EXPLORATORY STUDY OF ENVIRONMENTALLY SUSTAINABLE SUPPLY CHAINS IN NEW ZEALAND FOOD INDUSTRY

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ABSTRACT

The purpose of this study is to investigate the development of environmental management, in particular in terms of logistics and supply chain perspective in New Zealand food industry. Both qualitative and quantitative research methods were applied in this exploratory study.

The results have found out that in recent years, energy-climate issues have affected the food industry's logistics and supply chain development and performance. However, the effects have been neglected by most of the New Zealand food organizations due to the various internal and external barriers. The results indicated a number of issues:

- A lack of robust supply chain management system
- A lack of focusing on sustainable supply chain
- A lack of the knowledge of environmental sustainable management from managers
- A lack of trust and relationship in the supply chain system
- A lack of incentives and encouragement from government perspective
- A lack of stimulation for environmental concerns in domestic market

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Chapter 1 Introduction

1.1 Introduction

The linkage between energy and climate is unbreakable (Halldorsson & Kovacs, 2010). Because of the urgency, the energy-climate issues are the focus of the debate in global economic development. It has become a crucial factor challenging the world business. Since logistics and supply chain is the key part in the business management, both of these impacts—energy and climate issues in business lead to the challenges in logistics and supply chain management

On the one hand, the rising energy prices and more frequent environmental disasters resulted from the energy crisis and climate change are constraining the development of logistics and supply chain management (SCM) leading to an adverse effect of global business(Halldorsson & Kovacs, 2010). On the other hand, traditional logistics and SCM contributes towards the acceleration of energy-climate issues (Carter & Easton, 2011; Van Hoek & Johnson, 2010; Wu & Dunn, 1995).

To solve the conflicts, the environmentally sustainable supply chains are urgently required since green supply chain management (GSCM) could mitigate the impacts caused by energy crisis and climate change.

1.2 Energy Crisis and Climate Change

1.2.1 The Facts of Energy Crisis

The world business is developed by a number of finite energy resources, such as coal, oil and natural gas, in particular oil consumption. The demand for oil is growing rapidly from developing countries. "Annual world oil demand growth has been close to 1.8 per cent since the early 1990s, and the new industrial countries of East and South East Asia have typically shown national growth rates for oil consumption of 3.5 to 5 per cent per year, and China's growth of oil consumption averaging 7 per cent over the last ten years"(Korpela, 2008, p. 36). The oil consumption from developed countries does not slow down either. In US, it is estimated that oil consumption will grow 50 per cent in 20 years (Appenzeller, 2004).

The development of the global economy is completely oil dependent. “Oil provides some 40 per cent of the world’s energy needs and as much as 90 per cent of its transport fuel” (Campbell, 2008, p. 48). This dependence raises the question of how long the oil could last. According to Korpela (2008), the world oil production will peak by 2011. At current extraction rates the amount of time left is measured in decades (Archer & Rahmstorf, 2010)

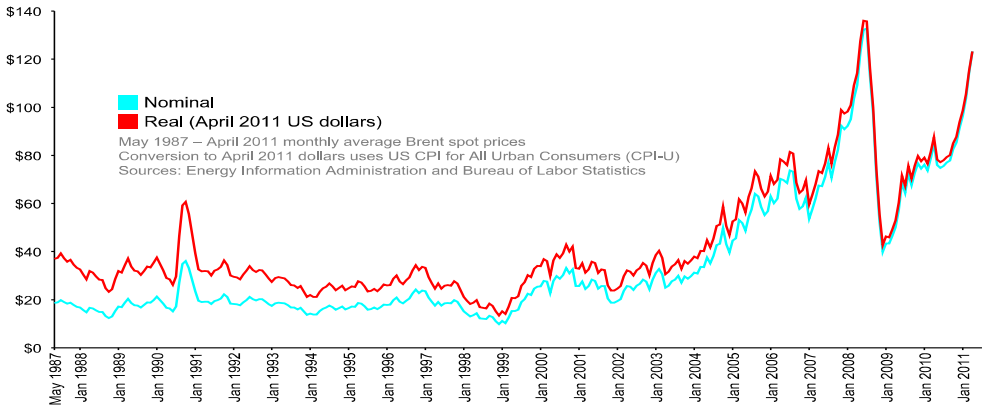
Soon the world will run out of the cheap oil (conventional oil). “Of the 50 highest-producing oil countries, 18 have now passed their peak, even according to conservative estimates” (Giddens, 2009, p. 41). It is getting difficult to discover oil fields and meanwhile more expensive to extract oil. Oil extraction locations have been extended from conventional oil field into deeper water field and moved to politically less stable regions (Middle East) (Appenzeller, 2004; Campbell, 2008; Giddens, 2009; Lapide, 2009).

The conflict between the increasing global energy demand and the shortage of the energy supply will only indicate one direction for the energy price – upward (Giddens, 2009). A few years ago, the oil price was mainly dominated by the global demand: oil prices have skyrocketed as high as $147 per barrel when the demand was increasing in 2008. With the global financial crisis happened, the oil price was dropped back to $40 per barrel due to the decline of oil demand (Giddens, 2009; Lapide, 2009).

However, today, oil prices are influenced not only by the fluctuation of global demand, but also by the reliability of energy supply. Because of the unreliable supply caused by the shortage of resources, terrorist attacks or civil wars and high production cost, the price would not drop back to $20 or $30 per barrel anymore (Lapide, 2009).

Based on the information from EIA (U.S energy information administration), the oil price was about $80 per barrel in 2010. It is almost three times higher compared to decades ago. As shown in Figure 1.1 that the latest data on cost per barrel has climbed up to about $120 per barrel by April 2011.

Figure 1.1 Imported Crude Oil Prices



Source: http://en.wikipedia.org/wiki/File:Brent_Spot_monthly.svg#file

The cheap oil is dead. With the global economy keeps growing on the demand of oil, it is inevitable that oil crisis and high oil prices would dramatically disrupt and constrain the development of the global economy (Appenzeller, 2004; Lapide, 2009; van Ruijven & van Vuuren, 2009). Unlimited global economic growth has added the pressure to limited energy resources. In recent years, even though energy prices keep rising, little action has been taken to curd the energy usage (Campbell, 2008; McCluney, 2008).

1.2.2 The Facts of Climate Change

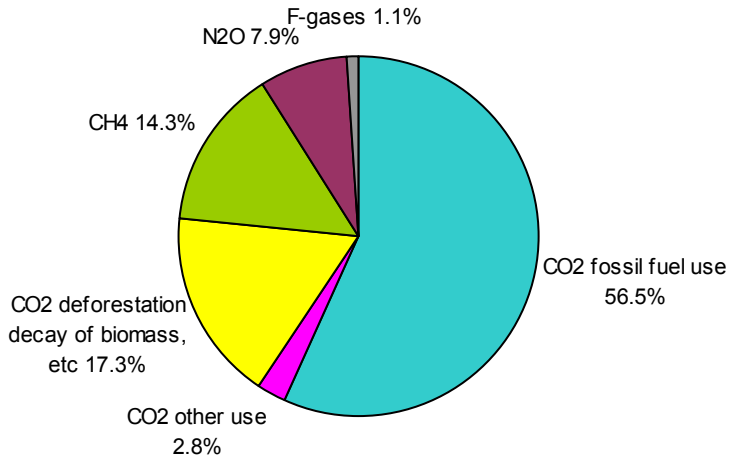
Climate change is happening. The past couple of years global warming impacts are more clear and frequent: floods, hurricanes, earthquakes, fires, raising sea-level, extreme weathers. It is considered to be an inevitable result of energy consumption including human activities (Lash, 1998).

The industrial world has an enormous growth which is considered to be a contributing factor to the high level energy consumption. “The demand for energy is projected to grow 50% by the year 2030 under business-as-usual” (Archer & Rahmstorf, 2010, p. 196).

Energy consumption is the vital resource for the emission of carbon dioxide CO_2. Which is the most important contributor of greenhouse gas (Schafer, Heywood, Jacoby, & Waitz, 2009). "Burning a litre of gasoline, diesel, or jet fuel in an automobile or aircraft engine releases early 2.5 kilo grams of CO_2, a major greenhouse gas (GHG) into the atmosphere" (Schafer et al., 2009, p. 11). The United Nation's International panel on Climate Change (IPCC) has identified that emission of greenhouse gases (GHG) as the primary driver behind significant and potentially critical changes in global climate (The International Transport Forum, 2008).

Energy-related activities can emit greenhouse gas (GHG) and have warming effect to atmosphere (Schafer et al., 2009), such as the transportation system, which has a strong dependence on oil. "Transportation uses 24% of our energy production and it is the fastest growing sector of energy use" (Archer & Rahmstorf, 2010, p. 205). Figure1.2 shows that 56.5% GHG was derived from fossil fuel. Economic growth has resulted in the fact of the increasing temperature on the earth's surface (Archer & Rahmstorf, 2010; Browne, 1998). "The global average temperature has risen about 0.7ºC already in response to rising greenhouse gas concentrations" (Archer & Rahmstorf, 2010, p. 224).

Figure 1.2 Greenhouse Gas Emission



Source: Archer, 2010, p.195

Meanwhile, driven by an increase in the price of gas and oil, the demand on coal has raised since 2000, resulting in the rising of CO_2 emission (Archer & Rahmstorf, 2010).

The impacts of global climate change and energy crisis could affect virtually every one on earth: human health; water and food supplies; energy supplies; productivities of natural system et al. (Lash, 1998). As a result, the future of the global economic development depends on how people are going to manage the global economy today.

1.2.3 Demand on Sustainable Management

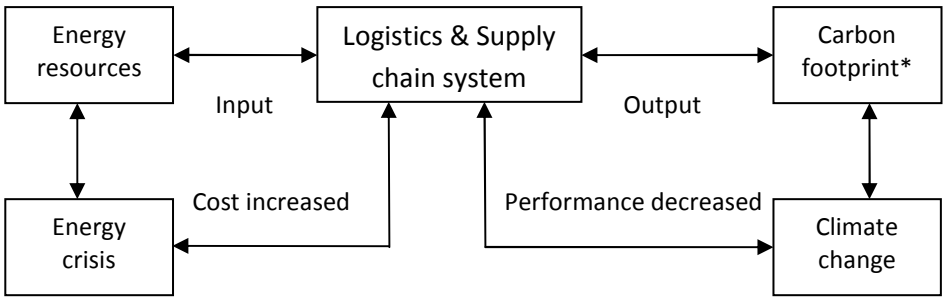
The development of the world economy is facing two pressures: energy crisis and climate change. Serious environmental problems and energy issues have arisen with the global economic growth. The topic of sustainable management has emerged in the agenda of world economic development. (Wu & Dunn, 1995).

