CRITICAL FACTORS OF INFORMATION TECHNOLOGY INFRASTRUCTURE QUALITY FOR ENHANCING ENVIRONMENTAL COMPETENCIES OF THE INDONESIAN ORGANIZATIONS

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Abstract: *Information technology (IT) can be adopted as a capability of organizations to improve its environmental performance. The purpose of this research is to develop IT infrastructure quality model and its environmental competencies of IT in order to improve its environmental performance. The model is developed based on the resource-based view as theoretical foundation and related literature including green IT. The validity of the model is tested using structural equation modelling based on data collected from the Indonesian ICT industry. Findings show that the IT infrastructure quality is critical abilities of an organisation used for developing environmental competencies of IT. It also indicates that the environmental competencies of organisations are positively associated with IT infrastructure quality. A new model of IT infrastructure quality constitutes an original contribution to the information system literature especially in an area the relationship between IT infrastructure quality and environmental performance.*

Keywords: *IT Capability, Environmental Performance, IT Infrastructure, IT Human Resources, and Green IT.*

Abstrak: *Teknologi informasi (IT) dapat diadopsi sebagai kemampuan organisasi untuk meningkatkan kinerja lingkungan dalam rangka memenuhi peraturan lingkungan, meningkatkan profitabilitas, dan meningkatkan posisi kompetitif di pasar. Tujuan dari penelitian ini untuk mengembangkan kualitas infrastruktur IT model, untuk mengembangkan kompetensi lingkungan TI dalam rangka meningkatkan kinerja lingkungannya. Model ini dikembangkan berdasarkan Resources Based View sebagai landasan teoritis dan penelitian terdahulu termasuk IT hijau. Validitas model ini diuji menggunakan structural equation modelling berdasarkan data yang dikumpulkan dari industri ICT Indonesia. Temuan menunjukkan bahwa kualitas infrastruktur TI adalah kemampuan penting dari suatu organisasi yang digunakan untuk mengembangkan perfoma lingkungan TI. Hal ini juga menunjukkan bahwa kompetensi lingkungan organisasi secara positif berhubungan dengan kualitas infrastruktur TI. Sebuah model baru dari kualitas infrastruktur TI merupakan kontribusi asli untuk literatur sistem informasi terutama di daerah hubungan antara kualitas infrastruktur TI dan kinerja lingkungan.*

Kata Kunci*: Kemampuan IT, Performa Lingkungan, Infrastruktur IT, SDM IT, dan IT Hijau.*

1. INTRODUCTION

The contribution of information technology (IT) to business operations and innovations by transforming business practices in order to create new business opportunities have been recognised (Molla, A. 2008). One of the contributions of IT is to help organisations to make their business operations more environmentally friendly (Adela, Marie-Claude & Richard 2008). For example, the organisations can improve the environmental performance through automating, transforming and informating IT including information system (IS) in business processes. Thus, an effective improvement of their environmental performance has a significant impact on organisations to improve organisational profitability, provide organisations with business opportunities, improve the competitive position of organisation in the market place, and meet the

government environmental regulations and the business international standard.

The development of environmental organisational competence is one of approaches that can assist organisations to improve their environmental performance. It can be defined as the ability of an organisation in effectively and efficiently using their IT resources for improving environmental performance in business operations. The environmental competence of organisations can be established by adopting the IT infrastructure quality. For example, Philipson (2010) shows that organizations can use server and storage virtualisation as IT infrastructure to significantly reduce the carbon dioxide from their business operations. Sayeed and Gill (2008) argue that environmental competence of an organisation can be improved by effectively adopting data centres. Therefore, unsurprisingly, many organisations have started to adopt the IT infrastructure quality as environmental capabilities of organisations facilitating the effectively developing environmental competencies.

IT infrastructure quality is about the foundation of IT resources that can be used for sharing capabilities and services in order to support business operations in organisations. It can be approached from different perspectives. The concept of IT infrastructure quality can be determined from many perspectives. Duncan (1995) posits a flexibility approach to the use of IT infrastructure in organisations, which is associated with the alignment of IT and business objectives, business design and IT plans, and the skill of IT human resources. Liu (2002) further supports the notion that IT infrastructure is a service ability of organisations used to enhance the efficiency and effectiveness of business operations. Harmon and Auseklis (2009) utilise the "green computing" approach to integrate power management, virtualisation, recycling, electric waste disposal and optimisation of IT infrastructure, in order to decrease the impact of business operations on the environment. Similarly, Molla, A., Cooper and Pittayachawan (2009) involve "green capabilities" to encompass the IT and communication resources of an organisation, along with the shared services and business applications. These studies show that the use of IT infrastructure can develop environmental competence of an organisation. Therefore, this study considers the role of serviceability, flexibility and greenness ability of IT infrastructure quality that can help organisations to develop their competence of environmental in business operations.

