THE EFFECT OF CLOSED-LOOP SUPPLY CHAIN ON ENVIRONMENTAL PERFORMANCE: AN INSIGHT FROM GERMANY AND MALAYSIA MANUFACTURING COMPANIES

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UNIVERSITI SAINS MALAYSIA

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ABSTRAK

Responsif firma dan reaksi terhadap kitaran hayat produk adalah penting untuk mencapai kejayaan yang berterusan terutama apabila persekitaran perniagaan mengalami situasi tidak menentu. Saban hari, kitaran hayat produk menjadi semakin pendek dan pengendalian yang cekap diperlukan bagi merealisasikan pulangan kewangan dengan mengekstrak bahan untuk diguna, diproses dan diedar semula. Oleh itu, amalan pelaksanaan rantaian bekalan *Closed-loop suppy chain* (CLSC) adalah penting untuk membezakan organisasi dari pesaing dan kaedah ini boleh mencapai matlamat dan kejayaan. Oleh kerana terdapat peningkatan kesedaran hijau dan keperluan untuk memenuhi syarat-syarat polisi alam sekitar, CLSC telah menjadi semakin penting terutama bagi organisasi pengeluar. Sehubungan itu, kajian perbandingan di antara negara Jerman dan Malaysia mengenai kesan amalan CLSC terhadap prestasi alam sekitar telah dijalankan. Satu kaji selidik dalam talian yang diberikan kepada organisasi didalam industri pembuatan membolehkan perbandingan hasil kajian dicapai. Sejumlah 275 data dari Malaysia dan 129 data dari Jerman telah dianalisis dengan menggunakan model struktur *SmartPLS*. Hasil kajian menunjukkan sektor industri yang berbeza mengalami tekanan yang berbeza hingga memerlukan strategi perniagaan yang berbeza dan juga undang-undang yang berbeza. Keputusan Jerman dan Malaysia menunjukkan prestasi alam sekitar organisasi pembuatan berbeza dari organisasi ke organisasi dan negara ke negara. Penemuan Malaysia mencadangkan pembalikan logistik organisasi pembuatan Malaysia telah mencapai prestasi alam sekitar yang memberangsangkan berbanding logistik hadapan. Selain itu, penemuan Jerman juga menunjukkan bahawa organisasi perbuatan Jerman adalah lebih berkesan dalam pelaksanaan amalan hijau untuk mengurangkan kesan terhadap alam sekitar berbanding dengan Malaysia.

ABSTRACT

Firm's responsiveness and reactions toward life cycles of products are critical to achieve sustained environmental performance. Life cycles are getting shorter, and efficient handling can save large amounts of cost since many materials can be extracted, reused, and redistributed. Thus, the implementation of Closed-loop supply chain (CLSC) practices can be a powerful way to differentiate a company from its competitors and it can greatly influence the firm to success. With increased green awareness and the requirement to meet the terms with environmental policy, CLSC is becoming increasingly important for manufacturers. Thus, this study examined the effect of CLSC practices on environmental performance between Germany and Malaysia manufacturing companies. An online survey is administered to manufacturing companies and a comparison was draw between these two countries. Approximately 275 data from Malaysia and 129 data from Germany were analyzed using the structural equation modelling with smartPLS. Analytical results indicated that different industries sectors of different countries are facing different pressures of different business strategies as well as different regulations and laws. The Germany and Malaysia findings revealed that manufacturing companies' environmental performance vary from company to company and country to country. The finding suggested that German manufacturers were seen to be more effectively and efficiently towards the implementation of CLSC practices to achieve environmental performance as compared to Malaysia. Moreover, the finding also revealed that Malaysia manufacturing companies' reverse logistics achieved a better environmental performance than forward logistics. In a nutshell, although Malaysia manufacturers were seen are still in their infancy stage to close the loop in their supply chain, but it has already been implemented in some companies.

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter provides the research outlines of this study. It begins with highlighting the background of study followed by a discussion on the problem statements, research objectives, and research questions. The definition of key terms of major variables will also be included to provide the understanding of the research outline. This chapter culminates with the significance of the study and organization of the dissertation.