In order to mitigate the effects resulted from energy-climate issues, people start to look for alternative energies to replace oil. But it is still a long run before it becomes reality (Lapide, 2009). Until then, fossil fuel energy will still be the main energy resource to support the development of global economy. Thus, the only solution to mitigate the impacts of this issue is to use energy efficiently by restructuring the traditional operation strategy towards an environmentally sustainable management.

Inefficient energy consumption not only wastes energy resources but also contributes to the global warming—climate change. How to slow down the global warming speed should be the priority concern in today's global economic activities (Davies, 2008).

Figure 1.3 depicts that it is an interactive relationship between energy-climate impacts and logistics and supply chain management. The demand of environmentally sustainable management is stimulated not only by the rising oil price and the needs on stable environment concerning the importance of human being survival, but also from current rising pressures of business performance and developments in the market place concerning the needs of extra value creation (Halldorsson & Kovacs, 2010; Wu & Dunn, 1995)

Figure 1.3 The Framework of Energy-Climate Impacts and Supply Chain Management



* Carbon Footprint: The amount of greenhouse gas emissions(carbon dioxide) produced by an individual or an organization, or the amount used in the manufacture and distribution of a product (Blanchard, 2010, p. 205).

1.3 Supply Chain Development

Since 80s, low energy costs, especially oil prices, and a relatively stable environment have provided substantial opportunities for logistics and supply chain management towards the evolvement of global integration. The development of logistics and supply chain activities was rapid and dramatic during the period of the cheap oil era. (Christopher & Holweg, 2011; Halldorsson & Kovacs, 2010; Lapide, 2010).

The low oil costs enabled organizations to pursue worldwide suppliers with low operation costs (such as labour cost and facilities cost), to reduce manufacturing cost without taking into account of distribution distance (Mollenkopf, Stolze, Tate, & Ueltschy, 2009), to establish decentralised warehouses achieving high customer service performance without respect to the impacts on environmental aspect (Aronsson & Brodin, 2006).

Furthermore, the relatively stable environment has provided a stage to enable organizations to achieve the goal of delivering the right amount at the right time to the right place at the right price. On time delivery with rapid respond to customer demand is the vital competitive strategy amongst most organizations to increase customer service performance (Christopher & Holweg, 2011). Transportation as crucial activity plays an important role in the development of logistics and supply chain management.

The benefits of a significant reduction on costs and increased customer services performance have driven organizations to design the logistics and supply chain structures based on these approaches: Just in time (JIT), global sourcing, and zero inventory control without taking into account of natural environment disruptions and consequences of energy consumption and impacts on environment (Aronsson & Brodin, 2006; Van Hoek & Johnson, 2010; Wu & Dunn, 1995; Yang, Yang, & Wijingaard, 2005). Today's supply chain structures are built on the promise of stable environment, inexpensive and plenty petroleum-based fuel and labour cost for a long time (Christopher & Holweg, 2011; Halldorsson & Kovacs, 2010).

1.4 Logistics and Supply Chain Activities Accelerate Energy-Climate Issues

The establishment of the logistics and supply chain system is to utilize the material flow from the raw material to the end consumers, which is cross-functional and integrative. So many activities are impacting the energy resources and environment (Wu & Dunn, 1995).

For instance, material moving needs transportation systems to complete the tasks. As the biggest operation sector in logistics and supply chain management, transportation is a giant consumption of energy as the fact that it almost totally depends on the use of petroleum fuels (Schafer et al., 2009). Ninety-four per cent of worldwide transportation system depends on petroleum products: gasoline, diesel. And 20 per cent of global primary energy consumption is derived from global transportation system (Halldorsson & Kovacs, 2010; Schafer et al., 2009). The economic globalization only could bring enormous challenges on transportation operation considering the energy climate impacts (Aronsson & Brodin, 2006; Halldorsson & Kovacs, 2010; Johansson, 2003; Schafer et al., 2009; The International Transport Forum, 2008).

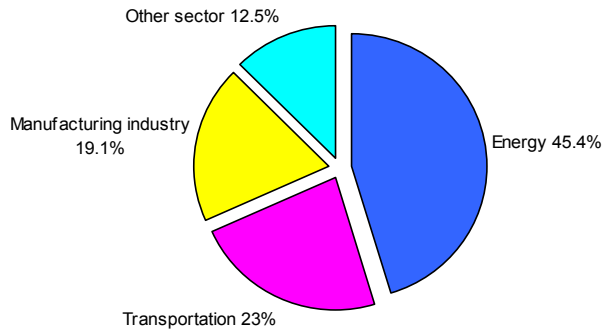
Moreover, the growth in energy consumption not only caused the concern of energy security but even more serious problem from the environment aspect—global climate change (Johansson, 2003; Schafer et al., 2009).

Logistics and supply chain activities produce a huge amount of carbon footprint in the environment. In particular, one major source is from transportation activity which has been recognized for many years as the contributor of GHG emission, air and noise pollution (Aronsson & Brodin, 2006; Johansson, 2003; Wu & Dunn, 1995).

According to The International Transport Forum (2008), transportation was responsible for 23 per cent of world GHG emission in 2005 as shown in Figure 1.4. Road transportation took up 74 per cent of it. Meanwhile, the GHG emission from transportation sector is rising at a fast rate. As the second major contributor of environment problem, in 2007, the percentage of GHG emission has raised to 33 per cent (Aronsson & Brodin, 2006; Lapide, 2010).

"Logistics and supply chain management affects the environmental, social and economic performance of organizations" (Van Hoek & Johnson, 2010, p. 149). Traditional cost efficient logistics and supply chain systems are energy-inefficient (Lapide, 2010).

Figure 1.4 World CO2 Emission from Fuel Usage



Source: (The International Transport Forum, 2008)

From environmental point of view, in contrast with a conventional view, JIT as high value approach by saving inventory carrying cost has resulted in more frequent deliveries, additional traffics, packaging, handling and demands on new road systems. With the rising of oil prices, traditional JIT approach would be questioned if increasing inventory level is cheaper than frequent transport costs (Mollenkopf et al.,

2009; Wu & Dunn, 1995; Yang et al., 2005). Moreover, inefficient road freight transportation can cause the increase in the level of CO_2 emissions (Sanchez-Rodrigues, Potter, & Naim, 2010).

Same as global sourcing approach, in order to achieve the cost benefits, supply chain managers tend to looking for the sources from low-cost countries. Nevertheless, from sustainability point of view, the long supply chains have led to an acceleration in energy consumption and GHG emission from the transportation system and it accelerates the energy-climate issues (Van Hoek & Johnson, 2010).

Apart from the transportation sector, the other supply chain activities also have responsibilities on the climate change and energy crisis. For instance, frozen warehouses require energy for temperature control; lighting; and administration (electricity and water et al.). Manufacturers use energy inefficient machineries or packaging systems generating waste and hazard materials. With the energy consumption involved, these operation processes will produce GHG emissions which are responsible for the climate change (Aichlmayr, 2002).

1.5 Energy-Climate Issues Affect Business Development

Energy crisis and climate change are real. Every individual and business is facing the energy-climate risks. The impacts of energy-climate issues are the threatens in front of the society, which are affecting the global business development (Davies, 2008; Lash & Wellington, 2007; The International Transport Forum, 2008). Energy-climate issues are challenging logistics and supply chain activities.

Traditional cost efficiency only has always been a pivotal driver for every company to evolve the business in order to success in global competitive environment, without respect to the impacts on energy consumption and environment. Gradually, the effects of energy-climate issues occurred in every corner of the global economy (Halldorsson & Kovacs, 2010).

One of the biggest impacts from raising energy prices and unexpected natural disasters caused by climate change is the cost. Theoretically, “the purpose of logistics is to reduce costs which are involved from the materials moving through the supply

chain, notably transport costs. In addition, economies of time and improvement in service, reliability, flexibility are further objective" (Rodrigue, Slack, & Comtois, 2001, p. 342). Energy is vital in logistics and supply chain activities, it is unavoidable that the overall supply chain operation expenses and costs of goods would increase with the rising of energy prices.

Nowadays, companies are struggling to control the operation costs (Halldorsson & Kovacs, 2010; Tanowitz & Rutchik, 2008). For instance, it was evaluated that from major transportation providers, fifty per cent of the total cost goes to transportation cost (Tanowitz & Rutchik, 2008). Also, in the air cargo industry, the fuel costs account for 30-35 per cent of total costs. The high oil prices are impacting profitability (Halldorsson & Kovacs, 2010). Ferreira and Prokopets (2009) pointed out that the cost of ocean freight has increased 135 per cent. The benefit of outsourcing on saved labour cost could be offset by transport cost. Supply chain managers need to consider a near-shoring strategy rather than off-shoring in order to create the balance between cost-effective and environmental sustainability (Murphy, 2008).

In addition, the environment issues as the most substantial forces influence and shape the economy. The overall supply chain performance could be influenced by unexpected disruptions of natural hazards, such as earth quakes, hurricanes, flooding and storms, which increase the disruption risk on business operation (Halldorsson & Kovacs, 2010). For example the recent Florida series of hurricanes in 2004, hurricane Andrew in 1992, and the Kobe earthquake in Japan in 1995 caused huge shipping disruptions in Florida and the Far East, and large losses to industry (Kleindorfer & Saad, 2005). The consequences of environmental uncertainty are not only affecting the costs and performance of supply chain management (Halldorsson & Kovacs, 2010; Sanchez-Rodrigues et al., 2010).

Driven by the fluctuated energy supply and dramatic climate changes, the overall logistics and SCM is getting expensive and disrupted. The world economy is encountering the pressures (Halldorsson & Kovacs, 2010; Sanchez-Rodrigues et al., 2010).

The global business is in the time of uncertainty: the uncertainty of energy supply; uncertainty of weather conditions; uncertainty caused by unexpected disruptions from politics and natural environment. There is no doubt that energy-climate issues will constrain global economic development (Halldorsson & Kovacs, 2010).

1.6 Environmental Sustainable Supply Chain Management

Energy-climate issues have caused unexpected demand and supply disruptions in today's business operations resulting in a turbulent environment (Christopher & Holweg, 2011; Sanchez-Rodrigues et al., 2010; Singh, 2009). Within the turbulent environment, it forces organizations to re-visit current logistics and supply chain structures which designed under assumption of stability on environment and energy, such as worldwide supply chain systems, frequent transportation strategies (Christopher & Holweg, 2011). More structural flexible logistics and supply chain strategies need to be created in order to fit into the increasing uncertainty of global business environment (Christopher & Holweg, 2011).

As a critical issue, people have started to realize the impacts of energy-climate issues in business development. Sustainability has gradually become the vital consideration of the strategic planning agenda in some international organizations. Logistics and supply chain management as the key component in business management, plays a pivotal role in order to achieve the sustainability in business because it strongly influences component selection, materials sourcing, production, packaging, distribution and recycling decisions (Closs, Speier, & Meacham, 2011).