This paper aims to identify the critical factor for evaluating the IT infrastructure quality in developing the environmental competence of organisations from the perspective of the serviceability, flexibility and greenness ability. A conceptual framework is hypothesised based on the serviceability, flexibility and greenness ability of IT infrastructure quality for improving environmental competence of organisations. The proposed framework is validated and examined with the survey data collected in the Indonesian ICT organisations using structural equation modelling (SEM). The study reveals that adoption of server, storage, and desktop virtualisation are the critical factors for improving environmental competence of the Indonesian ICT organisations.

In what follows, this study is started to review the existing studies related with respect to the IT infrastructure quality and environmental competence of organisations. Furthermore, it will propose the Resources Based View (RBV) theory as a lens to better understanding how the role of IT infrastructure quality can be leveraged in improving environmental competence of organisations. We then provide the research methodology followed by comprehensive analysis of data collected, leading to the validation and testing of the proposed framework. Finally, the discussion of the research finding and their implications are discussed in last section.

2. RESEARCH METHOD

2.1 Environmental Competence of IT

Environmental issues are now influencing businesses' competitive landscapes in new ways. Organisations with the IT and vision to provide products and services that address environmental issues will achieve a competitive edge. One reason is that when making decisions about purchasing, leasing or outsourcing, many customers now take into account the environmental initiatives of the provider of products or services (Murugesan, San 2008). Therefore, organisations need to consider using IT to develop and improve their environmental competence.

To develop their environmental IT competence, organisations have to consider their ecological competence in business operations to improve environmental performance. This is because environmental IT competence is being used as a new source of strategic advantage, value differentiation and intangible brand value (Molla, A et al. 2012; Porter 2006). Furthermore, this competence can facilitate organisations in meeting government laws and regulations (Adela, Marie-Claude & Richard 2008) and international environmental requirements (Zhu, Q., Sarkis & Lai 2007). Therefore, environmental IT competence has emerged as an important new archetype for organisations to achieve profits and market share objectives by lowering their environmental risks and impacts while improving their environmental performance (Remko 1999; Zhu, Q., Sarkis & Lai 2007).

Numerous studies have attempted to explain environmental IT competence in order to improve the environmental performance of an organisation. For example, Hart (1995) investigates the environmental competence of an organisation based on RBV theory, which can be accomplished through pollution prevention, resources stewardship and sustainability vision. Pollution prevention focuses on the control and prevention of pollution emissions and effluents during business activities. Resources stewardship refers to an organisation's ability to evaluate the environmental impacts of its resources and main business activities. Sustainability vision aims to change human behaviour to more sustainable options (Hart 1995; Hart & Milstein 2003).

Molla, A et al. (2012) provide an ecological IT competence model drawn from Hart's (1995) environmental competence and

previous studies of green IS and green IT. The study identifies three components of environmental competence that can be enhanced by IT. The first environmental IT competence is emission management, defined as the ability of an organisation to manage its emissions in business operations through implementing its environmental vision, goals and policies. Resource stewardship as the second competence refers to the ability of an organisation to re-use IT resources to improve its efficiency in business operations. The last competence is sustainability behaviour, which refers to building behavioural values that encourage the employees of an organisation to consider environmental issues in their business operations.

A recent study by Antoni and Jie (2013) involves the IT capabilities used for developing the environmental competence of organisations. This study develops an ecological competence model based on previous studies of green IT and environmental performance. The most interesting findings show that organisations are enabled to develop their environmental competence through the use of IT infrastructure quality to delivery sustainable value to relevant stakeholders and improve environmental performance. For example, the adoption of IT equipment made from hazardous materials can help organisations to meet government regulations in order to improve their environmental performance, including environmental reputation.

Based on the studies above, this current study attempts to measure environmental IT competence through sustainability behaviour. Sustainability behaviour refers to building behavioural values that encourage employees to consider environmental issues in their business operations. The use of IT infrastructure quality can help organisations to develop sustainability in order to enhance environmental performance, because it can deliver information that relates to environmentally friendly work practices (Adela, Marie-Claude & Richard 2008).

