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THE INFLUENCES OF GREEN INNOVATION ON GREEN ORGANIZATIONAL PERFORMANCE – CONCEPTUAL OVERVIEW

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ABSTRACT

As the increase of awareness on human health and environment, consumers are now looking for Green products compliance (especially electrical and electronic equipment). This has creates more demand on Green products which has led an organization to invest on innovation. However, the successful of the innovation activities will be dependent on how the organization manage the internal factors (readiness on its process capabilities, resources, supply chain and etc.) and also external forces (environmental regulations, customer requirements, etc.) – Green Management. This paper is aiming at the linkage of these relationship: Green management, Green innovation and Organizational performance. The study will be conducted to the electrical and electronic supply chain firms in Malaysia; which are globally known as electrical and electronic manufacturing hub in the world. Researchers believe that the findings from this study will soon bring benefits to the practitioners and academia. As the practitioners (specifically refers to the electrical and electronic organizations) the study will help them to understand on how the influences of Green innovation can affect Green organizational performance. While for academia, this study is believed to explore another areas of Green innovation which previously many past studies concentrated only on definitional issues and theoretical explanation.

Keywords: *green management, green innovation, organizational performance, electrical and electronic*

INTRODUCTION

With the current focus on global warming, 'going green', renewable energy and minimizing our carbon footprint, it is little wonder that environmental requirements have ultimately trickled down to the electrical and electronics industry. The manufacture, use and disposal of these electrical and electronic (EE) equipment pose a risk to human health and the environment. Hazardous chemicals are used in production processes, in components and within products and they can also be released into the environment by disposal processes (Goodman, 2008).

Concerning that this matter will induce health risk to the consumers, many countries are now formulated environmental regulations to directly or indirectly establish limits on emissions and to control the material and energy outputs of society to the environment

(Cohen, 1987; Sanchez & McKinley 1998). Other than that, there are also some regulations being imposed as a product requirements prior to market them in their countries. Various requirements with the impact to the EE equipment industries have emerged over the past several years. For example European Union (EU) has adopted Restriction of Hazardous Substances (RoHS) Directives, Waste of Electrical and Electronic Equipment (WEEE) Directives, Registration Authorization Evaluation of Chemicals (REACH) regulation; China has adopted China RoHS; California in USA has done through Electronics Waste Recycling Act and Norway has adopted Prohibited of Hazardous Substances (PoHS).

As it involves regulatory and statutory bodies, the environmental or so called Green requirements must be complied by the manufacturers to ensure their products still applicable and sellable in a market. This has given a pressure to the EE manufacturers to innovate their products, ensuring its meeting the requirements. As an example, API Technologies (a well-known company on providing technology solution for radio-frequency, microelectronics and security technologies for critical and high-reliability applications) had previously mentioned (API Technologies, 2015), manufacturers who place non-compliant products on the EU market risk facing severe penalties that include fines, impounded goods, loss of the right to sell into the 25 EU Member States and related loss of market share, and adverse press and media coverage. Any country that can prove a product does not comply can levy fines against the vendor. There has already been clear evidence that failure to meet the RoHS Directive means lost sales:

- *Palm Inc. recently announced that its extremely popular Treo 650 is no longer being shipped to Europe due to it not meeting RoHS requirements.*
- *Apple Computer Inc. products including the iSight Web camera, AirPort base station with modem, AirPort base station power-over-Ethernet and antenna, iPod Shuffle external battery pack, and all versions of the eMac all-in-one desktop computer were withdrawn by the company for sale in the European market due to them not being RoHS compliant.*

The impact of RoHS Directives is not limited to the EU manufacturing firms only; firms that supply components to customers who put products on the EU market must also be prepared to address RoHS Directives or face the possibility of losing customers or even incurring liabilities (API Technologies, 2015). These has supported that the environmental regulations and requirements is also significantly impact to the whole supply chain. It's extremely important for an organization to ensure that their suppliers have the capability to supply materials that are comply with the environmental regulations – for this context we will look specifically on compliance against RoHS Directives. The issue arose when an organization, with specifically refer to the electrical and electronic supply chain, need to prepare themselves: considering internal and external factors; ensuring their products being innovated to meet the environmental requirements. Studies from Chen *et al.* (2012), suggests that firms should invest their resources in developing and cultivating the internal and the external origins.