1.1 Background of the study

In order to survive in today's ever-challenging business environment, companies have to cope with the increasingly customer demand expectations and the emerging markets (Ramezani, Kimiagari, Karimi & Hejazi, 2014). Business managers should find a way for the companies to survive in the hypercompetitive global business environment. Also, the public concern towards the disruption of climate system, the biodiversity loss and its uncontrollable consequences has urged the companies to take green action (Caniels, Gehrsitz & Semeijn, 2013). The ongoing awareness towards the natural resource scarcity in manufacturing industries has little potential to cause the supply chain (SC) at risk if companies fail to take business strategy to better resource utilization in production processing (Bell, Mollenkopf & Stolze, 2013). Hence, supply chain management (SCM) are become one of the essential research in operation strategy that attracts the attention of business practitioners and also researchers with regard to SCM is a key element to

achieve operational success in business organizations (Croom, Romano & Giannakis, 2000; Ramezani, et al., 2014).

To this date, manufacturing companies have been argued as the major industry that producing a significant amount of hazardous pollutants, creating the waste pollution and harming the life of existence on earth (Rashid, Asif, Krajnik, & Nicolescu, 2013). Indeed, it is evidenced that manufacturing sector has a major impact towards the natural environment (Zaman, 2012) and degrade the environmental substantially at its various production stages (Olugu, Wong & Shaharoun, 2011). All the product life cycle from extraction of the resources to manufacturing, remanufacturing, refurbish, material recycling, and even at disposal stage are actually scarring the world. Thus, a lot of unfavorable environmental issues have been created while manufacturers doing their business. The manufacturing processes deteriorates the environmental and ecosystem by global warming, ozone depletion and deforestation. In fact, the ecosystem are interacted and the contaminated the air, water, soil, ground or surface disposed from production processes is directly used by humans, wildlife and livestock and therefore substantially influences the human health (Shaw & Barry, 1992). The ocean ecosystem is also being disturbed by the oil spills, ocean disposal and ocean extraction from manufacturing processes. Yet, the production of chemical pollutants and the toxic air such as carbon dioxide (CO_2) from companies have also caused the global climate change and it is therefore claimed that most of the environmental problems are correspondence to the poorly regulated of manufacturers (Ayres, 1996; Zaman, 2012; Zailani & Eltayed, 2012). As a result, these challenges and pressure have eventually forced the manufacturers

around the world to seriously consider about the environmental impact during manufacturing and to design their processes to be even more environmentally acceptable (Klassen & Angell, 1998; Zailani et al., 2012).

Moreover, as the limited available of natural resources were decreased and the increasing of the world population consumption, companies are now getting realized that its supply chains have to be restructured to implement closed-loop supply chain (CLSC) practices (Carter & Jennings, 2002). It is essential to have appropriate green actions to "close the loop" in their SC in order to be more environmentally friendly, social responsibility, conserve natural resource, limit using resources, capture, reuse disposed waste materials and reduce pollution towards the product recovery and remanufacturing process (Carter & Jennings, 2002; Simpson, 2012; Ramezani et.al., 2014). This is because of our planet limits the supporting of natural resource and also to absorb the production outputs from processes. Moreover, "Green image" is portrayed in some companies to be closed-looped that is essential for attracting new customers and keeping the loyal ones (Flapper et al., 2005). Also, there are many factors to induce manufacturers to consider CLSC management in their process. One of the factors is the identification of business opportunities related to the residual value of end of life (EOL) products such as reduce raw material costs, manufacturing cost, distribution cost, after sales services cost, and disposal cost as well. Closing the loop may also able to create new profit opportunities by opening potential new markets and protecting market share as well (Flapper et al., 2005). Therefore, closed loop supply chain management (CLSCM) has been recognized as an efficient and effective strategy to alleviate environmental issues

toward the environmental sustainable practices and also as an economical strategy to provide economical and even social benefits to meet the customer's sustainability expectations (Olugu & Wong, 2011; Zailani et.al., 2012). Moreover, it has been proved that the companies' knowledge resources with an internal "know-how" in organization can successfully help waste abatement and thus this directly allows manufacturers to understand the complicated practical of performance problems (Simpson, 2012). So, it is eminent for manufacturers to implement manufacturing capabilities in order to increase the flexibility, cost control, quality control in production processes. It is believed that a firm's management of issue related to the natural environment might potentially benefit if they use capabilities/resources (Klasse & Angell, 1998).

This study is hereby seeking the empirical justification to investigate the relationship between environmental oriented SC alike close loop and its impact to environmental performance. The CLSC also has been argued would enhance the manufacturing capabilities. The theoretical model has been developed to be tested in the manufacturing industry. This study would benefit the manufacturing companies in order to find the practical implication to manage environmental oriented SC. Thus, in light of the current business pressure and challenge, the CLSC concept is one of the attractive choices in order to optimize EOL products (Kongar & Gupta, 2006) and the manufacturing processes. These CLSC concepts requires both traditional forward activities and reverse activities combines into a one single system in manufacturing (Krikke et al., 2004), with the potential to improve its environmental performance by raising green awareness in companies. This has been contributed for manufacturing

industries to achieve new standards (Pappis et al., 2004) and the CLSC would even enhance companies' competitiveness for each SC participants (Ferrer & Whybark, 2003) in a dynamic and complicated supply networks.