Table 1. Summary of Environmental Competence of Organisation Items

Constructs	Items	References
Sustainability Behaviour (SB)	SB01:Deliver information that relates to environmentally friendly work practices in an organization	Cooper and Molla (2012)
	SB02:Build the commitment of employees to environmentally friendly work practices in an organization	
	SB03:Promote the choices of environmentally sustainable course of actions	
	SB04:Educate the employees' behaviour reducing the energy consumption	
	SB05:Change the employees' behaviour to environmentally friendly work practices in an organization	

In addition, York et al. (2009) argue that the use of IT infrastructure quality can help an organisation to promote the choice of environmentally sustainable courses of action by their employees. Molla, A., Cooper and Pittayachawan (2009) argue that eBay uses its market portal and other Web 2.0 technology to empower its internal green team, which helps concerned buyers to evaluate and select 'green'

merchants. From this perspective, it has been shown that the sustainability behaviour of an organisation can be developed by using IT Infrastructure quality, including IS, to reduce the impact of business operations on the environment.

2.2 Resources Based View Theory

Resource-based view (RBV) theory has emerged in recent years as a popular theory of competitive advantage. This theory, developed by Wernerfelt (1984), asserts that organisations can gain and sustain competitive advantage by developing and deploying valuable resources and capabilities. Capabilities are complex bundles of skills and accumulated knowledge, exercised through organisational business processes, which enable organisations to control activities and to make good use of their assets (Day 1994). Bharadwaj (2000) argues that capabilities are the organisational abilities that are created by the interaction among organisational resources in an organisation. Hafeez, Zhang and Malak (2002) define capability as the combination ability of an organisation which is obtained from its resources that enables it to perform several business processes or activities in order to achieve competitive advantage. De Bakker and Nijhof (2002) argue that the capabilities of an organisation can be derived from collaboration with other organisations in regard to resources and capabilities that are not present in the organisation, in order to achieve competitive advantage. Therefore, the main objective of RBV is to identify the resources and capabilities required by an organisation to obtain competitive advantage.

RBV highlights the importance of resources and capabilities that are valuable, rare, inimitable and non-substitutable for delivering services or producing goods more economically (Barney 1991). The characteristic of value refers to the capacity of organisational resources to make a difference in performance and create sustainable value for an organisation. Rarity refers to the scarcity of the resource, that is, the heterogeneously distributed nature of a resource which is possessed by few organisations. It can also refer to the resources of an organisation which have the potential to create a superior advantage for the organisation. The inimitable characteristic means that it would be difficult for other organisations to imitate or copy the resource. The non-substitutable attribute is a strategic resource that cannot easily be substituted. Therefore, RBV is a theory that covers key resources and capabilities which, when combined, enable an organisation to compete successfully with other organisations in the market (Barney 1991).

Adopting RBV theory, scholars have identified several types of IT capabilities in organisations. For example, Kettinger et al. (1994) argue that the IT capability of an organisation for achieving competitive advantage is determined by its IT infrastructure. Bharadwaj (2000) states that IT capability is the organisational ability created by the interaction between IT infrastructure, IT human resources and IT intangible assets in an organisation for improving its organisational performance. Tippins and Sohi (2003) argue that IT capability

is the ability of an organisation to use IT resources for improving its performance. Jiao, Chang and Lu (2008) state that IT capability, determined by IT infrastructure, IT human resources and IT management, can be used for improving organisational performance. Therefore, RBV is used in this study to define IT infrastructure quality as IT capability required for enhancing an organisation's performance, including its environmental competence of IT.

2.3 IT Infrastructure Quality

There are many definitions of IT infrastructure in the literature. Generally, IT infrastructure is a set of shared IT resources that provide a foundation to enable business applications in an organization (Broadbent, M., Weill & Neo 1999; Liu 2002). In this paper, IT infrastructure quality refers to the capability of IT infrastructure determined by its capabilities including greenness, service, and flexible capability. Greenness capability refers to the ability of IT infrastructure used for improving environmental performance of an organization (Molla, A. 2009). Service capability is the abilities to provide kind of services to meet the business demand of organizations which focuses on the efficiency of business operations (Duncan 1995). Flexibility refers to the ability of the IT infrastructure to enable an organization to adapt to the changing environment through renewing and redeploying the IT infrastructure to cope with future business and technological uncertainties (Duncan 1995).

