due to the fast-changing of the IT applications. Nowadays, there have been deep changes particularly in



terms of IT infrastructure in all related areas with the firm's hierarchy, thus, IT infrastructure assist the corporation in many ways such as re-engineering of business processes, diversification of products/services, inter-firms relationships, supply chain with suppliers and customers, to name a few.

IV. FLEXIBILITY OF IT INFRASTRUCTURE DIMENSIONS AND ITS EFFECT ON SUSTAINABLE COMPETITIVE ADVANTAGE (SCA)

Duncan (1995) viewed IT infrastructure flexibility as an enabler of strategic innovation. She proposed three dimensions of IT infrastructure flexibility that is connectivity, modularity, and compatibility as the most components of ITIF. Now, IT systems involve on complex networks and multiple access points and servers, consisting of thousands of computing devices and software components (Raad, Chbeir, & Dipanda, 2010). Due to e-commerce revolution, IT changes rapidly. The top managers have begun to conscious about how should they manage IT infrastructure to reach the planned business goals in future under turbulent business environments and in line with the existing technological changes (Alam & Noor, 2009; Issa-Salwe, Ahmed, Aloufi, & Kabir, 2010).

4.1 Connectivity (Network) Definitions and its Effects on Sustainability Advantages

Byrd & Turner, (2000) defined connectivity as the capability to connect one technical hardware or software component to another technical hardware or software component. Zhang, Li, and Ziegelmayer (2009) viewed connectivity as the capacity of users to connect with hardware and software systems. Also, can say the customer's ability to connect with systems wherever and whenever they want. Duncan (1995) demonstrated that connectivity is a crucial source contributing to IT flexibility because it provides the IT infrastructure to expand its scope of capacities by attaching together software and hardware components. The critical role of linking these a variety of software and hardware with each other is that assist the corporation to generate more value added rather than the overall of its individual parts. A study by Zhang et al. (2009) explored a relationship between the three dimensions of ITIF, which indicating that connectivity has an indirect effect on the overall ITIF. While modularity which is assisted by connectivity has a direct effect on ITIF. Both direct and indirect relationships of ITIF is present a holistic picture regarding the three dimensions contributing to ITIF.

Therefore, technological connectivity is the ability of IT systems to provide corporations with communications, coordination among all its business units as well as linking them to the outside. However, electronic connectivity is valuable capabilities that help firms in different ways namely: effective support of decisions making, managing and coordinating data storage, facilitating communications within a firm hierarchy, which in turn improving IT effectiveness and support business productivity. Another empirical study Scheel (2005) emphasized that an appropriate IT infrastructure connectivity could able to create business value through empowering IT resources, by integrating and linking various internal core business activities within the corporation itself and its relationships with external stakeholders. Moreover, firms that deploying adequate technologies and with a suitable connectivity could allow them to use



and can access to useful information for a business strategy purpose, which would result in creating a competitive advantage.

Hypothesis 1: Connectivity has a significant influence on the sustainable competitive advantage.

4.2 Modularity (Software)

Duncan (1995) she defined modularity as the capability to add, remove, or modify any hardware or software component without any negative effect on the overall infrastructure. While Byrd & Turner, (2000) defined modularity as the absorbing ability of IT infrastructure to integrate new hardware and software. The definition provided by both above scholars examined what a modular IT infrastructure can do, but not necessarily what a modular IT infrastructure is. Based on her examination of the relationship between connectivity, compatibility, and modularity Zhang et al. (2009) found that both connectivity and compatibility are positively associated with modularity. While Byrd and Turner (2000) he didn't establish any relationship between the three elements of ITIF. The critical role of modularity is that allows hardware and software components as well as business processes to be changed easily and adapting with business needs in the accurate time (Zhang et al. 2009). Also, she suggests that one way to support IT flexibility is that through assisting the modularity of their hardware and software. Duncan (1995) mentioned that modularity is the integration of all the business operations to become as a single process in order to provide a corporation with a great flexibility in terms of reusability and shareability of routine systems, planning system, and structured programmes within the whole business units. The changes in the product's features during the production process probably require a software program to be changed as well.

The practical implications of modularity within IT infrastructure is that provides corporations with the ability to respond in line with the changes in business needs, customer preferences, and all related stakeholders. Therefore, firms are significantly required for better adaptation in terms of deleting, adding, modifying its hardware and software components for well establishing IT infrastructure (Byrd & Turner, 2001a).