In order to get the comprehensive understanding on modern SC concept, a comparison was draw between the developed country (Germany) and the developing country (Malaysia). Germany and Malaysia have been chosen for this study because of the exchange program of Master of Business Administration (International Business) between Universiti Sains Malaysia (USM) and Technische Hochschule Nürnberg, Germany. By comparing these two countries, the difference of each country towards the effect of CLSC practices on environmental performance can be contributed to the existing literature from business perspective. According to Pujari and Wright (1996), a study was carried out to compare the developed and developing countries' environmentally conscious manufacturing companies in managing SC. This study has been argued that there is a need that environmental issues should be taken in a company's SC and be integrated into business strategy. Thus, comparison between countries can thereby generate useful insights for theoretical robustness and the greening of these two countries could therefore provide a useful direction for future research. Thus, this study has chosen Germany and Malaysia as a comparison because German as being known as comparative advantage in the knowledge-intensive manufacturing sectors which is a part of its SC whereas Malaysia, has a comparative advantage in labor-intensive sectors of its manufacturing sectors. The developing country can learn some lessons from a developed county. Indeed, such comparative study of CLSC practices on environmental

performance between Malaysia and Germany has not yet been reported. However, in contrast to the widespread discussion, green issue and empirical studies on the CLSC topic appear to be limited in literature. Moreover, the scope of the above mentioned studies is very limited given the importance and comparison of the impact of environmental issues on SC. Yet, there are not many studies to examine the adoption and the implementation of CLSC practices especially for developing countries such as Malaysia. Thus, this present study is presented in the context of this research gap and addresses what is the impact of greenness of its CLSC practices in manufacturing companies of Germany and Malaysia. The research brings forward a proposed research direction on CLSC adoption and implementation in developing countries such as Malaysia.

1.2 Problem statement

Malaysia has tried every effort to become a developed nation since gaining its independence in 1957. In the past few decades, Malaysia has transformed from agriculture industry into manufacturing industry (Mokthsim & Salleh, 2014). With the drive of Malaysia's vision to be a developed country by the year 2020, the environmental quality is further threatened by the industrialization development (Rao, 2004). One the environmental issues in Malaysia is air pollution, which is caused by combustion processes of manufacturing renewable and non-renewable resources in energy-intensive sector and it directly emits the gases such as Carbon dioxide (CO_2), Suphur dioxide (SO_2) and Nitrogen oxides (NO_X) to the environmental (Shafie, Mahlia, Masjuki & Andriyana, 2011). Figure 1.1 below shows the CO_2 gas emissions in Malaysia from 1980 until 2006

and the CO_2 emissions added up to 118 million tonnes in 2006 (Shafie et.al., 2011). Undoubtedly, due to the rapid growth of primary energy consumption of renewable or non-renewable resources in industrial sector, CO_2 gas emissions in particular have increased speedily since 1990s. This evidence is also indicated that environmental degradation processes precedes economic growth in Malaysia. Thus, it is not surprising that economic expansion in Malaysia triggers the high level of pollutions such as CO_2 emission to the environment (Ang, 2008).

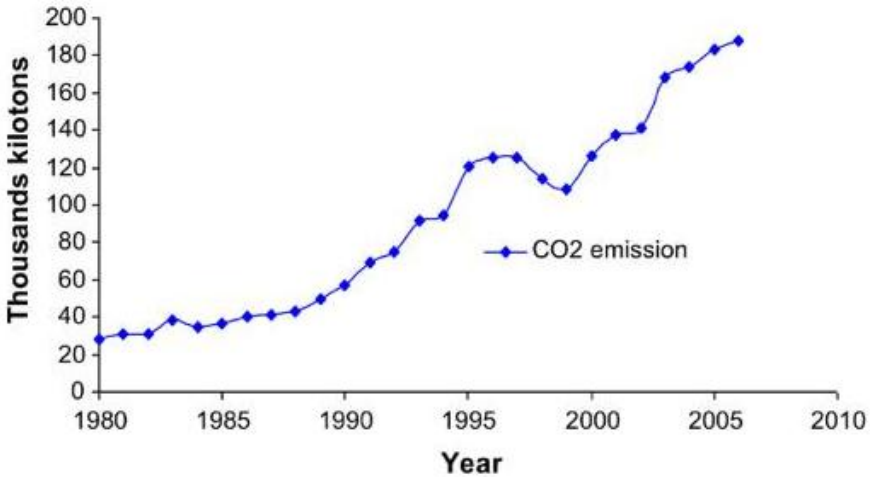

Figure 1.1 CO_2 emission at Malaysia, 1980-2006.