IT infrastructure greenness or green IT is defined as the green computing that refers to the study and practice of design, manufacturing, and using computer hardware, software, and advanced communication system efficiently and effectively with minimal impact on the natural environment (Murugesan, S. 2008). It is also about the utilization of green IT infrastructure greenness to help organizations to develop its ecological competencies including emission management, resources stewardship and sustainability behaviour. For example, (Loos et al. 2011) argue that the adoption of virtual server in business operations can help organization to reduce energy consumption. It is because the server virtualization has capacity to share its services including hardware and software resources with other operating systems.

Many previous studies argue that the virtualization of database can help an organization to enhance the ecological competencies of organizations. For example, (McKendrick 2010) argues that the database virtualization is used by organization to more effectively grow their data capabilities while reducing in staff time and operational costs. (Chaudhuri, Dayal & Narasayya 2011) argues that the database virtualization can increase flexibility and agility of existing computing infrastructure for reducing business operation costs. (Molla, A., Cooper & Pittayachawan 2009) state that virtualization of databases are able to help organizations to mitigate energy consumption in business activities. Thus, organizations can reduce the energy consumption in its business operations through increasing the utilization of excess capacity possessed by virtualization technologies.

Thin clients refer to a computer or computer program that depends heavily on some other computer including server to fulfil its abilities of computational roles through the network system (Pattinson & Cross 2011). There are many advantages of using the thin client computer including lowering administration costs, lowering energy consumption, lowering hardware cost, more efficient use of computing resources, using less network bandwidth, lowering up-gradation costs (Mann, Grant & Singh 2009). Therefore, based on this study, the adoption of thin clients is able to improve the ability of organizations to improve their environmental performance.

(Adela, Marie-Claude & Richard 2008; Watson, Boudreau & Chen 2010) investigate the role of IS functions in reduce the impact of business operations in the natural environment. The outcome of this study is that IS functions can improve operational efficiency through the enhanced organizational ability of information processing. It refers to the extent to which of an organization provides automatic business operations controlled and operated by electronic to reduce human intervention for improving information efficiency.

Service capability is the abilities of an organization in providing kind of services to meet the business demand of organizations that focuses on the efficiency of business operations. This service consists of digital communication, digitalized business, digitalized-file, and uniform services (Loos et al. 2011). The digitalized-file refers to the number of physical components replaced by digitalized documents to reduce the office space, and material cost (Huang 2009). The digitalized communication refers to the extent to which an organization utilizes the communication technologies to reduce energy consumption and transportation cost. Digitalized business refers to numerous of the IS functions available to reach and connect customers and suppliers (e.g. e-commerce and e-procurement). The uniform services refer to the extent to which an organization uses the IT infrastructure in providing the information consistency. It means that an integrated database contains single information for entire the business operations including business units (ex. Marketing or production) (Chen et al. 2009; Loos et al. 2011).

Other studies have considered the relationship between information quality and environmental performance in an organization. For example, (Weill & Vitale 2002) argue that information quality is often associated with enhanced organization control, as it informs in almost all aspect of business operations. Therefore, it leads to increased planning accuracy, which enables organizations to reduce buffer inventory, allows organizations to maximize the throughput and output from raw materials. Therefore, it leads to increased planning accuracy, which enables organizations to reduce buffer inventory, allows organizations to maximize the throughput and output from raw materials. In Logistic perspective, ISs provide timely and accurate information on stock holding and whereabouts, and thereby allow organizations to concentrate inventory at a smaller number of strategic locations (Zhu, Qinghua, Sarkis & Geng 2005). In addition, (Adela, Marie-Claude & Richard 2008) investigate the IS functions providing

information of environmental footprint in business operations. This study show that organizations use IS to gain timeliness, accuracy, and relevance of ecological information for meeting environmental regulations and policies.

Flexibility is defined as the degree to which an organization possesses a variety of actual and potential procedures and the rapidity with it can implement these procedures to increase and the control capability of the management and improve the controllability of the organization over its environment. In addition, flexibility is viewed as an organization core competency, suggesting that a good infrastructure is quantified by its flexibility and robustness to enable change. Byrd and Turner (Byrd & Turner 2000) argue suggested that IT infrastructure flexibility must be able to handle increased market demands without increased costs. Broadbent and Vitale (Broadbent, Marianne & Weill 1997) argue that IT infrastructure should mainly focus on speed of implementation and flexibility. Therefore, in this study, flexibility refers to the ability of the IT infrastructure to enable an organization to adapt to the changing environment through renewing and redeploying the IT infrastructure to cope with future business and technological uncertainties. It is determined by connectivity, compatibility, and modularity of IT infrastructure in an organization. The compatibility refers to the extent to which an IT infrastructure either facilitates the sharing of any information internal and external an organization across any technology equipment. The modularity is defined as a way for improving the services to customers and suppliers by modifying, removing and adding any software, hardware and data components of an infrastructure. The connectivity refers to the extent to which an IT infrastructure to connect all business branches and units in an organization.