The triple bottom lines of economic, social and environmental performance towards corporate social responsibility management is a more comprehensive approach aligned with suppliers and customers crossing the whole corporate functions (Davies, 2008; Porter & Kramer, 2006; Preuss, 2005a, 2005b). It could result in an improved efficiency and profitability in business. Sustainable supply chains could strengthen firm's ability to plan, respond to and recover from potential global risks (Closs et al., 2011).

In order to improve market position and enhance a competitive strength on the intense global competition stage, it is time to build 'green' logistics and supply chains. Concerning the factors of climate change and energy crisis, green supply chain strategies could lead the supply chain system onto the track of more cost efficient, more energy efficient, more customer focused by integrating sourcing, manufacturing, distributions, transportation and recycling processes. It contributes to the mitigation of the negative effects on the natural environment caused by business activities (Blanchard, 2010; Halldorsson & Kovacs, 2010; Handfield, Sroufe, & Walton, 2005; Walton, Handfield, & Melnyk, 1998). "Green logistics and supply chain management is not just about being environmental friendly, it is also about good business sense and higher profits. It should be a business value driver not a cost centre" (Srivastava, 2007, p. 54).

Eventually, environmental management would benefits corporation's financial performance, which would generate benefits in terms of cost and quality (Vachon & Klassen, 2008) and lead to improved organization outcomes, increased profit and reduced costs (Closs et al., 2011; Klassen & McLaughlin, 1996; Pil & Rothenberg, 2003).

Hence, logistics and SCM needs a new direction—environmental sustainable supply chain management. Driven by increasing concerns of regulatory or social changes, customer preferences, competitive pressure, and environmental issues, traditional logistics and SCM pursuing economic optimization only is encountering the challenges and demands of adjustment (Carter & Easton, 2011; Walker, Sisto, & McBain, 2008). Lee Scott (cited from Closs et al., 2011, p. 101), CE of WalMart stated that " being a good steward of the environment and our communities, and being an efficient and profitable business are not mutually exclusive. In fact, they are one and the same". To look for a competitive edge continuously, it is not enough focusing on economy only (Aronsson & Brodin, 2006; Preuss, 2005b).

Two ways to achieve sustainability of logistics and SCM (Aronsson & Brodin, 2006) are either using alternative fuels such as new technology bio-mass, hybrid electric (Johansson, 2003; Rogers, Kelly, Rogers, & Carter, 2007; Wu & Dunn, 1995); or to alter the supply chains structures or managing approaches – the way of the

corporations managing the activities, by taking into account comprehensive environmental issues into supply chain strategies and corporation functions (Handfield et al., 2005; Preuss, 2005a, 2005b).

Environmental sustainability needs to be considered along with the decision making of logistics and supply chain activities and it needs to be integrated with the supply chain strategies (Aronsson & Brodin, 2006). Collaboration between suppliers and customers is paramount in the implementation of environmentally sustainable supply chains (Closs et al., 2011). It is desirable to focus on working with suppliers and customers, from internal operations and processes to extended product life-cycles towards collaborated environmental management in the supply chains (Mollenkopf et al., 2009; Vachon & Klassen, 2008; Walton et al., 1998). Besides, it has been examined that cooperative environmental management has a positive linkage to superior improvement on delivery, flexibility and quality performance (Pil & Rothenberg, 2003; Vachon & Klassen, 2008).

"Do the right thing" (p. 3) has to be the paramount in today's business. Successful corporations and health society are interdependent. The world business would not be flourished without either part (Porter & Kramer, 2006).

Nevertheless, because of the nature of uncertainty and complexity in environmental information, makes it more difficult to transit into green supply chain management. There are lack of measurements and limited understanding with regard to the environmental sustainable management (Sharfman, Shaft, & Anex Jr., 2009; Vachon & Klassen, 2008).

Generally speaking, can't measure it, can't manage it. In order to effectively manage the supply chains in the turbulent global market, it is essential to adopt comprehensive environmental measurement initiatives to monitor the performance from environmental point of view, such as carbon footprint measurement or ISO14001 (Handfield et al., 2005; Preuss, 2005a; Shaw, Grant, & Mangan, 2010).

One key initiative is to measure carbon footprint to minimize the impacts of transportation. However, measuring and controlling carbon footprint across a supply

chain is not an easy option for organizations due to the lack of understanding of this measurement amongst managers (Sundarakani, Souza, Goh, Wagner, & Manikandan, 2010; Tohamy, 2009).

Furthermore, a lack of appropriate tools or environmental criteria, measures to monitor environmental operation also influences managers on the decision making of supply chain activities (Handfield et al., 2005; Preuss, 2005a). So far there is no existing framework on environmental supply chain performance measure which increases the difficulty for managers to executive sustainable supply chain constantly (Shaw et al., 2010). Another barrier is the low status of the supply chain manager position in the decision making process on strategy development and planning (Handfield et al., 2005; Preuss, 2005a).

The importance of sustainable logistics and supply chain towards a business development has led the role of supply chain manager in a substantial position. It is important that supply chain managers are aware of environmental issues and make a contribution in environmental initiatives. Manager's decision on logistics and supply chain activities has a huge impact on sustainable practices (Handfield et al., 2005; Wu & Dunn, 1995). Without the understanding of the importance of the environmental responsibility from supply chain managers, especially top managers, the transition towards a low carbon economy will be just words on the papers (Halldorsson & Kovacs, 2010).

Even though the energy and environmental responsibility in business is not a new topic, it has been put aside by most corporate managers (Aronsson & Brodin, 2006; Halldorsson & Kovacs, 2010). Preuss (2005b) and Pederson (2009) pointed out that economic benefit is still the dominant driver of business amongst the majority of supply chain managers, especially in small companies. "Believing that only profitable companies can afford greener supply chain" (Preuss, 2005a, p. 136) is the vital obstacle of applying environmental initiatives into management practices.

Another obstacle to develop feasible framework in which would characterize and categorize environmental activities in supply chains is the limited understanding of environmental management (Vachon & Klassen, 2008). Some managers are arguing

that investment in environment is associated with lower performance and draws away the attention on core competitive improvement (Pil & Rothenberg, 2003). This non-economic dimension is irrelevant, thus has low priority (Closs et al., 2011).

Currently, the comprehensive environmental management only occurred in a few industry areas, such as chemicals, petrochemicals, mining and semiconductors. In other industry fields, the corporations only took actions on packaging or waste sections. It tends to be more environmental compliance rather than responsibility amongst the majority of corporations (Handfield et al., 2005).

Even though there are a few barriers underlying the development of sustainable and energy efficient supply chain system, it is perceived that environmental sustainability in supply chain management is the direction of business development in order to reduce environment impacts and improve profit performance (Aronsson & Brodin, 2006).

It is trade-off between environmental impacts and optimum supply chain efficiency beyond the traditional trade-offs, such as transport versus inventory; customer services versus logistics costs; transport cost versus transit time (Wu & Dunn, 1995). Examining the trade-offs between environmental initiatives, profitability and efficiency across the integrated supply chain is paramount with regard to achieve sustainable and energy efficient logistics and supply chain strategy (Tohamy, 2009). The goal is the trade-off between been environmentally friendly and being profitable and the balance between environmental issues and corporate strategy and values (Handfield et al., 2005).

1.7 Objectives

- To investigate the development of environmental management in supply chains in New Zealand food industry;
- To examine the effects of energy consumption and the climate issues in the food industry supply chains by focusing on the energy costs, logistics costs and logistics performances;

- To examine the implementations of green supply chain management in New Zealand food industry supply chains;

  - Sub-objective 1: To identify the drivers and barriers towards green supply chain management practices;
  - Sub-objective 2: To indicate the differences of environmental management between domestic companies and international company;

1.8 Format of Thesis

The rest of the thesis consists 4 chapters which are structured as follows:

- After this introduction, in chapter 2, a review of relevant literature helps to establish a line of understanding of corporate social responsibility, sustainability and environmental sustainable management in supply chain management
- Followed, the research methodology is presented in chapter 3
- The results and the implications of the results are discussed in chapter 4.
- Finally, in chapter 5, the conclusions of the research objectives are drawn. Also, limitations of the research and the future research directions are proposed.

Chapter 2 Literature Review

2.1 Introduction

The purpose of this chapter is to offer a general comprehension of corporate social responsibility (CSR), sustainability and environmental management from a logistics and supply chain management point of view.

The emerging of the environmental concerns in supply chain management has resulted in an increasing attention in academic study. A considerable amount of research has been undertaken on Corporate Social Responsibility (CSR), sustainability and environmental management, such as CSR in supply chain (Maloni & Brown, 2006), sustainable supply chain management (Pagell & Wu, 2009), corporate sustainability (Dyllick & Hockerts, 2002), environmental management (Sharfman et al., 2009) and green supply chain (Handfield et al., 2005; Preuss, 2005a; Srivastava, 2007). These studies have indicated the significance of environmental management in current logistics and supply chain management.

Furthermore, a literature review of New Zealand logistics and supply chain development is undertaken.

2.2 Corporate Social Responsibility (CSR)

Driven by multiple stakeholder's interests and pressure from customers, suppliers, governments, and community groups, managers are facing the challenges on how to develop the business in order to keep the balance between social, ecologic and economic perspectives and to integrate these three aspects together as a whole (McWilliams & Siegel, 2001; Orlitzky, Siegel, & Waldman, 2011). An enormous attention on CSR has been given by academic literature and corporate managers for several decades (Maon, Lindgreen, & Swaen, 2009; McWilliams, Siegel, & Wright, 2006; E. R. Pedersen, 2009).

The first definition of CSR emerged in 1950s (Maon et al., 2009). Since then, due to the conflicting objectives between social, economic and environmental perspectives, a number of definitions of CSR have been proposed in several theoretical frameworks

(McWilliams & Siegel, 2001; McWilliams et al., 2006; E. R. Pedersen, 2009). As a result, there is no clear description which could be adapted as the definition of CSR (McWilliams et al., 2006).

Simply speaking, CSR could be understood as a relationship between business and the larger society (Hill, Stephens, & Smith, 2003; Snider, Hill, & Martin, 2003). Environmental issues, diversity, safety and human rights were placed under the label of CSR (Carter & Jennings, 2002). Taking into account the three dimensions: economic, social and environmental responsibilities into business decision making, means that business needs doing good things beyond obeying the law (Maon et al., 2009; McWilliams & Siegel, 2001). CSR is about the company's overall treatment of human beings and the environment (Andersen & Skjoett-Larsen, 2009). It emphasizes that social and environmental responsibility should be as critical as economic responsibility. Focusing on making profit is not the only responsibility for corporations anymore (Lindgreen, Swaen, & Johnston, 2009).

Considered as a form of strategy (McWilliams & Siegel, 2001), adapting CSR provides essential tools with opportunities, innovations and advantages (Porter & Kramer, 2006). The development of CSR in corporations could be considered as corporation's changing process (Maon et al., 2009).