Source: Shafie, Mahlia, Masjuki and Andriyana (2011).

Malaysia, being a developing and middle-income country, its manufacturing industry is the leader industry to stimulate the economic growth. However, manufacturing industry is also highly regarded as one of the main contributors towards environmental concerns to the Malaysia government and also the public due to the intense media scrutiny of environmental issues (Mokhtar, Ta & Murad, 2010; Eltayed, Zailani & Ramayah, 2011; Zailani et. al., 2012). The rapid development of manufacturing sector led to the adverse impact on environment, due to the increasing amount of toxic pollutants

and hazardous wastes generated (Mokhtar et. al., 2010). Thus, it is recommended that the manufacturers should adopt CLSC practices. By building up closed-loop, it help improve environmental performance by reducing waste and "green" the production processes to be more environmentally friendly. Hence, it is noticeable that one of the goals of CLSC practices is to conserve the environmental and save the environmental by limiting the usage of resources (Carter & Jennings, 2002; Winkler, 2011; Amin & Zhang, 2012).

Concomitant with rapid industrialization in the past decade, Wah (1992) explained that industrialization development had a major impact to the health of shop floor employees in the industrial area. Approximately three to four hundred of 200,000 industrial workers were reported annually deaths at the workplace and another 13,000 are disabled in Malaysia. This happened because industrialization development caused "sinister killers" that consisted of poisonous and toxic chemicals, gases such as CO_2, SO_2, NO_2, dust, excessive heat, noise and vibrations with the symptoms that develop slow and sometimes unidentified (Zaman, 2012). Moreover, a past report illustrated that the major pollutants in Malaysia is heavy metals (e.g. lead, cadmium) from industrial emissions and it has been found in water-way that exceeds the minimum recommended levels (Abdullah, 1995). Indeed, this lead can influence human brain and nervous system (Foon & Kong, 1998). Furthermore, according to DOE (2012), the wastes (e.g. E-waste, oil & hydrocarbon, heavy metal sludge, paper & plastics, rubber sludge etc.) produced in Malaysia is higher in 2010 (1.8 million metric tonnes) as compared to 2009 (1.7 million metric tonnes).

Hence, manufacturing industry is believed to be responsible for these environmental problems (Beamon, 1999). Although numerous pressure groups has been formulated in Malaysia to monitor environmental issues such as non-governmental organizations (NGOs) and Environmental Protection Society of Malaysia (GPNM, 2003). However, environmental problems continue to persist in Malaysia in spite of government efforts and growing green awareness of the public. It is therefore this research is set as a platform to introduce Malaysia manufacturing industry to implement CLSC practices in order to solve the environmental problems. This study also contributes to the CLSCM literature and environmental performance especially in the Malaysian context, as the integration between CLSC practices and environmental performance in industry is quite new. Moreover, Flapper et al. (2005) stated that in spite of a growing number of CLSC practices, "closing the loop" in SC was still relatively new phenomenon for business organization. Indeed, very little is known about the realities of industrial operations as the smart firms are not willingly to transfer their CLSC knowledge to others companies. In addition, according to Klassen (2009), most past research focused on CLSC modelling to give rise to create efficiency and optimal network design, with little emphasis has been given to the benefits of CLSCM to the environmental and society.

Furthermore, there has been an increasing concerns of global policymakers, researcher and public towards global warming and climate change issues due to the increased of greenhouse gas (GHG) emissions. In the European Union (EU), several studies revealed the environmental performance analysis regarding the GHG emissions with regard to provide scientific aspects to European environmental policies in response