There is much research at IT infrastructure compatibility in reducing the operation costs in their business operations. For example, Weil and Vitale (Weill & Vitale 2002) argue that the organization requires the IT infrastructure that has ability to share services with different platform technologies including hardware platforms, base software platforms, communication technology and middleware. Duncan (Duncan 1995) state that the compatibility is used to support the commonality between different applications and uses as well as to facilitate information sharing across and outside the organization, cross-functional integration infrastructure and reduce the business operation costs. For example, any information including process, service, video, image, text, audio, or combination of these can be used by any system, regardless of manufacturer, hardware, make, or type. With compatibility, organizations can respond the market quickly and develop new products and services rapidly. Therefore, IT infrastructure can transform organizational business operations efficiently and effectively to meet business demands (Huang 2009; Pappis 2011).

The connectivity refers to the extent to which an IT infrastructure to connect all business branches and units in an organization. It is defined in terms of ‘reach and range’ (Keen 1991). ‘Reach’ refers to locations that can be

connected via infrastructure. It consists of computer networks and IS functions for connecting internal and external business operations. For example, workstation network can be used for connecting business units and branches. For the external stakeholders, organizations can provide IS functions (e.g. web access and extranet) as interfaces accessed by stakeholder for business transactions. 'Range' determines the level of functionality (e.g. information and/or transaction processing) that can be shared automatically and seamlessly across each level of 'reach'.

The modularity has capabilities to support the organizational eco-competency. For example, repeated IS functions such as data or software module call routines, as well as data, can and will be converted into reusable objects. As data and applications components become independent and reusable, they become part of infrastructure, and the processes of development, maintenance, or engineering of "direct-purpose" systems are simplified and the costs are reduced (Duncan 1995). Furthermore, an adequate use of selected modules of publicly available software packages (e.g. ERP) can support the standardization of information in business operations. It means that the data and information provided by software packages are easily to share across organizations.

Table 2 summarizes the discussion above. In summary, numerous studies investigate the items of IT infrastructure quality that might be used for support the environmental competencies of an organization.

Table 2. Summary of IT Infrastructure Items

Constructs	Items	References
Flexibility	ITF01:Modularization of IS application system	Duncan 1995 Broadbent and Weil 1997 Byrd and Turner 2000
	ITF02:Standardization of information and reports across organizations	
	ITF03:Implementation of simple administrations and rules	
	ITF04:Adoption of network systems for connecting business units and stakeholders together	
Serviceability	ITS05:Implementation of data privacy and security procedures for protecting the privacy of information	Weil and Vitale 2002 Zhu et al 2005 Byrd and Turner 2000 Molla 2008 Gorla, Somers and Wong 2010
	ITS06:Adoption of user interfaces that can be accessed by all platforms and applications	
	ITS07:Adoption of centralized database management systems	
	ITS08:Adoption of online or electronic form as entry points for internal and external user	

Continued Table 2		
Greenness	ITG09:Adoption of server virtualization for running multiple operating systems on one server	Chen 2008 Weil and Vitale 2002 Mann 2008 Molla 2009
	ITG10:Adoption of storage virtualization for improving data processing in business transactions	
	ITG11:Adoption of desktop virtualization for access the data and information from any location	
	ITG12:Adoption of thin client computing used for accessing servers through a computer network	
	ITG13:Adoption of cloud computing for improving business infrastructure efficiency	
	ITG14:Use of radio frequency identification for managing and tracking organization assets	

Drawing from literature discussed above, we propose a research framework presented in Figure 1, which outlines the relationship between IT infrastructure quality and environmental competencies of organisation in the Indonesian ICT industry.