This capability of high modularity allows firms to decrease on the misunderstanding between IT infrastructure and business changes that are prerequisite to meet with competitive challenges in the marketplace. An empirical investigation by Byrd and Turner (2001) stated that modularity positively influences other IT-based resources which integrated and lead to create VRIN resources that are the main road of SCA. Seltzer (2005) demonstrates that modularity of IT infrastructure is a strong strategic source for managing core business activities, also assisting the interaction between applications and data management capabilities.

Hypothesis 2: Modularity has a significant influence on the sustainable competitive advantage.

4.3 Compatibility (Hardware)

Byrd & Turner, (2000) compatibility is the capability to share all kinds of information over all kinds of hardware and software. Zhang et al. (2009) stated that in order to share that information across all kinds of hardware and software, that hardware and software should be linked together in some way. Actually, a study by Duncan (1995) disclosed a relationship between compatibility and connectivity indicating that compatibility is more needed for



valuable IT infrastructure because it is necessary to connectivity. She also notes, hardware and software that are not suitable and not compatible with each other can't be simply connected without some type of specialized adapter or bridge. Based on the relationship chain from compatibility to connectivity to modularity makes compatibility a basis element of IT infrastructure (Byrd & Turner, 2000). He also mentioned that compatibility is positively related IT flexibility. In addition, the study discovered that compatibility and connectivity could be integrated into a single element, which author Zhang et al. (2009) agreed and found the same results with (Byrd et al., 2000).

Singh, Lai, and Cheng (2007) observed that incompatibility of IT infrastructure could negatively affect inter-firms information sharing and communication, where ultimately negatively affecting IT effectiveness. Tallon (2008) indicate that IT compatibility has a positive effect on business and value creation when firms are deploying and adopting it. Thus, existing IT compatibility along with future IT systems would be strategically and operationally more crucial. To conclude, the three dimensions of IT infrastructure flexibility are positively related. Also, both compatibility and connectivity positively contribute to modularity. All the elements are related positivity to IT flexibility either directly or indirectly. In addition, hardware contributes to network and network contribute to software.

Hypothesis 3: Compatibility has a significant influence on the sustainable competitive advantage.

Hypothesis 4: IT infrastructure flexibility has a significant positive influence on the sustainable competitive advantage.

V. RESEARCH MODEL

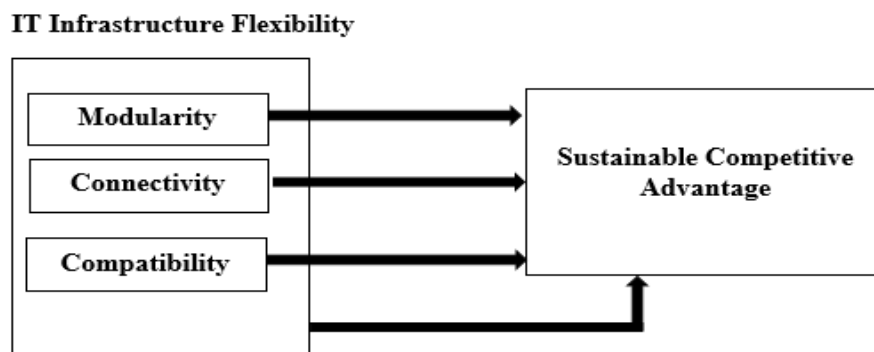


Figure 1. Research Model: IT Infrastructure Flexibility in the Low-Tech Industry

VI. CONCLUSION

This study provides significant evidence in the field of IT studies about the critical role of those strategic resources that have a great positive effect on the business operations such as IT



infrastructure flexibility where firms ability to generate and sustain their advantages highly depends on the flexibility of its IT infrastructure and thereby lead to strengthening internal resources. In addition, the study explains how these intangible IT resources influence firms in different aspects and levels which in turn support and integrate with other organizational resources that could be lead to generate valuable, rare, imitable, non-substitutable resources, hence suit the Barney (1991) VRIN attributes who is the founder scholar of resource-based view. The study proposes a direct relationship between IT infrastructure (connectivity, modularity, compatibility) as a strategic resource to support a firm's sustainable competitive advantage in a strategic context.

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