to the climate change condition (Picazo-Tadeo, Castillo-Gimenez & Beltran-Esteve, 2014). Thus, Germany, as a developed country and a member of EU, it has already set ambitious goals of becoming almost greenhouse gas-neutral in future and GHG abatement by 95% compared to 1990 by 2050 (Umweltbundesamt, 2013). This past report stated that Germany's GHG neutrality is technically attainable in future. Therefore, Germany has taken many important steps to be a GHG neutral country in 2050 and the steps are closely related with the EU developments, EU policy and national policies to propagate the ambitious objective with the effort to reduce GHG and achieve GHG neutrality. Also, in order to ensure green action towards the green recycling and green disposal to avoid landfill, German manufacturing companies have to cope with EU regulations such as waste electrical and electronic equipment directive (WEEE) and also EOL products directive, paper recycling directive, and EOL vehicle directive. Additionally, there are even stringent regulations enforced in Germany such as take-back obligation for packaging and electronic devices. Moreover, past German research also indicated that environmental regulation should be included to stimulate the environmental investment on production growth in German manufacturing industry (Bohringer, Moslener, Oberndorfer & Ziegler, 2012). Besides, another past study also stated that manufacturing industry seems to be motivated to implement Environmentally Conscious Manufacturing which is one of the environmental regulations to protect the environment.

Indeed, based on the international agreement on climate change (Kyoto Protocol) from 1997 and legislation of the EU, German manufacturers have to buy certificates to be allowed to emit GHG (Mittal, Sangwan, Herrmann, Egede & Wulbusch, 2012). Yet, the

German manufacturing industry was responsible for 13 percent of the country's CO_2 emissions in 2009, due to fuel consumption. Moreover, the policy in EU such as "Europe 2020" is the growth strategy which aiming sustainable growth by reducing the GHG emissions and developing green production (EC, 2010; Ghisetti & Rennings, 2014). Thus, German manufacturing industry has the responsibility to take green practices in order to reduce GHG emissions and also to achieve GHG neutrality in future 2050.

In fact, before 2000, there was relatively few research linked between SCM and environment (Shang, Lu & Li, 2010). Moreover, past findings from Seitz & Wells (2006) stated that SCM only concentrated on the efficient and responsive of production and delivery system from the manufacturers to the end-users and thus scant attention were given to the environmental concerns. However, environmental issues in the SC are significantly growing due to the broader debate initiated on how industry respond to the sustainability challenges (Seitz & Wells, 2006). And thus, the question was raised regarding what are the actual environmental outcomes that can be realized in the SC. Additionally, Zailani et al. (2012) claimed that SC managers faced pressure from stakeholder to integrate the sustainable in SCM that are deemed to be vital for eco-friendly packing, EOL and used product returned to the manufacturers as well as the environmental-friendly handlings of returns, recycling, reuse and so on. Also, the scholars and practitioners faced a challenging issue to improve their manufacturing capabilities and as companies develop proficiencies and capabilities for greener production, research should continue in its quest to better comprehend the potential link between SC systems and environmental performance (Hajmohammad, Vachon, Klassen,

& Gavronski, 2013). Therefore, this study tries to cover these gaps and focus on how the CLSC practices exert significant influence on the environmental performance.

Moreover, most of the research designed the SC focused on operational performance metrics and neglected the environmental performance (Paksoy, Bektas & Ozceylan, 2011). Furthermore, Eltayed et. al, (2011) researched the extent of the green SC practices among the ISO 14001 certified companies in Malaysia and reverse logistics was found to have only positive effect on cost reductions but no significant relationship on environmental aspects. Besides, a survey was carried out among 400 manufacturing firms in Malaysia, the results also was found the aligns with the notation that business benefits was expected to have a significant effect on sustainable SCM practices, particularly from economic and social aspects (Zailani et al., 2012). Thus, there is a gap in the literature concerning the impact of environmental performance improvements on CLSC practices. With regard to the increased external environmental demands, such as stringent regulations and increased customer demands, manufacturing companies need to enhance their manufacturing capabilities in evaluating, planning and controlling the environmental performance. In addition, the available literature indicates that there is a lack of knowledge among practitioners regarding how to measure environmental performance in SCM (Bjorklund, Martinsen, & Abrahamsson, 2012).

A considerable amount of companies began developing and using environmental sustainability indicators (Veleva et al., 2003). Supply chain managers have to consider the impact of their performance towards the natural environment (Zhu et al., 2008;