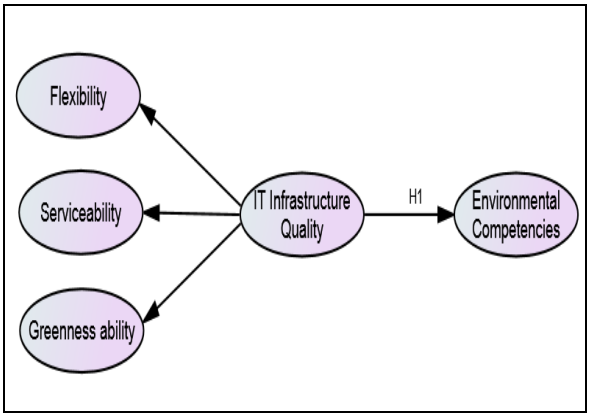

Figure 1. Conceptual Framework

2.4 Research Methodology

The data for this paper are collected based on a survey conducted in 2013. The survey involved the distribution of the survey questionnaire to identified respondents, who were selected from Indonesian ICT organisations. The selection of organisations to be sent questionnaires was identified based on information provided by the Ministry of Trade, Republic of Indonesia that there were 1265 ICT organisations in Indonesia. The respondents were selected using a clustering approach. Clustering was based on the regions where the ICT organisations are located and meant that the region with the largest number of ICT organisations received the biggest portion of questionnaire. The samping criterion is to target Chief Information Offeicer or their equivalent. Most of questions in the survey are IT decision related. Thus, we believe that IT managers or equivalent from IT divisions or departments of ICT organisations are both well positionned and better informed to answer the questions. Furhtermore, the IT manager is a key participant in improving environmental performance in organisations (Bowen et al. 2001; Carter & Ellram 1998; Zhu, Qinghua, Sarkis & Geng 2005). After a four-month period, 404 responses were received (31.9 per cent return rate). Initial examination of the 404 responses identified 20 incomplete cases with too many missing data and so these responses were excluded. This left 384 cases for further analysis. With response rate

20%, all necessary efforts were made to avoid data entry error through utilising SPSS' feature of defining acceptable values and labels for each variable.

Table 3. Respondents Profile

Organization Types	%	Rest.'s Profiles	%	Employ Number	%
Computer hardware and periperal IT	45	CEOs	5.7	1-50	50.8
Telecommunications	32.8	Directors	4.7	51-100	30.7
IT training and consultans	6.3	Mangrs	27.3	101-250	10.2
Software IT solutions	9.9	Supervisors	26.3	251-500	3.1
Others	5.7	Others	35.9	>501	5.2
Total	100		100		100

Furthermore, the remaining 384 data are stored and screened using the SPSS statistic software version 21.0 for addressing missing values, normality, outliers, linearity, common method bias and non response bias (see the appendix). The objective is to avoid failure of the model estimation and crashing of fitting programs (Kline 2005). After data screening, there are 378 remaining data used for further analysis.

3. ANALYSIS AND RESULTS

The collected data are analysed utilising exploratory factor analysis (EFA) and Structural Equation Models (SEM). The objective of EFA use is to identify the underlying constructs of the research and concern in sample adequacy. According to Hair et al. (2010), a reliable EFA procedure has to be guaranteed by a cese-to-variable ratio of 5:1. The proposed measurement variables consist of 45 variables with a sample size of 378. Therefore, the sample of the study meets sample edequacy criterion.

Using the Principal Component analysis extraction technique and Promax with Kaiser method, one item is identified as can be seen in Appendix 1. The finding show that there are one item of flexibility and two items of greenness ability, dropped from further analysis due to their factor loading less than 0.5. In addition, the result is also reveal that the EFA model for whole variables are similar with proposed model based on literature review. Based on the EFA findings, the discriminant validity of the measurement model is examined through CFA. First, each factor identified from EFA, is independently examined to test if the measurement models fit the data. During the process, there are one item of serviceability, one item of sustainability behaviour, and two items of greenness ability, are dropped from further analysis.

Table 4. Statistics for Congeneric Factor of Each Constructs

Constructs	Items	Factor Loadings	GOF indices		
			Absolute	Incremental	Parsimony
Flexibility	ITF01	0.612	X^2/df =3.190 P-value=0.041 RMSEA= 0.76 SRMR=0.0330	CFI=0.980 IFI=0.980 TLI=0.970	PCFI=0.653 PNFI=0.647
	ITF02	0.769			
	ITF03	0.651			
Serviceability	ITS05	0.565	X^2/df =1.351 P-value=0.245 RMSEA= 0.31 SRMR=0.0133	CFI=0.999 IFI=0.999 TLI=0.996	PCFI=0.333 PNFI=0.332
	ITS07	0.815			
	ITS08	0.812			
Greenness ability	ITG09	0.771	X^2/df =4.832 P-value=0.02 RMSEA= 0.101 SRMR=0.0281	CFI=0.980 IFI=0.980 TLI=0.960	PCFI=0.490 PNFI=0.487
	ITG10	0.794			
	ITG11	0.761			
	ITG12	0.659			
Sustainability Behaviour	SB01	0.700	X^2/df =0.242 P-value=0.785 RMSEA= 0.000 SRMR=0.039	CFI=1.000 IFI=1.000 TLI=1.000	PCFI=0.333 PNFI=0.333
	SB02	0.842			
	SB03	0.918			
	SB05	0.867			