Unfortunately, after decades of studies, various definitions of CSR make it difficult on the development of CSR performance measurements and even the theoretical perspective (McWilliams et al., 2006). As a result, most researchers tend to examine the strategic role of CSR and focus on the relationship between CSR and firm performance from a theoretical point of view.

A considerable amount of research has been undertaken in recent years with regard to the strategic role of CSR in organizations (Maon et al., 2009; McWilliams et al., 2006; Orlitzky et al., 2011). McWilliams and Siegel (2001) demonstrated that as a strategic tool cost-benefit analysis will maximize profits while satisfying the demands from social and environmental perspectives. Others studied the relationship of CSR and firm performance from practical aspect in different organizations. It is noticeable

that CSR as a strategic role has been studied worldwide from different organizations as shown in Table2.1.

Table 2.1 CSR research on different organizations

Authors	Year	Research titles
Snider, Hill, and Martin	2003	CSR in the 21st century: a view from the world's most successful firms
Hill, Stephens, and Smith	2003	CSR: an examination of individual firm behaviour
Welford, R	2005	CSR in Europe, North America and Asia
Maloni and Brown	2006	CSR in the supply chain; an application in the food industry
Lindgreen, Swaen, and Johnston	2009	CSR: an empirical investigation of U.S organizations

Even though the theory of CSR has been addressed by corporation managers and researchers for several decades, it only occurred in logistics and supply chain management field in the last 15 years (Maloni & Brown, 2006). However, an intense study of CSR in supply chain management was taken place until 2009 and a considerable amount of literature on this topic management has been published from Supply Chain Management: An International Journal in 2009 as shown in table 2.2.

Table 2.2 Literature of CSR in Supply Chain management

Authors	Research title
Eltantawy, Fox, and Giunipero	Supply management ethical responsibility: reputation and performance impacts
Maon, Lindgreen, and Vanhamme	Developing supply chains in disaster relief operations through cross-sector socially oriented collaborations: a theoretical model
Andersen and Skjoett-Larsen	Corporate Social responsibility in global supply chains
Defee, Esper, and Mollenkopf	Leveraging closed-loop orientation and leadership for environmental sustainability
Pedersen, E.R	The many and the few: rounding up the SMEs that manage CSR in the supply chain

Study has demonstrated that different industries have relatively different supply chains (Maloni & Brown, 2006). Due to the complexity and difficulty of this concept, researchers are prone to focus on the study of supply chain CSR in theoretical perspective instead of the practical study within organizations. In this literature review, there was only one study discussing CSR in supply chain from specific industry point of view from Maloni and Brown (2006) which depicted the implementation of supply chain CSR in U.S food industry. Meanwhile, the

complexity and difficulty of the concept also constrains the study on supply chain CSR measurement which led to the impediment to transit the theories into practices (Lindgreen et al., 2009).

Since logistics and supply chain activities have a major influence on the environment and energy consumption, integrating supply chain management with economic, social, and environmental responsibilities could provide an environmental friendly and energy efficient system—sustainable logistics and supply chain management (Carter & Jennings, 2002). "Recently, sustainable supply chain management has become part of the CSR agenda" (E. R. Pedersen, 2009, p. 111).

2.3 Supply Chain Sustainability

The literature review demonstrated that the importance of sustainable supply chains is arising. It was suggested that focusing on economic sustainability alone is not sufficient for a long run success (Halldorsson & Kovacs, 2010; Handfield et al., 2005; Walton et al., 1998).

In general, sustainability is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Preuss, 2005a, p. 14). Integrating the three dimensions: economic, environmental and social as a whole is paramount towards the development of sustainable and stable business and society (Dyllick & Hockerts, 2002). Effective and efficient rather than efficient only supply chain strategies are required to enhance competitiveness (Closs et al., 2011). "The truly sustainable supply chain would at worst do no net harm to natural or social system while still producing a profit over an extended period of time" (Pagell & Wu, 2009, p. 38).

During the last two decades, the environmental and social issues are unavoidable for organizations to deal with constantly in daily business. The practices of the current logistics and supply chain operation strategies, such as increased outsourcing activities and cost-efficiency management, are driving the attentions of both academic and practical perspectives towards the examination of supply chain sustainability (Pagell & Wu, 2009).

Sustainable supply chains are a business necessity under current intense global competitive market. Sustainability not only reduces the use of energy, water, GHG emissions but also includes responsibilities to employees, customers, suppliers and communities (A. K. Pedersen, 2009). Furthermore, it can be a source of opportunity, innovation, and competitive advantage. It could even be a matter of business survival. Whereas, it is undeniable that it creates challenges for corporations (Mahler, 2007; Porter & Kramer, 2006).

Promised positive results such as reducing consumption of limited resources, mitigating climate change, preserving natural environment, increasing global economic stability, and improving sustainable supply chain, have demonstrated that sustainability as a supply chain strategy is one of the crucial success factors in the long term business development (Crittenden, Crittenden, Ferrell, Ferrell, & Pinney, 2011).

Even though a number of theories and concepts have been developed related to the sustainable supply chain management, the truly sustainable supply chains do not exist today. There is only some doing more or less better than others (Pagell & Wu, 2009).

2.4 Environmental Management in Supply Chains

Environmental management has been studied for several decades by academics and organizations. However, to integrate environmental management into supply chain management only emerged in recent decade.

As shown in Table 2.3, in the last several years, the increasing concerns of energy depletion and environmental risks have occurred amongst researchers and managers. Environmental sustainability has become a critical issue in today's business development. It consists of natural resources and ecosystem (e.g. climate stabilization) (Dyllick & Hockerts, 2002). The results of the implementation of environmental sustainability could lead to the reduction in costs and waste in the supply chain system and benefit the environment as well (A. K. Pedersen, 2009). Over a long term, it could benefit the organization within a competitive advantage in terms of the cost, flexibility

and quality performance (Closs et al., 2011; Parmigiani, Klassen, & Russo, 2011; Pil & Rothenberg, 2003).

Table 2.3 Academic Researches on Environmental Sustainable Supply Chain Management

Authors	Year	Research Titles
Wu and Dunn	1995	Environmentally responsible logistics system
Klassen and McLaughlin	1996	The impact of environmental management on firm performance
Walton, Handfield, and Melnyk	1998	The green supply chain: integrating suppliers into environmental management processes
Preuss, L	2005	Rhetoric and Reality of corporate Greening: a View from the Supply Chain Management Function.
Yang, B; Yang, Y; and Wijingaard, J	2005	Impact of postponement on transport: an environmental perspective
Handfield, Sroufe, and Walton	2005	Integrating environmental management and supply chain strategies
Aronsson and Brodin	2006	The environmental impact of changing logistics structures
Rogers, Kelly, Rogers and Carter	2007	Alternative fuels: are they achievable?
Walker, Sisto, and McBain	2008	Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors
Vachon and Klassen	2008	Environmental management and manufacturing performance: the role of collaboration in the supply chain
Sanchez-Rodrigues, Potter, and Naim	2010	The impact of logistics uncertainty on sustainable transport operations
Shaw,Grant and Mangan	2010	Developing Environmental Supply Chain Performance Measures
Sundarakani, Souza, Goh, Wagner, and Manikandan	2010	Modelling carbon footprints across the supply chain

This research focuses on the environmental management in logistics and supply chain management. Environmental management in the supply chain is taking into account environmental concerns of energy resources and climate issues in supply chain management (Andersen & Skjoett-Larsen, 2009). It also refers to green supply chain management which is addressing the influence and relationship between supply chain management and the natural environment, involving green manufacturing, green purchasing, and green logistics from suppliers to manufacturers to customers (Srivastava, 2007).

Such cooperative supply chain management is not an easy path due to the overwhelming economic driver and trust based relationship issues with suppliers and customers (Sharfman et al., 2009). The examination on the importance of collaborated environmental sustainability in supply chain management observed the positive correlation between environmental management and the overall organization performance in terms of efficiency and profitability (Closs et al., 2011; Parmigiani et al., 2011; Pil & Rothenberg, 2003). The success of achieving environmental management in supply chain requires some systemic changes from production process design to collaborated environmental activities within every stage of the system (Closs et al., 2011; Parmigiani et al., 2011; Sharfman et al., 2009).

The literature review revealed a tendency that the supply chain management is evolving towards the new direction (Carter & Easton, 2011; Carter & Rogers, 2008; Christopher & Holweg, 2011; Pagell & Wu, 2009). They emphasized that traditional supply chain management does not fit into the current turbulent business environment. A more flexible supply chain structure is required to meet the increasing uncertainty global markets and increasing demand on environmental sustainability (Christopher & Holweg, 2011).

Literature review indicated a few issues that led to a gap between the theoretical perspective and practical execution perspective on the implementation of environmental management in supply chain (Andersen & Skjoett-Larsen, 2009).

A lack of collaboration between suppliers and customers was pointed out by Pagell and Wu (2009) and Crittenden et al. (2011). They emphasized that most companies do not include supply chain partners in the environmental management. Managers tend to focus on single function or company without taking into account other parties of the system in the supply chain.

A lack of metrics on the implementation of environmental sustainable activities in terms of the return of dollars has been discussed by Crittenden et al. (2011) and Anderson and Skjoett-Larsen (2009).

A lack of supply chain management functions influences the results of the implementation of environmental sustainability (Preuss, 2005b). It was discussed that the lack of integration amongst managers within organisations is contributing to the gap between the theory and practice rather than the lack of awareness of environmental issues.

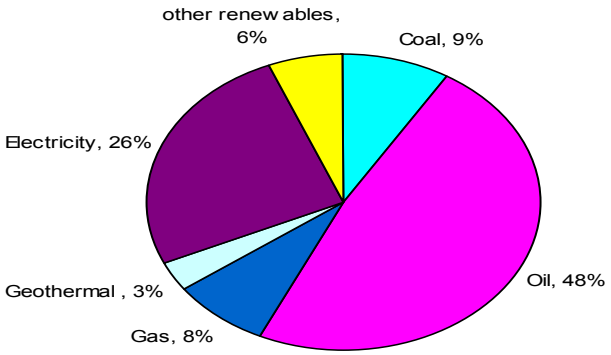
The majority of literature studies focused on the internal issues. Only Walker, Sisto and McBain (2008) mentioned the external facts to environmental management in supply chains, such as government, suppliers and customers.

Even though a number of studies have been introduced regarding environmental management in supply chain for years, the literature review revealed that managers are prone to neglect it and pursue the economic benefits. Little attention has been paid to the environmental issues in supply chain management. (Halldorsson & Kovacs, 2010; Preuss, 2005b; Van Hoek & Johnson, 2010).

2.5 New Zealand Environmental Management and Supply Chain Development

In New Zealand, energy resources are mainly derived from petroleum, natural gas, coal, geothermal and wood, wind, solar (Eng, Bywater, & Hendtlass, 2008). Like the rest of the world, oil, natural gas and coal energies dominate two thirds of energy consumption in New Zealand which is demonstrated in Figure 2.1

Figure 2.1 New Zealand Energy Consumption



(Source:Ministry of Economic Development, 2004)

According to the report from New Zealand Ministry of Economic Development (2004, p. 16), “In 2004, New Zealand energy consumption is growing by about 2 per cent a year, that is faster than other developed countries”.