Zsidisin & Sifert, 2001). The findings of Cuthbertson and Piotrowicz (2008) also suggest that environmental criteria are increasingly essential in order to sustain the business. Both researchers and practitioners that examined the SC measurements have to focus not only financial but environmental aspects as well. The findings of Vasileiou and Morris (2006) also illustrated that greater importance was given to environmental factors that act to indicate business performances and act to influence on decision making. Moreover, environmental protection has been stressed on (Shang et al., 2010) due to the global warming and fluctuating oil prices, and thus it is necessary for manufacturers to specifically consider environmental factors when implementing SCM (Paksoy et.al., 2011). Additionally, the findings of Cuthbertson & Piotrowicz (2008) stated that the approaches of performance measurement seldom include the environmental aspects and they urged that environmental SCM performance measurement tools was one of the important issue to be considered in future research. The limited understanding of environmental management in the SC also limited the development of a widely accepted framework that would characterize and categorize environmental activities in the SC (Vachon & Klassen, 2008). Yet, overall environmental performance measurement and supporting systems, across SC has not been as extensively studied (Hervani, Helms & Sarkis, 2005). The mix of the past finding stated above gives rise to a possibility combination of challenging issues to the researchers. However, the benefits of such as under-investigated area cannot be denied. This study is premised on these research gaps. Moreover, according to Caniels, Gehrsitz & Semeijn (2013), manufacturing green products with green practices are fast evolving into an order wining criterion, making competition on being green as fierce as on the traditional SC areas. Hence, there is a need

to investigate the way on how to improve environmental performance by utilizing the manufacturing capabilities (cost control, quality control and flexible manufacturing). The CLSC literature has been used to shed some light on the environmental performance in manufacturing industry.

1.3 Research objectives

This study attempts to achieve the six main objectives below:

1. To investigate the most effective type of CLSC practices that could strongly related to environmental performance (reverse logistics & forward logistics).
2. To examine the relationships between CLSCM on manufacturing capabilities.
3. To examine the effect of manufacturing capabilities on environmental performance.
4. To investigate the mediating effect of manufacturing capabilities on relationship between CLSC and environmental performance.
5. To examine the environmental performance of manufacturing companies which implementing CLSC.
6. To compare the research constructs between Germany and Malaysia.

1.4 Research questions

Six research questions are formulated as below to accomplish the research objectives:

1. What is the most effective type of CLSC practises that strongly relate to environmental performance?
2. Is there any relationship between CLSC on manufacturing capabilities?

3. What is the effect of manufacturing capabilities on environmental performance?
4. Does manufacturing capabilities mediate the relationship between CLSC and environmental performance?
5. What is the outcome of environmental performance of manufacturing companies which implementing CLSC practises?
6. What is the research constructs difference between Germany and Malaysia?

1.5 Definition of key terms

The following key term's definitions are given in order to share a common understanding on the concepts and better understanding for further discussion.

1.5.1 Closed-loop supply chain

Closed-loop supply chains (CLSC) consists of forward and reverse chain that is the manufacturing and distribution of new products from manufacturing plants to the customers and the return of the used products from the customer back to the manufacturing plant and suppliers (French & LaForge, 2006).

1.5.2 Environmental performance

Environmental performance is defined as the extent to which company processes and practices to better resource utilization, waste reduction and environmental risks diminish (Roberts & Gehrke, 1996).

1.5.3 Manufacturing capabilities

Manufacturing capabilities are the bottom-line of know-how in manufacturing that companies are able to achieve production-related objectives involving such matters as consistent product quality that conforms to specifications, cost control, volume and product flexibility, and delivery dependability (Boyer & Lewis, 2002).

1.6 Significant of study

Closed-loop supply chain will be one of the relatively new-fangled supply chains in the future growth for sustainable manufacturing capabilities that potentially improve the environmental performance. This study is the empirical study of CLSC from the SC perspective that could make several notable contributions to the manufacturing industry or the society.

1.6.1 Theoretical contribution

Theoretically, this study provides theoretical framework for SC researchers and also the scholars who interested to explore the CLSC that can enhance the environmental performance by fully utilizing the manufacturing capabilities. This study introduces the CLSC model and lays a good foundation to explore how manufacturing companies can react to the potential growing threats of the scarcity of natural resources. Moreover, the collective understanding of CLSC issues remains scanty in these days despite a growing body of literature covering topics related to RL management. Yet, this study will be the earlier among others attempt to fill this research gaps and thus provide several distinct contributions to the SC literature.

In addition, Resource-Advantage (RA) theory is used to explain the practice of CLSCM that used manufacturing capabilities that effective in term of cost, flexibility and quality control to enhance the environmental performance. This study attempts to provide insights to SC scholars to understand how economic activities affect the scarcity of a resource. For example, the SCM activities involve in recovering the resources may directly reduce the extraction of renewable resources and also non-renewable resources such as metals, oil and mineral. Moreover, it may also indirectly reduce the degradation of the natural resources that are being polluted by the mining and extraction of non-renewable resources. Therefore, this study provides evidence link among the natural resources used as raw materials by the company and internal resources, capabilities and knowledge used by a company to convert the inputs into outputs and thus enhancing the environmental performance. Specifically, the role of CLSCM is evaluated as a capability for creating resource advantages that can lead to marketplace competitive advantages. Moreover, relatively less is known about how the value of manufacturing capabilities can be enhanced by CLSC and also the linkage between manufacturing capabilities and environmental performance outcomes is strengthened. This knowledge gap provides the impetus for the current research. Besides, previous studies on CLSC much focused in other operations areas such as product returns in inventory management, remanufacturing issues on product return. However, other research gap such as the mediating effect of manufacturing capabilities on relationship between CLSC and environmental performance are less focused and tend to be neglected.