Second, multi-factor model analysis was then done on the one-factor congeneric models. This analysis was undertaken to test for the multi-dimensionality of each theoretical construct. Multi-factor measurement models were also used to examine scale reliability (Cronbach's alpha), internal consistency (construct reliability) and distinct validity (variance extracted), and to calculate weighted composite scores and test for convergent and discriminant validity. One multi-factor models, namely, environmental IT infrastructure quality was examined and goodness-of-fit statistics associated with each model were assessed before the final measurement model was obtained.

Table 5. Statistics For Multi-Factor Model Analysis of IT Infrastructure Quality

Constructs	Items	Factor Loadings	CR	AVE	GOF indices		
					Absolute	Incremental	Parsimony
Flexibility	ITF01	0.774	**0.721**	**0.500**	X^2/df =2.308 P-value=0.000 RMSEA= 0.59 SRMR=0.393	CFI=0.968 IFI=0.968 TLI=0.957	PCFI=0.726 PNFI=0.709
	ITF02	0.611					
	ITF03	0.650					
Serviceability	ITS07	0.888	**0.802**	**0.672**			
	ITS08	0.745					
Greenness ability	ITG09	0.771	**0.835**	**0.560**			
	ITG10	0.781					
	ITG11	0.767					
	ITG12	0.663					

Third, the entire measurement model is examined whether it first the data. The finding shows that the measurement model fits the data with P-value=0.000; CMIN/DF=2.323; CFI= 0.962; TLI=0.953; and RMSEA=0.059 as can be seen in Table 6.

Table 6. Statistics For Full Structural Model

Constructs	Items	Factor Loadings	GOF indices		
			Absolute	Incremental	Parsimony
Flexibility	ITF01	0.612	X^2/df =2.323	CFI=0.962	PCFI=0.789
	ITF02	0.770	P-value=0.000	IFI=0.962	PNFI=0.767
	ITF03	0.651	RMSEA= 0.59	TLI=0.953	
Serviceability	ITS07	0.901	SRMR=0.047		
	ITS08	0.734			
Greenness ability	ITG09	0.778			
	ITG10	0.782			
	ITG11	0.767			
	ITG12	0.659			
Sustainability Competencies	SB01	0.717			
	SB02	0.857			
	SB03	0.911			
	SB05	0.54			