Even though New Zealand produces oil from 11 Taranaki fields, most of its oil consumption is imported from Middle East countries, that means it is vulnerable to the international oil market and it creates disruption risks on supply and price same as the rest of the world (Ministry of Economic Development, 2004).

The impacts of these disruption risks from global market will result in enormous challenges on energy consumption, especially on the development of the transport sector since transportation has high dependence on oil (Ministry of Economic Development, 2004). Millar and Puckey (2008) emphasized that “New Zealand is likely to be one of the more severely affected countries in the early stages of declining oil production” (p. 10).

Despite of the continuing growth of renewable energy in New Zealand such as hydroelectricity, geothermal, wind, solar and biomass, they cannot substitute fossil fuels in the near future. Same as the rest of the world, New Zealand relies on fossil fuels in an increasing tendency (Ministry of Economic Development, 2004).

Conversely, Millar and Puckey (2008) have pointed out that New Zealand is not only one of the world’s greatest contributors to oil depletion but also the contributor to climate change. Even though New Zealand has always been imaged by clean and green land, energy intensity (“energy intensity is a measure of energy used per unit of production”) (Millar & Puckey, 2008, p. 9) is worse than UK and United State by 150 per cent and 52 per cent respectively in 2005. It has caused the major global environmental impacts, such as more frequent extreme weather events (e.g. flood, tornado) or a change in rainfall patterns. Climate change has emerged and it is threatening New Zealand’s economic, social and environmental development (Ministry of Economic Development, 2004).

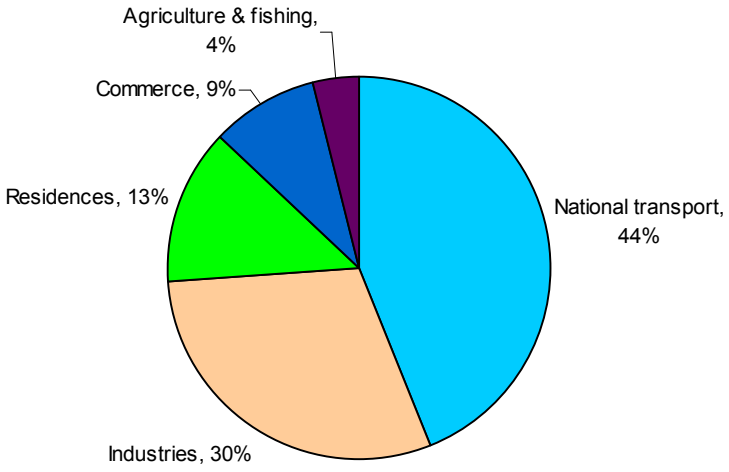
Sustainable management would mitigate the impacts of energy resource depletion and global climate change. From the politics perspective, since early 90’s, New Zealand

government has taken actions in the sustainable development with regard to reduce greenhouse gas emissions (Cavana, 1997). Such as in 2003 January, New Zealand government released Sustainable Development Programme of Action (Ministry of Economic Development, 2004) and New Zealand Emissions Trading Scheme (ETS) in 2009.

In addition, the impacts of energy-climate issues have become apparent and energy is getting expensive in recent years. New Zealand government has put more attention to the development of household energy-efficiency policies (Ministry of Economic Development, 2004).

However, compared with other developed countries, in reality, little attention has been paid by New Zealanders to industry areas which are main contributors to the energy consumption and GHG emission. Sustainable energy report (2004) stated that 88 per cent of the emission is from road transport. Figure 2.2 shows that industries and transport are actually the high energy intensity sectors and also the areas that need more attention from both a government and a society perspective (Eng et al., 2008; Ministry of Economic Development, 2004).

Figure 2.2 New Zealand's Energy Uses



(Source:Ministry of Economic Development, 2004)

The literature has shown that sustainability in the transport section has been paid more attention and been studied constantly. Unfortunately, there is no literature to provide the results on the reduction of greenhouse gas emission in New Zealand (Basnet, Childerhouse, Foulds, & Martin, 2005; Cavana, 1997; Eng et al., 2008; Kissling & Bachels, 2000; Millar & Puckey, 2008; Ministry of Economic Development, 2004)

In terms of the supply chain management practices in New Zealand, studies outlined that due to the reality of geographical distance of New Zealand, the supply chain management in New Zealand has not been motivated as strong as other developed countries, especially the small size of firms are struggling with the implementation of supply chain management without support from the government (Basnet, 2000; Basnet et al., 2005; Sankaran, 1998).

The literature review has revealed that environmental issues and supply chain management tend to be studied separately. With regard to the environmental issues, it was observed by New Zealand Manufacturers' Federation (Inc) in 1994 (Victoria University of Wellington, 1994) that compared to small size companies, the larger organizations tend to have more concerns on environmental factors and likely take responsible actions towards the environmental management. However, only a small per cent of companies have the environmental policies or procedures taking place. A few of them took environmental initiatives to monitor environmental performance. In addition, a company's attitude towards the environment is another obstacle in the implementation of sustainable management in practices, especially within the medium-small organizations (Gehrke, 2000).

With regard to the supply chain sustainability, it has only been discussed briefly in the study from Basnet et al. (2005). In this survey, it was discovered that there were only 9.4 per cent of respondents achieved ISO14001 (environmental management standards). It was emphasized that more awareness and attention was needed from New Zealand corporations on environmentally sustainable supply chain practices in order to gain competitive advantage in the global market (Basnet et al., 2005).

2.6 Summary

The literature review revealed that the environmental issues within management has been discussed in various theory frameworks, Corporate Social Responsibility; sustainability and green supply chain management. All of these terms are referring to the same subject – environmental sustainability.

The study of the environmental management in supply chains is still relatively new and has only been studied in recent decades. Hence, even though theoretically environmental sustainability in logistics and supply chain management has drawn huge attention in academic field worldwide, it is not an easy path to transmit the theory into practice.

There is a huge gap between theory and practice: The gap of collaboration between suppliers and customers; a lack of measurements on economic benefits from the environmental management; a lack of comprehensive supply chain management functions. In reality, due to a lack of understanding of the theories, organization's managers are struggling to apply them into practice.

Meanwhile, it was outlined that in New Zealand, there were not sufficient academic studies on the environmental issues in industry supply chains. The development of environmental management in supply chain is far behind of other developed countries.

Chapter 3 Methodology

3.1 Introduction

This chapter explains both of quantitative and qualitative data collection methods, which have been used to conduct this research and indicates the instruments of data collection – questionnaire and telephone interview; the research participants; the procedures of the data collection. Both qualitative and quantitative data analysis processes were depicted in this chapter.

3.2 Research Objectives

- To investigate the development of environmental management in supply chains in New Zealand food industry;
- To examine the effects of energy consumption and the climate issues in the food industry supply chains by focusing on the energy costs, logistics costs and logistics performances;
- To examine the implementations of green supply chain management in New Zealand food industry supply chains;

  - Sub-objective 1: To identify the drivers and barriers towards green supply chain management practices;
  - Sub-objective 2: To indicate the differences of environmental management between domestic companies and international company;

3.3 Research Design and Planning

3.3.1 Exploratory Study

Since energy and environment issues in logistics and supply chain management is a developing direction in research study, not many studies have been conducted on this specific research topic especially related within New Zealand food industry. This study is trying to find out what is happening and issues in New Zealand food industry in terms of environmental management in supply chains. An exploratory method is useful when the research is focusing on the understanding of a problem and trying to find out what is happening (Saunders, Lewis, & Thornhill, 2009).

Furthermore, when the facts of the research topic are known, but there is little available information on hand at similar problems or issues that have been studied in the past, The exploratory study will take place when more information is needed in order to develop a viable theoretical framework (Cavana, Delahaye, & Sekaran, 2001; Sekaran & Bougie, 2010). "The great advantage is that it is flexible and adaptable to change which means that the focus is initially broad and becomes progressively narrower as the research progresses" (Saunders et al., 2009, p. 140).

As a result, an exploratory method is appropriate for this research as there was not much available relevant information with regard to this research topic – environmental management in supply chains within New Zealand food industry.

3.3.2 Case Study

A case study approach is often associated with exploratory research when the issue of research is difficult to study and quantify (Cavana et al., 2001; Ghauri & Grønhaug, 2005; Veal, 2005). When the research issue is current phenomenon in a real-life context, the single quantitative survey method is insufficient to understand the research phenomenon. It is necessary to provide adequate qualitative analysis and interpretations by asking the questions of 'why', 'what' and 'how' in order to gain a good understanding of the problem and phenomenon (Ghauri & Grønhaug, 2005; Saunders et al., 2009; Sekaran & Bougie, 2010). Both qualitative and quantitative methods can be used in case study (Ghauri & Grønhaug, 2005).

The case study is useful when the research phenomenon cannot be understood without their social context (Ghauri & Grønhaug, 2005). Energy-climate issues as a real-life phenomenon are happening now. In this case, without few cases to examine, it was inadequate to draw the interpretation of observation by quantitative survey method alone. Hence, the energy-environmental issue in logistics and supply chain management was focused within a few New Zealand frozen and chilled food organizations in order to gain sufficient explanation on this research issue.

3.4 Data Collection Methods

Research data can be collected by use of numbers or words. Quantitative data—the answers of research questions are involved with numerical and standardized data. Qualitative data refers to use words to answer the research questions (Ghauri & Grønhaug, 2005).

The main differences between qualitative and quantitative are the form of data collection and the way it is analysed (Ghauri & Grønhaug, 2005; Veal, 2005). Quantitative data collection has results of 'thin' description; while qualitative data represent the 'thick' abstraction or description (Saunders et al., 2009). "Qualitative research tends to be more explorative and unstructured with emphasis on understanding, while quantitative research tends more to emphasize descriptions and testing of derived hypotheses" (Ghauri & Grønhaug, 2005, p. 202). Table 3.1 illustrated the distinction between quantitative and qualitative data collection methods.

Table 3.1 The distinctions between quantitative and qualitative data collection

Quantitative Data	Qualitative Data
.Based on meanings derived from numbers	.Based on meanings expressed through words
.Collection result in numerical and standardized data	.Collection result in non-standardized data requiring classification into categories
.Analysis conducted through the use of diagrams and statistics	.Analysis conducted through the use of conceptualisation

(Source: Saunders, Lewis & Thornhill, 2009, P378)

Quantitative data collection method is appropriate in terms of relatively large number of subjects study. Quantitative data could dominate the research while the information is in the form of quantity or the information could be presented in the form of quantity (Veal, 2005).