1.6.2 Practitioner contribution

Practically, this study increases awareness on importance of CLSC practices in manufacturing companies, and also the question arises about how to diffuse these valuable and important CLSC practices among manufacturing companies in Malaysia. This study also associates that CLSC practices with better environmental performance to reduce hazardous wastes, toxic pollutants and material use. Therefore, it may raise the level of green awareness of environmental issue in a firm and thus directly create value to the companies. Moreover, the development of the CLSC research framework would also be a great added benefit to the manufacturers and customers.

For example, the manufacturers could appropriate the benefits by offering the green products that can retain the environmentally conscious customers and employees, the returned goods from customers can reveal the valuable information for market survey such as customer satisfaction level, expectations level and opinion. Also, the philanthropy and goodwill of the company for taking responsible for good returns can significantly help improve the corporate reputation by portraying "green image" and this indirectly increase the market share. Indeed, with the adopting of CLSC practices that concentrate on reducing negative impacts on the environmental and promoting eco-friendly products, are expected to improve the company's image in the eyes of various parties such stakeholders, governments, customers, suppliers, employees and the society in general.

Therefore, this positive corporate image is very important and essential for the company to gain the intangible benefits such as customer satisfaction and loyalty in

addition to motive employees. Yet, this study also enables the manufacturers to collect the used products from customer. The manufacturers can transform the “valueless used products” into valuable raw materials or even refurnished it into new parts to produce new products. Furthermore, they can recover value from EOL products by recycling/reusing the materials or recovering energy through incineration. Therefore, this leads to environmental improvement through cleaner air and water, reduce risk of accidents, less demand for landfill and less demand for natural resources. Thus, this study definitely provides managerial contribution by guiding managers in setting a suitable operating context for adopting and implementing green practices within the organization.

Also, it can increase the company revenues from sale of reprocessed or remanufactured products. Besides, the green practices can also increase the customer value toward the awareness of environmental and lower customer risk for using the product that could bring negative impact to their health. Thereby, the customers can get the proper incentives for the return products too. Overall, closing the loop is always beneficial to business organization with respect to the better resource utilization and reduced waste.

1.6.3 Social Contribution

Despite the fact that an increasing attention is being given to green supply chain management and sustainable supply chain management, very little research has been undertaken in the area of connecting CLSC and environmental performance. Thus, this research induces manufacturers to involve in green practices to “close the loop”. Hence,

this leads to the environmental improvement, minimize the waste, reduce pollution and limit the greenhouse gas emissions to the environmental. Thereby, this indirectly promotes the population health. Moreover, by identifying the CLSC relationships, a higher understanding can be gained about the structure of the CLSC practices in manufacturing industry, and provide insights to understand how green of the CLSC practices can contribute to improve the company performance from an environmental point of view, as well as economic and operational performance. Furthermore, companies develop new products and services continually to meet customer satisfaction by portraying "green image". This can also reduce the natural resource using and thus reduce the environmental impacts globally.

1.7 Organization of the Dissertation

This study is structured in five chapters. Chapter one covers the introduction of background information pertinent to this study as well as the problem statement, research questions, research objectives, significant of the study and definition of the key terms. Chapter two provides insight from previous researchers' related studies which literature review on overview of Germany and Malaysia manufacturing industry, CLSCM, manufacturing capabilities and environmental performance and the variables in the theoretical framework. Theoretical framework and hypotheses development are discussed as well. Chapter three consists of the research methodology including the method of data analysis and measurement of variables to investigate the research problems. Chapter four analyses the results on the data collection whereas chapter five discusses the recapitulation of study findings, result and the theoretical and managerial implications.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

An overview of past literature with regards to the manufacturing industry in Germany and Malaysia, supply chain management (SCM), closed-loop supply chain (CLSC), manufacturing capabilities and environmental performance are discussed in this chapter. Moreover, this chapter also examines the role and relationships of each variable. Underlying theories which comprised of resource-advantages view as a main theory and natural resource-based view as a supporting theory are also added. The theoretical research framework and hypothesis development are discussed at the end of this chapter.