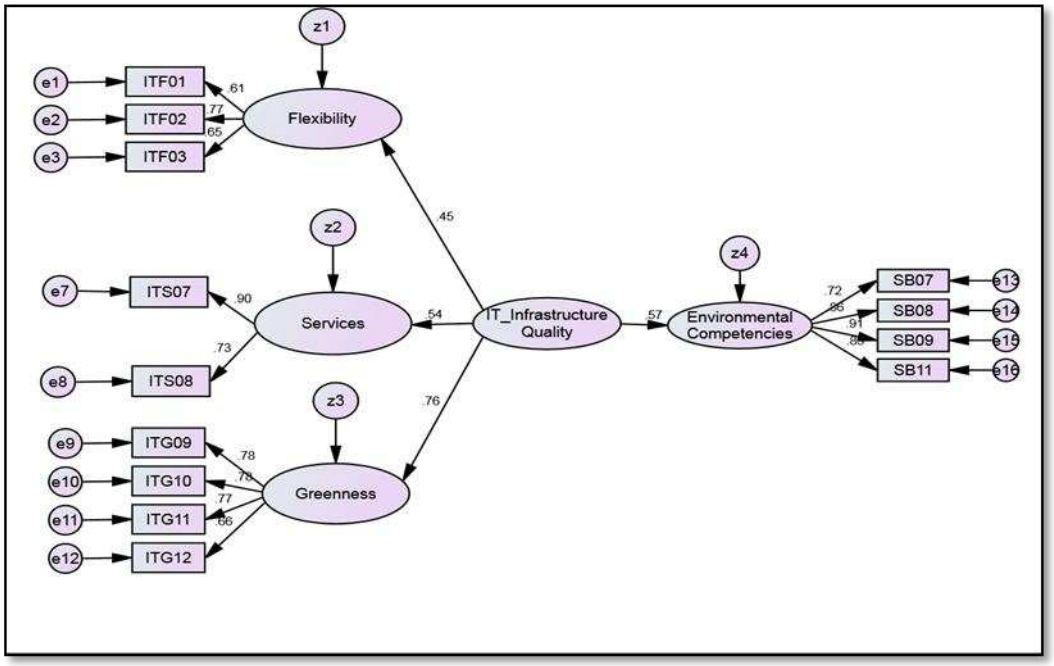

Figure 2. The Hypothesised Structural Model

As can be seen in Table 7, the results indicate that H1 is statistically significant in the hypothesised direction. This is because these hypotheses have T-values above 2.00. Thus, the hypothese is supported.

Table 7. Hypotheses Testing For Initial Hypothesised Structural Model

Hypothesised path			Standardised estimates	CR	P
Environmental Competence of Organisations	←	IT infrastructure quality	0.117	5.536	***

*** p<.001, ** p<.01, *p<.05

3. RESEARCH FINDINGS

This study investigates the role of IT infrastructure quality in developing organisations' environmental competence. The quality of IT infrastructure includes flexibilities, serviceability and level of greenness. First, the hypothesised structural model in Figure 2 shows that strong support is evident for the path of IT infrastructure that is determined by flexibility, serviceability and greenness with path coefficient values of 0.45, 0.54 and 0.76, respectively. The path of flexibility consist of modularised IT application systems, standardised information and reports throughout the organisations, and implementation of simple administration procedures and rules with factor loading values of 0.61, 0.77 and 0.65, respectively. The serviceability model accounts for 0.90 of the factor loading in adopting a centralised database management system, and 0.73 in adopting the online or electronic form as entry points for internal and external users. The concept of greenness makes an enormous contribution to the quality of IT infrastructure with 0.78 of factor loading in adoption of server virtualisation, 0.78 in storage virtualisation, 0.77 in desktop virtualisation and 0.66 in thin client computing.

Third, the research has proposed a theoretical framework with a relationship between IT infrastructure quality and environmental competence. Based on the structural analysis and hypothesis testing as shown in Figure 2, IT infrastructure quality has a significant positive effect on environmental competence with β value=0.117 and P value =0.001. Thus, the hypothesis as mentioned in section 2 (IT infrastructure quality makes a significant impact on an organisation's environmental competence), is supported at a 99% confidence interval. This research finding is consistent with Molla et al. (2012), who concluded that IT infrastructure quality can serve to build environmental competence in organisations. This finding supports Bose and Luo's (2011) research regarding the importance of IT infrastructure quality for developing green IT competence.

4. CONCLUSION

This research investigated the critical factors involved in IT capability for developing environmental competence in Indonesian ICT organisations from the perspective of IT infrastructure quality. The hypothesised framework is developed based on a review of the

literature on RBV theory and green IT. The framework is validated using SEM based on survey data collected in Indonesia. It is evident that IT capability is determined by the quality of IT infrastructure.

The success of developing environmental IT competence will heavily depend on organisations' use of their IT infrastructure in conducting business processes. IT infrastructure provides organisations with the green abilities to perform environmentally friendly business processes in order to accommodate stakeholder demands. For example, generating environmental competence in organisational business activities can be aided by adopting virtualisation technologies in business processes that can delivery environmentally friendly services. Additionally, virtualisation technologies will help organisations and their business partners to collaborate in business operations to decrease energy consumption and travel costs. Therefore, to build environmental IT competence, organisations have to place their IT infrastructure including virtualisation technologies into their business processes.

Future researchers are encouraged to explore whether the final IT capabilities and environmental competence of IT model of this study holds in other industry contexts. As discussed, the factors of each construct in IT infrastructure quality were identified for environmental competence of IT, which might be suitable for improving the innovation capability of the electronics industry. This research employs RBV theory, to identify the factors and indicators related to environmental performance. It also requires to add several constructs from different theories such as Behaviour Theory and Technology Acceptance Model. Therefore, the implications might show differences in contexts where the identified factors of IT infrastructure quality are tested in industries with the adoption of environmental procedures and appropriate IT equipment.

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