The gap that we identified in here is the readiness of the organization's downstream supply chain as per suggested by Chen above. According to the report by Stone & Associates, Inc. (2006), small and medium enterprises (SME) EE organizations will face challenges to comply with RoHS Directives. Three (3) major areas identified:

Figure 1
SMEs challenges in complying with RoHS directives

Product substitutions and process changes, or in other words Green Innovation, will require the manufacturing organizations eliminating the restricted substances, as defined in EU RoHS Directives (Council Directive 2002/95/EC, 2003). While in inventory and supply chain management, it is the responsibility of the organization to develop processes to assure that no restricted substances are present in purchased materials. This may include ensuring compliance documentation in-place, perform auditing and testing of suppliers, enhancing system on identification and tracking both RoHS and non-RoHS compliant products. And with small capital available, higher cost incurred for the investment in RoHS compliant processes, increase on the overhead related to managing compliance process and etc. This had explained that many local electrical and electronics supply chain organizations especially SMEs in Malaysia may not be ready to meet those requirements. Not ready may include the unawareness with the standards, lack of knowledge, limited capabilities and technologies and very minimal resources knowledgeable in this area. According to Malaysian's Productivity and Investment Climate Survey (PICS) in 2003, a variety of organizations' responses point to concerns about the regulatory and policy environment as a constraint to doing business. Dedication to environmental compliance are required which includes engaging in internal, corporate-wide initiatives, as well as adhering to environmental standard established for the upper stream which are mainly multinational companies (MNCs). If the MNCs unable to find local suppliers (in this context referring to the EE industries in Malaysia) that can meet with the requirements, later will end up for them on sourcing other suppliers either locally or globally. According to Michida and Nabeshima (2012), firms that do not have capacity to comply with product environmental requirements, its global market access would be lost. Hence, these will be an opportunity for an organization who have the capabilities to take up the business and ultimately increase their business growth and performance.

GREEN INNOVATION AND ORGANIZATIONAL PERFORMANCE

Innovation can be described as generating or changing products or processes to be more effective. In organization's perspective, innovation will help to foster business success through better process and product performance. Innovation is acknowledged as the key activity to build core competitive advantage for an organization's long term-development (Xu & Zhang, 2008; Raza & Murad, 2014).

Competitive pressure has forced firms to consider innovation as a vital strategy for differentiation (DeSai, 2010). Businesses seeking to stay ahead of the competition should think more widely than product innovation, which is usually the most common focus (Goffin & Mitchell, 2005). Firms could be more successful in innovating than their industry counterparts (DeSai, 2010). Innovation in Green is another areas that can provide a competitive prime to a firm. With the increase of international environmental

regulations and growing consumer concern over environmental protection, it's demonstrated the importance of environmental sustainability in corporate operations (Dangelico & Pujari, 2010). For example, the Kyoto Protocol, the Basel Convention and the Montreal Convention require the strengthening of waste disposal processes and the control of environmental pollutants. Groups such as Greenpeace insist that IT products meet energy-saving, non-toxic, recycling and other environmental protection standards (Chen, 2008). Therefore, organizations must actively engage in green innovation, including environmentally oriented product designs and manufacturing processes, in order to meet the requirements of sustainable development (Tseng *et al.*, 2013).

Green innovation is defined as the creation or implementation of new, or significantly improved, products (goods and services), processes, marketing methods, organisational structures and institutional arrangements which - with or without intent - lead to environmental improvements compared to relevant alternatives (Schiederig *et al.*, 2011). This is further supported by Fussler and James (1996) which they had defined green innovation as new products and processes that provide customer and business value but significantly decrease environmental impacts. Kemp and Pearson (2007) also added that green innovation as the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives. Green innovation is aimed at preventing pollution, saving energy, recycling of waste and environmental management. This type of innovation is closely related to sustainable, environmental and ecological innovation.

The environmental issues have created economic crisis in the world today and affecting many industries. According to Ramanathan *et al.* (2010), most of the environmental regulations directed at the EE industries sector have had direct impact on the operations and performance of an organization. With the fight against environmental degradation, these industries have been tasked with finding ways of curbing environmental degrading factors. This led to green innovation in the worldwide today. Stringent environmental regulations saw the introduction of numerous green new products and process revamps especially on the electrical and electronics product (e-product) front (Wong, 2012). The ban on the use of Lead (Pb) in solder material and Hexavalent chromium (Cr^{6+}) used in chrome plating or coatings in consumer electronic manufacturing industries are a just few examples of industrial and entrepreneurial initiatives to combat environmental degradation.