2.1 Overview of Manufacturing Industry

It is evidenced that the manufacturing industry is one of the most essential activities to stimulate the potential economic growth and account for gross domestic product (GDP) contribution, employment level, supporting for the development and innovation (Mittal et al., 2012). The fastest-growing of manufacturing industry is viewed as the important stimulator for both developed and developing country that functions as the biggest contributor to the GDP and also as the biggest employment sector. Moreover, manufacturing industry also serves as a pivotal backbone to

enhance citizen‟s quality of life and brings prosperity to the industrialised nation globally (Rahid et al., 2013; Mittal & Sangwan, 2014). However, the pace of development in technically developed countries has been slowed down as a result of the increased scarcity of natural resources and the continuation energy demand consumption. Whereas the manufacturing industry in developing countries has attracted investors‟ attention due to their unexploited potential for growth with respect to natural resources as well as human resources, together with their environmental regulations are comparatively less stringent than developed countries (Ganiyusufoglu, 2013). Moreover, the manufacturing industries are also facing some unpredictable challenges like rapid depleting of natural resources, steadily raising pollution level of soil, water and air and the severe impact of pollutant hazardous to human health. These challenges are substantially causing threats for achieving sustainable in general (Mittal & Sangwan, 2014). Indeed, manufacturers are under tremendous pressures from various parties such as stakeholders, along with the customers who are inclined to select eco-design products as well as governments‟ environmental regulations to demand them to make significant changes for their manufacturing activities (Zailani et al., 2012; Mittal & Sangwan, 2014).

Besides, the exponential growing of manufacturing industry is claimed to be consumed tremendous amount of resources, emitted large volume of GHG such as CO_2, and the major industry to cause the global environmental risks like climate

change and global warming (Mittal & Sangwan, 2014; Martin-Pena, Diaz-Garrido & Sanchez-Lopez, 2014). Indeed, these presented environmental pollution scenarios were viewed as the key element that precedes organizations‟ poor financial performance (Hart & Ahuja, 1996). Therefore, manufacturers started to recognize that the underpinning principles of firms‟ environmental performance is the competitive advantages (Wagner, 2005) and hence they started to take necessary actions by implementing green practices to develop new products, new market opportunities and invest green technology (Masoumik, Abdul-Rashid & Olugu, 2015). Moreover, the ethical dimension is also embedded during manufacturing activities as a distinct objective towards the environmental impact as well as the unforeseen widespread of environmental ramifications (Flannery & May, 2000). Furthermore, Trevino (1986) also underscored the existing of ethical issue where manufacturers should consider about ethical dilemmas as it adversely affects human health and natural ecosystems (Flannery & May, 2000). Thus, it is nature of manufacturing companies to be argued as a "creator" of environmental problem and therefore the companies have to strike their best to extend its environmental responsibility and reduce these impacts of waste and pollution throughout the supply chain. However, these actions are not only involving their own plants but it demands the participation of external suppliers in their supply chain (Canning & Hanmer-Lloyd, 2001; Saha & Darnton, 2005; Devika, Jafarian & Nourbaksh, 2014). Also, it should be noted that there are many benefits if manufacturing industry adopts green practices like it enables them to develop safe and

green products, retrain loyal customers for long term, have a good reputation, gain public image as well as reduce the total operating costs (Harrison & Lewellyn, 2004; Masoumik et al., 2015). However, if the companies are intertwined with the risk of designing unsafe products and they will eventually involve into social impacts like public perusal, negative publicity on media, governments laws and may increase the total expenditure towards operating costs (Harrison & Lewellyn, 2004). Accordingly, this study introduces practitioners the CLSC practices which attribute to the environmental performance. Thus, CLSC practice has been viewed as the reliable robust solution to these issues especially to issue of resource scarcity (Rashid et al., 2013).

2.1.1 Overview of Germany and its manufacturing industries

Germany has high population density of any EU country (82 million) with total area 356 854 km² (Eubusiness, 2014), high industrialisation level and located in central Europe. Accordingly, Germany strongly relied on fossil fuels for its energy supplies that contributing to make environmental protection continually warrant further public attention and therefore placed even a higher priority for its environmental policy Also, Germany is one of the few members in OECD that collectively decoupled the GHG emissions from its economic growth since the year of 2000s (OECD, 2012). As a member in EU, Germany"s environmental policy is subjected to the EU environmental legislation and the internal EU market (Umweltbundesamt,