The collection of quantitative data uses measurements providing evidence to explain and analyse the research objectives in order to conduct to the research conclusion. Quantitative research emphasizes the evidence of numerical data. Applying instrument and statistical analysis, quantitative data collection method interprets the

numerical data which represent the information into meaningful data as research evidence of the study to conduct the research results (Ghauri & Grønhaug, 2005; Saunders et al., 2009).

Quantitative research methods focus on social structures. The data can be collected through questionnaire-based surveys, observation or secondary data (Veal, 2005).

Qualitative data collection methods would be appropriate when there is a need of a deeper insight into the research phenomenon, as it could provide the information which explains what the reasons are behind the research topic (Ghauri & Grønhaug, 2005; Veal, 2005).

Qualitative methods are flexible and unstructured. It does not need the assistance of statistical analysis instrument because there is no standardized numerical data in the information collected. Qualitative method could provide the detailed understanding on the research phenomenon from the perspective of 'how' or 'why'. "Qualitative research is a mixture of the rational, explorative and intuitive where the skills and experience of the researcher play an important role in the analysis of data" (Ghauri & Grønhaug, 2005, p. 10). Thus, it is not an 'easy option'. Standardized approaches cannot provide the richness and fullness of the information. A number of broad approaches are needed in qualitative data collection methods (Saunders et al., 2009).

Qualitative data collection involves gathering 'rich' information from a small group of subjects (Veal, 2005). The qualitative method focuses on social process, is more useful on research areas of human-behaviour or interest issues (Ghauri & Grønhaug, 2005). Collecting qualitative information can be accessed by interview, observation, and focus group (Veal, 2005).

3.5 Justification

Quantitative and qualitative methods are not mutually exclusive. Both approaches complement one another (Veal, 2005). Especially in case study, it generally uses a number of data gathering techniques from both quantitative and qualitative methods (Ghauri & Grønhaug, 2005).

In order to build the exploratory theory, qualitative methods are most useful and appropriate for providing a deeper insight and 'rich' information on this research. However, as there was not enough information on the subject's background, quantitative methods are also necessary in this research in order to gain a small group of valid subjects for qualitative data collection. Based on the reality of this research, it was appropriate to apply both quantitative and qualitative methods together at different stage of the research.

In order to identify the variability and discover the similarities from defined wider representatives, the questionnaire approach (Appendix A) is useful at the first stage of data collection for the structured questions on decision-making (Veal, 2005).

There are a few types of questionnaires: on-line questionnaires by email or the internet; mail questionnaires collected by post; face to face questionnaires contacting the respondents directly; and telephone questionnaire by talking to the respondents on phone (Saunders et al., 2009).

The research populations were scattered all over New Zealand. Considering the time and cost facts, an on-line questionnaire by e-mail is appropriate in this research. However, the risk of e-mail questionnaire is the survey's response rate (Veal, 2005). To ensure a high response rate, the pre-survey contact emails sent to all of the research objectives. Then there was the first follow-up three weeks after the questionnaires have been sent out. The second follow-up happened four weeks later after the first follow-up. The results of the questionnaire would help to discover representative's background in the perspective of logistics and supply chain activities.

In an exploratory study, semi-structured interviews can be very helpful to draw a clear picture of the respondent's position or behaviour. Because of open-ended questions, through the interview, it discovers new insight on this research field and finds out what is happening (Ghauri & Grønhaug, 2005; Saunders et al., 2009). Telephone interview can still be effective. It is faster and less expensive (Hair, Babin, Money, & Samouel, 2003).

Based on the information observed from the questionnaires, the appropriate representatives for the semi-structured telephone interview (Appendix B) were selected from each organization size groups in order to obtain a deeper understanding of the research phenomenon. Considering the time, cost and geographic constraints, interviews were managed by telephone calls and focused on questions such as why , how or what happened with regard to the phenomenon of energy-climate issues in New Zealand food industry supply chains.

Hence, Quantitative methods—questionnaire—based survey was used at the first stage of data collection. Qualitative methods—telephone interview was adopted following the result of quantitative data collection. A questionnaire works best with standardized questions, not with open-ended questions, such as the questions of 'how', 'why', 'what'. A telephone interview was needed to explore and understand the research phenomenon (Saunders et al., 2009). As a result, this research was using multi-method approach: questionnaire complemented with telephone interview.

3.6 Sampling

There are two types of sampling: probability sampling and non-probability sampling (Ghauri & Grønhaug, 2005; Hair et al., 2003; Sekaran & Bougie, 2010).

Table 3.2 Type of sampling methods

Probability	Non-probability
Simple random	Convenience
Systematic	Judgment
Stratified	Snowball
Cluster	Quata
Multi-stage	

Table 3.2 illustrates the distinction of two types of sampling: Probability and Non-probability.

In probability sampling, the researcher knows that all of samples have a valid and non-zero chance of being selected. Such as simple random sample, each unit has equal probability of be selected in a target population (Hair et al., 2003).

In non-probability sampling, the sampling is selected by experience, convenience or judgment of researcher. It means that some samplings may not represent the research topic (Hair et al., 2003). Moreover, regarding the exploratory research, non-probability – convenience sampling is useful when researchers need the information quickly and efficiently (Sekaran & Bougie, 2010).

In this research, the non-probability –convenience sampling was adapted to collect quantitative data due to the limit time and cost. Then samplings for qualitative data collection were chosen by using probability method.

The target sampling frame was derived from food industry within New Zealand. The size of the population was about 100 frozen and chilled food suppliers around New Zealand. The target representatives were the people who hold the title of manager, director or vice president of logistics and supply chain department in the organization.

3.7 Data Collection and Problems

The research sampling frame was aimed at frozen and chilled food organizations. Initially there were approximate 100 suppliers. Before the survey started, in order to ensure a high response rate, pre-survey e-mails were sent out to ask for the participation of this research. There were sixty organizations confirmed and were willing to participate. Hence, the size of sample was sixty suppliers. The target representatives were the people who hold the titles of manager, director or logistics and supply chain manager.

Sixty on-line questionnaires were sent out to these representatives by e-mail. However, during the three weeks responding period, a devastating earthquake hit Christchurch where some food industry businesses were located. Therefore, some companies who hold the business in Christchurch could not participate in this research.

After three weeks period, the follow-up e-mails were sent out for another four weeks respond period. At the end, after seven weeks responding period, twenty eight out of sixty organizations were returned. Another ten companies advised the reasons to cancel the participation in this research: such as the questionnaire was too

complicated; not part of company policy to provide the information; too busy to complete it; and the effects of earthquake. Twenty two organizations did not reply the questionnaire.

Twenty eight questionnaires out of sixty were received which was a 46%response rate. On review of the responses, it was identified that one response only fulfilled part of the questionnaire which is part one – company information, due to a lack of information on questions from the rest of the questionnaire. Hence, twenty eight questionnaires were used to analyse company background information and twenty seven completed questionnaires were analysed for part two and part three of the questionnaire.

For the telephone interview section, thirteen representatives were chosen based on organization size category and the purposive and pragmatic consideration (Veal, 2005). The Cases were selected from different organization size category. The purpose of the selection was trying to cover all organization categories and easy to access the interview. The interviews were conducted by telephone calls and generally lasted around half an hour. Interview questions were provided with a copy prior to the interviews. The interviews were recorded by note taking. Secondary data were collected such as environmental policies, sustainable strategies.

There is a possible bias within the survey towards underestimation of the level of logistics and supply chain management in New Zealand. Overall, the number of returns of the survey was reasonable.

3.8 Data Analysis Methods

In order to interpret a large amount of numerical data, quantitative data could be analysed with the help of techniques, which can be implemented by sophisticated computer software, such as SPSS (Bryman & Bell, 2003).

Whereas, based on the amount of returned questionnaires, the questionnaire data analysis were managed by computer program—Excel which could easily access and understand the data. The bar chart and pie chart were applied to discover the relationship of data and compare with each category group. The pie chart is a way to

present data visually and the bar chart is very useful for comparing differences (Hair et al., 2003).

Qualitative data analyse procedures include data reduction, data display and drawing conclusions to manipulate data in order to gain understanding and clarify problems in research (Ghauri & Grønhaug, 2005).

Different from quantitative data analysis approach, there is little computer software or easy techniques that could help on the analysis of qualitative data. With flexible and unstructured information from qualitative data, there is a difficulty to find analytic paths to analyse the richness of description or abstraction. (Bryman & Bell, 2003; Ghauri & Grønhaug, 2005).

Because of the nature of the case study, the data analysis process tends to be deductive (Veal, 2005), in which "the data collection with a defined research questions and objectives and a clear framework and propositions, derived from the theory have been used"(Saunders et al., 2009, p. 501) .

Thus, in this research, deductive approach was applied by using existing theory to formulate more structured research questions. Summarising the data analysis process was used to analyse the qualitative data from the interviews. The first step was to summarize the data from a large amount of notes and examine the frequency of occurred words and main themes. In order to classify and organise the information collected, then embedded information and characteristics were identified in the content. Finally the relationships and patterns between themes emerged from the observation of the key points towards the goal of uncovering the underlying meanings of the phenomena being studied (Hair et al., 2003; Saunders et al., 2009; Veal, 2005).

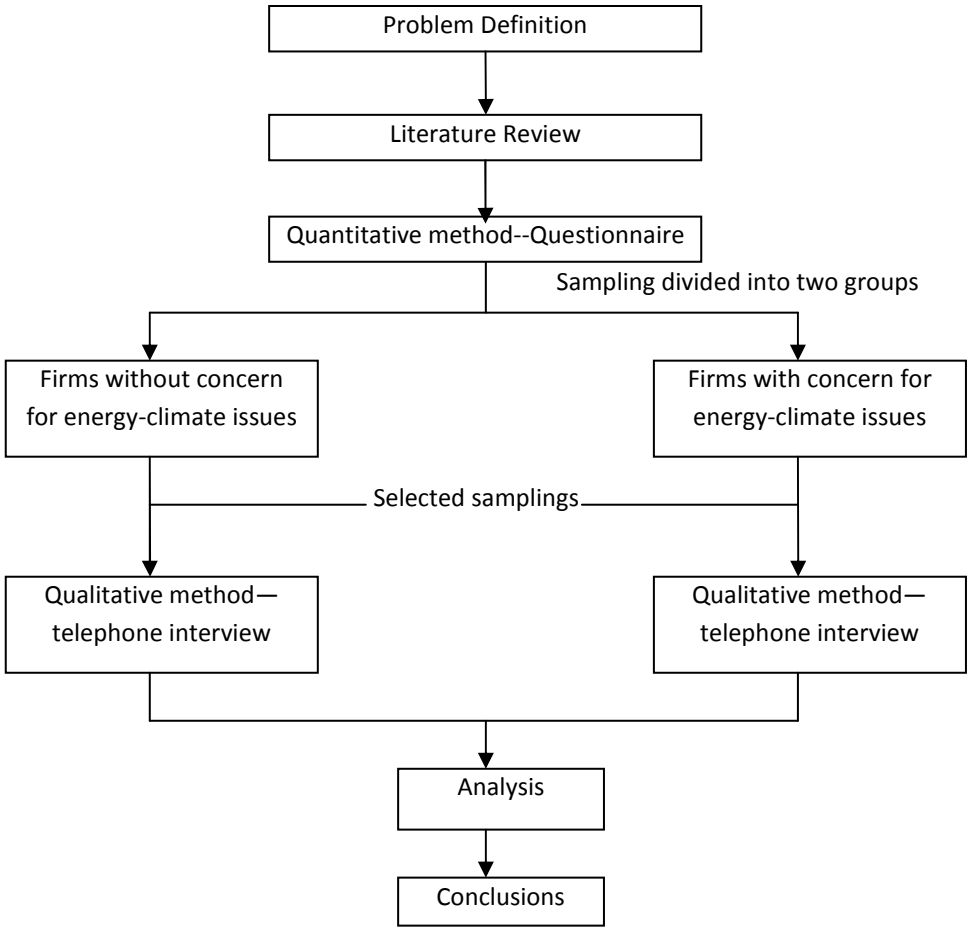
3.9 Ethical issue

This is an academic research and the representatives understood the purpose of the research. They have choices to participate this survey or not. Thus, the ethical issue is not concerned in this research.