Seems the topic on environmental trends become popular, sustainable development through green innovations need to be in-placed (Chen *et al.*, 2006). It is one of an important strategic tools nowadays for EE manufacturing organizations to adopt quickly to bring benefits especially on their financial performance. According to Porter and van der Linde (1995), costs of environmental investments will be offset when product value enhanced through green innovations. In addition, corporate image can be improved and be more successful. The environmentally proactive organizations have met the demands of environmental regulation generally by introducing innovations in their products, production and managerial processes. In many cases, innovation plays an intermediary role on the impact of environmental regulations to the economic

performance (Ramanathan *et al.*, 2010). Most of the proactive organizations that met regulatory requirements improved their economic performance mainly by developing innovative products and processes.

The impact of regulations on inducing or suppressing innovations (that may or may not include green innovations) in an organization has been independently studied heavily in past scholars. Some researchers have argued that regulations suppress innovation in organizations because the deterministic nature of regulation limits their strategic choices and does not leave enough scope for organizations to innovate (Breyer, 1982). On the other hand, there is also a view that environmental regulations can induce innovation, usually in the longer run, because organizations can find innovative ways of not only meeting the regulation but also use the innovation for improving their performance (Porter, 1991). Back in 1990s, resources investment in green activities was not essential. Until it is discovered that the strict environmental regulations and popular environmentalism have changed the competitive rules in practices (Porter & van der Linde, 1995). Same goes to academic areas where many past studies concentrated on definitional issues, theoretical explanations for the rise of green innovations (e.g. Porter, 1991; Porter & van der Linde, 1995; Chen *et al.*, 2006; Ramanathan *et al.*, 2010).

In a context of innovation on its impact to the organizational performance, many recent studies found mixed results – positive and negative relationships (Ramanathan *et al.*, 2010). Based on earlier study by Porter and van der Linde (1995), they acknowledged that product innovation can create new markets and product differentiation. With innovate products, the organization will have more competitive advantage; Hence will increase their marketing and business performance. Also study done by Roper and Love (2002) on the link between innovation and performance (focusing on exports), and a comparative evaluation of UK and German manufacturing industries. They have found that innovation and export performance are positively related in both countries. While in IT based industry, Dehning *et al.* (2007) found positive impacts of IT based innovative supply chain management in manufacturing organizations. On top of it, Loof *et al.* (2003) have used data from Community Innovations Surveys (CIS) to compare the extent of influence of innovation and performance in Finland, Norway and Sweden. They have found positive relationship between innovation and productivity in Norway and Sweden but not in Finland. Meanwhile, Cox and Frenz (2002) have studied the relationship between business performance, Research and Development expenditures and innovation in UK. They have found that product innovators (including those organizations who engage in both product and process innovation) performed better than the non-innovative organizations.

As mentioned previously, there are also studies that found negative relationship between innovation and performance. Recap on study performed by Loof *et al.* (2003), no relationship being found between innovation and productivity in Finland. Chang and Robin (2008) have found that Taiwan organizations that spend on innovation tend to perform less well, indicating negative relationships. The study have been done by looking on the links among public policy, innovation and performance in 23 sectors of Taiwan's manufacturing industry.

By looking on the impact of "green" or environmental regulations to the economic performance, past studies also found similar which it's positive and negative impact.

The management guru Porter (1991) has found that environmental regulations can positively influence performance. According to him, environmental regulations, if properly designed to "aim at outcomes and not methods", can encourage dynamic change and greater efficiency in the use of resources. The dynamic benefits from such practice will more than offset the static compliance costs which have traditionally concerned economists and managers. The resulting possibility is a "win-win" scenario – higher environmental standards mean greater protection for the environment, and will also encourage innovative practices that reduce costs and lead to new products, making organizations more internationally competitive.

The results of several studies in the literature have found such a positive relationship between Green management and improved performance (Hamilton, 1995; Sarkis, 2001; Boiral, 2007), thereby supporting Porter's hypothesis. Zhu *et al*. (2007) have studied operations strategies (in the form of green supply chain practices) and performance of Chinese manufacturers in response to environmental and institutional pressures using a survey and statistical analysis. They have found an increased environmental pressure on Chinese manufacturers and importantly that the existence of regulatory pressures improved organizational performance. Berman and Bui (2001) have found that stricter regulations in the US petroleum refining industry tend to increase abatement costs, but also increase productivity. In the UK context, Salama (2005) has found strong positive relationships between corporate financial performance and corporate environmental performance for top performing firms in Britain. Therefore, it also supports the findings from Rao and Holt (2005), which is, greening the different phases of the supply chain leads to an integrated green supply chain, which ultimately leads to competitiveness and economic performance.

Negative relationship between environmental regulations and performance also being found in previous studies. Filbeck and Gorman (2004) have found that regulatory compliance tends to lead to lower financial returns; study made at 24 US electrical utilities organizations. Triebswetter and Hitchens (2005) also found that the proportional cost of environmental compliance relative to turnover incurred by the German manufacturing industry organizations is likely to be a negative function of the productivity level.