3.10 Summary

Figure 3.1 illustrates the research procedure used in this study.

Figure 3.1 Exploratory study of environmental management in supply chains in New Zealand food organizations



Chapter 4 Survey Results

4.1 Introduction

The purpose of this chapter is to present a picture of green logistics and supply chain development in the New Zealand food industry, to identify the reasons on the implementation of environmental sustainable supply chain management and to discuss the implications of the research results.

4.2 General Information

As this questionnaire is anonymous, no company-specific information was involved in the questions. For the statistics purpose, the questionnaire did collect some general information such as company size and annual turnover.

The first part of the questionnaire was devised to discover the company background with regard to logistics and supply chain perspective. In addition, this part of the questionnaire revealed some information in terms of the influence of energy-climate issues on company's performance.

4.2.1 Company Background

Firstly, the questionnaire deals with the number of employee in each company to measure respondent size. Among of the organizations in this research, 52% of respondents have less than 30 employees, which indicated that the majority of companies are small organizations. There were only 18% of respondents has a range of 31-100 employees. The rest of the respondents (30%) are the companies who have more than 100 employers. As Table 4.1 shows, it was clear that the respondents have be divided into three categories: small size organizations (1-30 employees); medium size organizations (31-100 employees); and large size ones (over 100 employees).

Table4.1 organization size

Number of employees	Number	%	With GSCM	Without GSCM
1-30	14	52%	1	13
31-100	5	18%	1	4
Over 100	8	30%	3	5

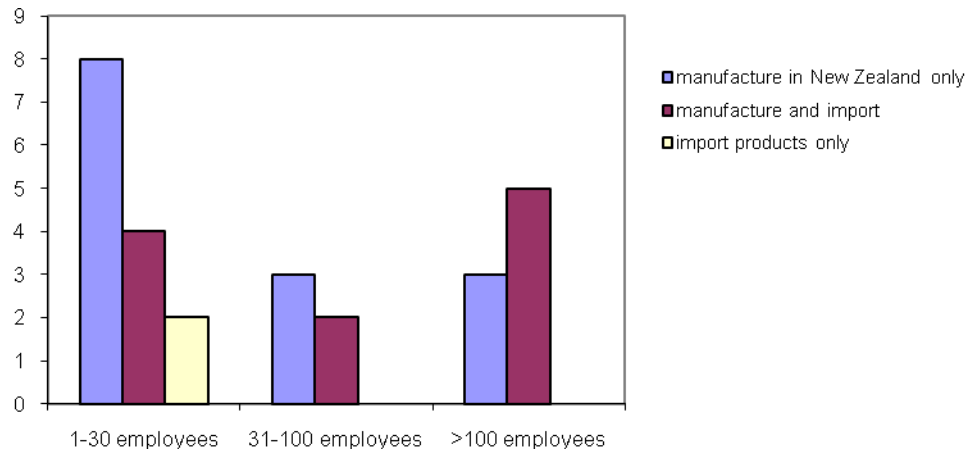
The average annual turnover section has revealed a relationship between the organization size and turnover level, in which the average annual turnover has a direct ratio with organization size as shown in Table4.2

Table4.2 Annual turnover

Average annual turnover	Small size	Medium size	Large size
< $1m	3	0	0
$1-10m	10	1	0
>$10m	1	3	8

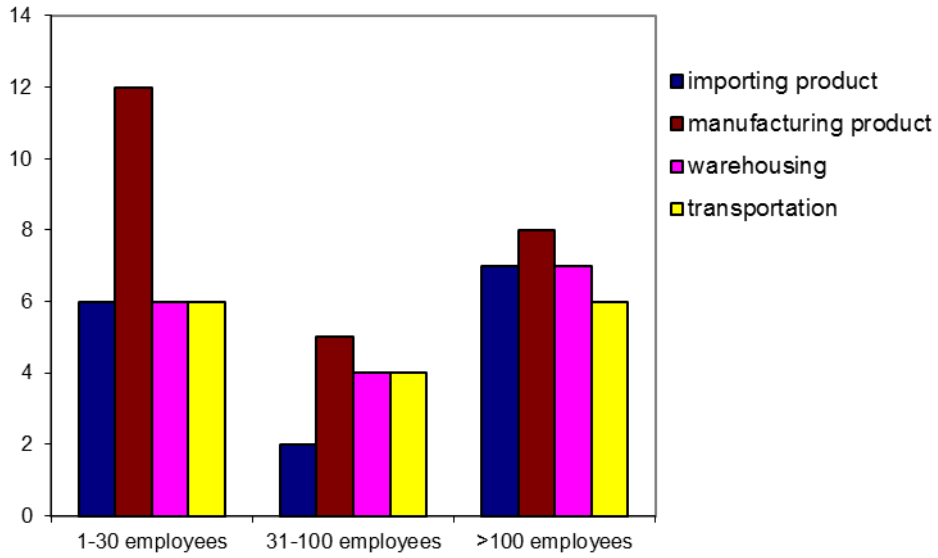
The majority of responding companies were New Zealand owned organizations. There were three international companies, where two of them were from the large size organizations and one was small size organization.

Figure4.1 Organization Types



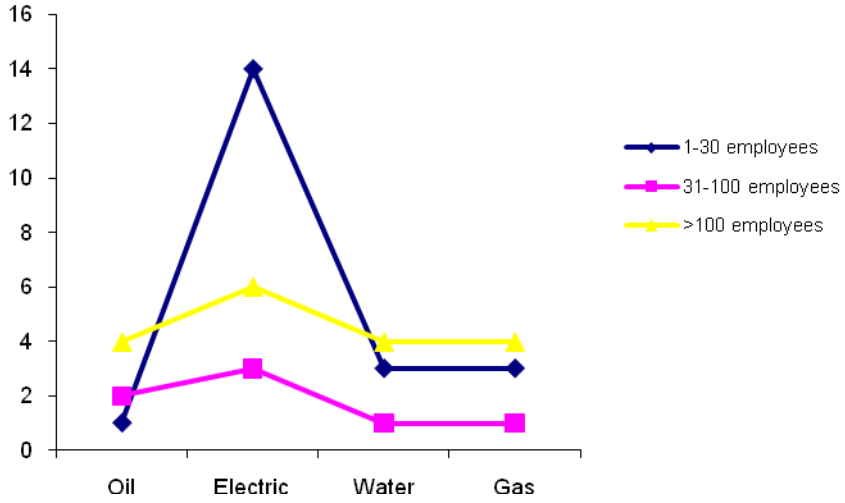
It is noticeable in Figure4.1, that manufacturing in New Zealand only appeared to be the dominate business activity from the categories of small and medium size organizations. Due to the limitation of the employee size and organizations capacity, a few of small organizations are importing products from overseas only. As for the large size category respondents, it showed a tendency that they tend to be more variable organizations, not only just producing products but also involved import business activity.

Figure4.2 Logistics Activities



In Figure4.2, logistics activities showed a similar variation which manufacturing activity was overwhelming in small and medium size categories. Along with the increase of organization size, organization's logistics and supply chain activities have been spread out approximately equally in each aspect: importing, manufacturing, warehousing, and transportation. Warehousing and transportation dominated logistics and supply chain activities as well within the large and medium size respondents.

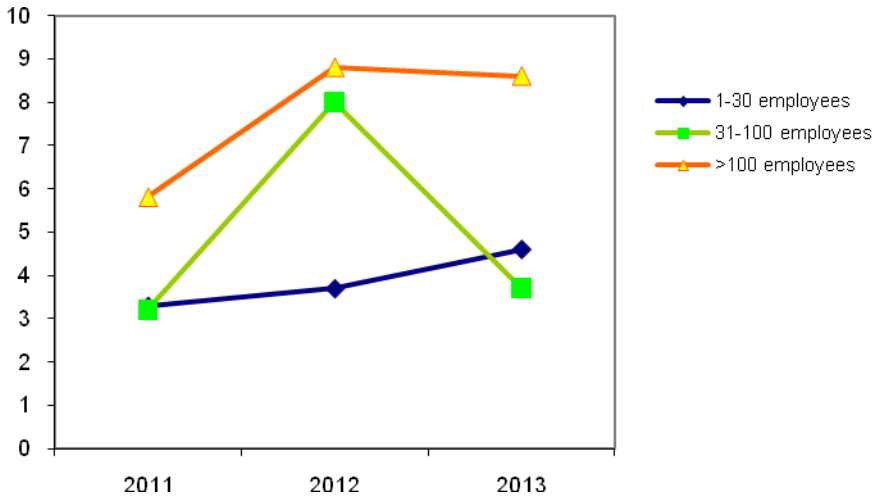
Figure4.3 Main Energy Consumption



As manufactures were the majority in the respondents, electricity appeared to be the crucial energy consumption source within these food organizations. According to the

result in Figure 4.3, along with a rise of organization size and a variety of logistics and supply chain activities taken place, oil cost has a dramatic rising, especially transportation activity gradually involved in the large organizations.

Figure4.4 Forecast of Energy Cost Increase



In terms of the forecast on energy cost for the next three years, amongst those responding companies as shown in Figure4.4, the forecast figures from large size organizations were much higher estimation than small and medium size groups. With the various logistics activities involved in the business operation, the large organizations' energy costs took huge ratio in the total cost. To achieve the efficient energy consumption will be a concern and challenge for them. The result explains the reason the large size organizations gave more considerations regarding the implementation of green logistics and supply chain management.