Explanation above have supports that majority of the early studies focused on the relationship of performance against specific areas either innovation or "green". Less studies being made on the relationship between green innovation and performance. Wong (2012) has defined that recently researchers are keener to explore on the policy implications of green innovations to the business performance.

REVIEW ON THE CONCEPTUAL FRAMEWORK

This research utilizes two major theories: absorptive capacity theory developed by Cohen and Levinthal (1990) and resource-based view (RBV) developed by Barney (1991). Both theories have been selected to be fit with the research model as it's involve on how firm absorb and react based on their resources and capability.

Absorptive capacity theory describe the firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends. Outside sources of knowledge are often critical to the innovation process, whatever the organizational level at which the innovating unit is defined. The ability to exploit external knowledge is thus a critical component of innovative capabilities. Past studies had shown, firms that conduct their own research and development (R&D) are better able to use externally available information. In our context, the knowledge on Green which is required by firms to adopt, in order to stay competitive in the industry. According to Rugman and Verbeke (1998), firms may decide to undertake Green management due to external forces as stakeholder environmentalism, competitive pressures and environmental regulations. By saying that, the absorption of the Green will lead to the innovation activities in the firms.

Investing resources in Green management is getting important nowadays especially in the dynamic global environment. Many firms are willing to put more efforts on developing Green innovations which resulted on enhancing their production efficiency and develop new environmental markets (Porter & van der Linde, 1998; Chen, 2008). In order to stay competitive, firms need to Green their products and to adopt Green innovations. Based on resource-based view (RBV), competitive advantage results from the valuable resources and capabilities of firms (Barney, 1991). RBV asserts that environmental social responsibility can become a key capability that can result in a sustained competitive advantage (Hart, 1995). To add further, Zahra and George (2002) defines that dynamic capabilities will enable the firm to reconfigure its resource base and adapt to changing market conditions in order to achieve a competitive advantage.

As a summary, investing in Green management by considering internal and external factors will influence to the Green innovation initiatives. Thus, this research will strategically looks on this relationship to the effect of organizational performance.

Figure 2
Conceptual Framework

METHODOLOGY

The sample in this study embraces electrical and electronic manufacturing firms in Malaysia. The entire chain connects customers, manufacturers and suppliers, beginning with the creation of raw material or component parts by suppliers, and ending with consumption of the product by customers. Therefore, the target respondents will be from any electrical and electronic manufacturing firms throughout the supply chain. A sample of 300 electronics' supply chain firms will be randomly selected from Federation of Malaysian Manufacturer (FMM) Directory. The target respondents will be requested to complete the questionnaires through online with a covering statement included. The covering statement explained the details of the survey, contact information and also instructions for completion of the survey through online. The

potential respondents also will be informed that all the information provided will be treated in the strictest confidence and that only aggregated findings will be reported.

A questionnaire is developed, comprised of previously developed scales (Rao & Holt, 2005; Chen *et al.*, 2012). The variables measured in this study cover the internal and external factors as defined in the conceptual framework. Each variables measured by 7-points interval scale. Any item which was not being answered will be treated as missing values. There are also 4 demographic questions included in the instrument to identify the job level of the respondents, departments, location of the company and nature of business. This will help us to segregate which respondents those are relevant to our research. Finally, regression analysis by using SPSS will be conducted, for the researchers to analyze the relationship among variables.

CONCLUSION

As the increase of awareness on human health and environment, consumers are now looking for Green products compliance (especially electrical and electronic equipment). This has creates more demand on Green products which has led an organization to invest on innovation. However, the successful of the innovation activities will be dependent on how the organization manage the internal factors (readiness on its process capabilities, resources, supply chain and etc) and also external forces (environmental regulations, customer requirements, etc) – Green Management. Previous studies majorly focused on the relationship between innovation and performance, not specifically in Green innovation. Since "going Green" or environmentalism is becoming more concerns nowadays, an organization especially from EE industries should take seriously in this matters. Furthermore, recently researchers are keener to explore on the policy implications of green innovations to the business performance (Wong, 2012).

The study will be conducted to the electrical and electronic supply chain firms in Malaysia; which are globally known as electrical and electronic manufacturing hub in the world. Researchers believe that this could make a useful contribution to the Green innovation research. For the academia, researchers believe that this study will explore another areas of Green innovation which previously concentrated on definitional issues and theoretical explanation. While for practitioners, the result of this study will help them to understand on how the influences of Green innovation can affect Green organizational performance; which later will be applies in their Green management decision making process.

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