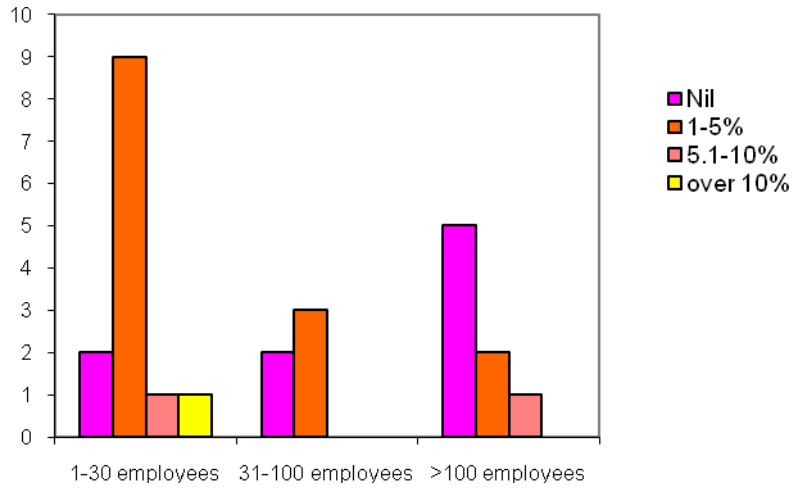
A number of respondents did not give a reply with regard to this research. It illustrated that within these organizations without planning in this aspect could lead to an ineffective management on energy consumption. It is argued that energy consumption issues still have not been paid much attention in New Zealand food industry.

4.2.2 Impacts of Energy-Climate Issues

With regard to the impacts of the energy-climate issues on the annual profit, in the last three years as shown in Figure 4.5, the results from the research indicated that small and medium size organizations were more vulnerable under the uncertainty of energy and climate change. One to five per cent loss on annual profit caused by energy–climate issues was observed overwhelming from respondents with less than 100 employees.

In this regard, the indication of the research result is explicit that energy-climate issues have not lead to a decline on profit for most organizations with more than 100 employees. It was noticeable that zero loss of annual profit was the highest compared other two bars in Figure 4.5.

Figure4.5 Loss on Annual Profit

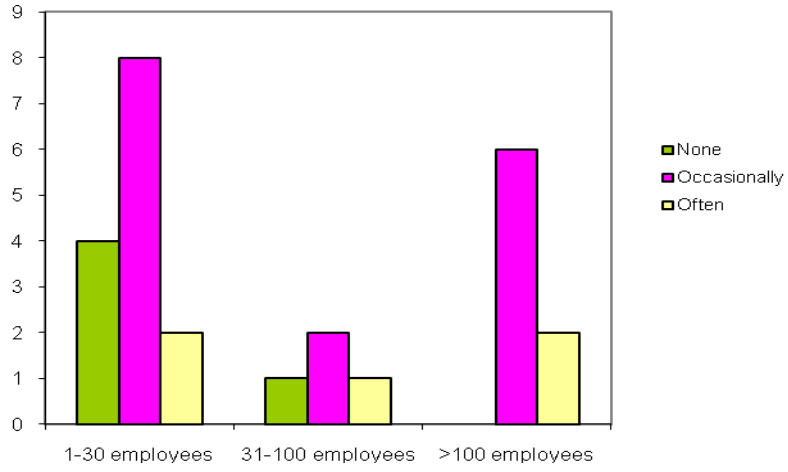


It is argued that considering organization's financial capacity factor, small and medium size organizations could be attacked severely on the financial performance along with the rapidly increased energy-climate impacts. As a manager from a large organization mentioned in the interview, currently the company still has the capacity to absorb the various increased costs to keep a healthy financial performance.

According to the results from the research, in the last three years, the climate issues have influenced supply chain activities more frequently in the large organizations than in the small and medium size organizations. As more logistics and supply chain

activities were involved in large company's business operation, observed from Figure 4.6, all respondents from large organizations have consistent opinion that climate change has influenced supply chain activities more or less to a certain. Interestingly, in this regard, the responses from some small and medium size organizations indicated that there were no effects on the supply chain activities at all. The result may imply that it is because of the undeveloped supply chains and limited business activities within these small size organization respondents.

Figure4.6 Influence of Climate Issues on Supply Chain Activities



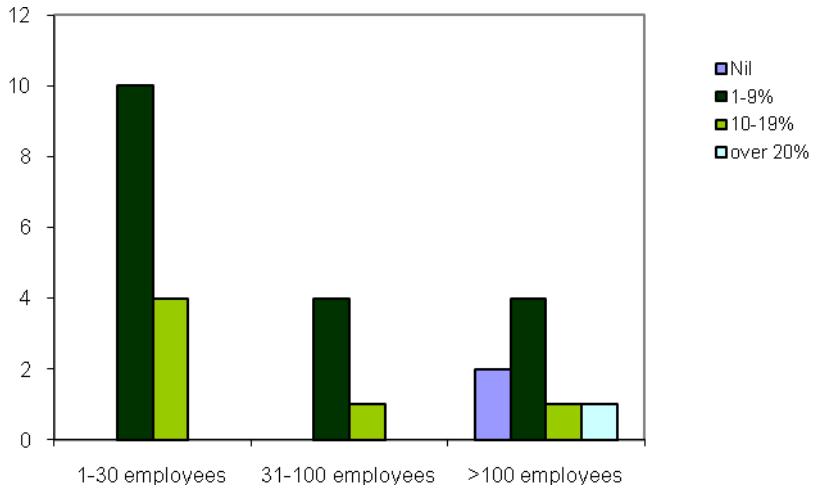
Various results were observed in the interviews considering the impacts of climate issues on supply chain activities in the future. For some organizations, since the business has no direct connection with the climate issues, it is not part of the business concern. The majority of managers did not think it could influence the business activities in the future. They believed that the climate has always been unstable and there would not have much change in the near future.

For others that the weather has a direct influence on resources, the influences of climate issues could be dramatic and, as a result, impact company's logistics and supply chain activities in terms of food sources supply, distribution, delivery quality and increasing total costs. For instance of the fishing company, in order to deal with the uncertainty of the weather, the organization has to develop a diversity business including a wide range of products: fishing, meat, vegetables, chips and ice cream. Furthermore, one manager from a large company pointed out that if there was not

enough rain, the production needs to be cut off because of no sufficient power generated. It could also contribute to an increasing on power price.

Compared to the climate issues, energy issues are more obvious as chilled and frozen food manufacturers are heavily reliant on energy, especially electricity. There were consistent responses from all organizations on the energy cost issue that the increase on energy cost was dramatic in the last three years. The survey result as shown in Figure 4.7 indicated that small and medium organizations have an explicit picture that the energy cost has arisen in the last three years. The majority increase was in a range of 1-9% and followed by a range of 10-19% increase. For the large organizations, the results were scattered, from zero to over 20% increase on annual energy cost, whereas, the rise of 1-9% was observed to be an average range of increase. It is argued that in large organizations there is a huge difference on the energy results between companies with GSCM and without GSCM.

Figure4.7 Increase on Annual Energy Cost



Two large organizations with GSCM have obtained the positive result on the control of total costs. Therefore, there were no increases on energy cost for these companies. However, as for the companies without green supply chain management, one manager has stated that since last year, lighting cost only has taken up 30% overall cost and transportation cost has risen to 50% this year. In terms of manufacturing and storage, electricity cost has been increased rapidly as well since 2009 because of the emission trading scheme. One supplier indicated that it is large cost in frozen logistics and there

were 20% increase on electricity cost. At the same time, with the accelerated increase on fuel and gas, the impacts of energy issues will be on each supply chain activity: manufacturing costs, storage costs, and distribution costs. As a result, the pressure will be put onto customer to pay more on frozen food in the future.

Some managers from small and medium companies were worried that energy issues could threaten the development of frozen food industry in the future since the freezer technology is getting more expensive. For example, one manager said that they had to cut off the machine and stop production due to the high electricity cost. One manager concerned that considering the cost of transportation may make some customers not economic to supply, such as Lower South island may not be economical for Auckland manufacturer.

The situation is same for large companies. Energy cost issue has affected most of the organizations. The rising electricity cost is driving the managers to pay more attention to operate energy-efficiently, such as using efficient lighting systems or renewable energy. Otherwise, the results will be an increasing retail prices in order to cope with the increasing energy cost. One manager said the electricity cost has a huge increase since last year. Lighting system cost only has taken up 30% of overall costs. Increasing fuel cost has led one company's freight cost raised from 30% to 50% of the total costs this year. Also, gas shortage could be another factor affecting manufacturing operation.

4.3 Organizations Without Green Supply Chain Management (GSCM)

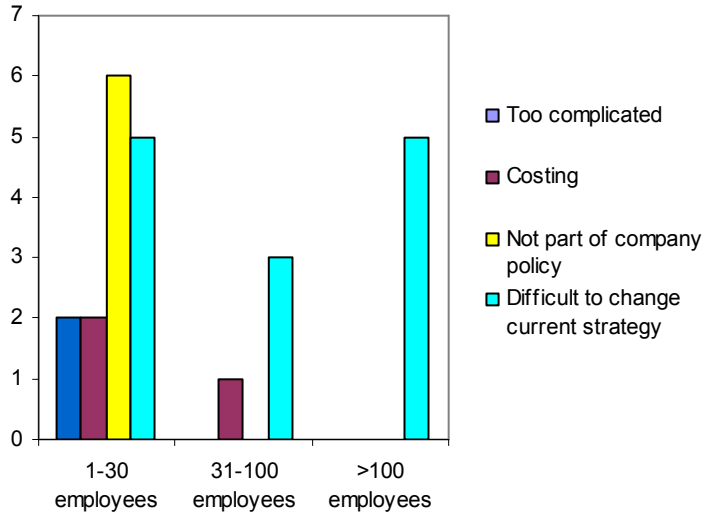
4.3.1 The Constraints

Internal Reasons

Firstly, in this section, the first question was to identify the main reasons of no concern for adopting green supply chain in the business in order to understand which factors have resulted in the difficulty of the green supply chain implementation.

The results from the questionnaire are illustrated in Figure4.8. From organizations with over 100 employees, currently the main impediment was the difficulty to change current logistics and supply chain strategy regardless the possibilities of alteration in the future. The costs and too complicated were not the main obstacles to stop the managers to take into account a green supply chains in the business. None of the respondents from medium and large size organizations chose the reason of "not part of company policy". It reflects that these organizations do realize the necessity of GSCM in the business development.

Figure4.8 Reasons without GSCM



Nevertheless, it was observed that "not part of company policy" has dominated the answers from the small size organizations. It may imply that adopting a GSCM has not occurred to be the consideration of business operation in most of the small companies.

In this regard, it may explain the reason that almost half of small size organization respondents (46%) showed no consideration on the effects in business caused by energy-climate issues. Whereas, only 22% of responding companies from medium and large size organizations gave the answer of "no consideration on its effects".

More issues were discussed through the interview with regard to the reasons for without GSCM. The results gave an explicit direction that the pivotal concern is from

the economy only in all organizations. Financial capacity was the main barrier in Small and medium organizations, since the economic return is low and it takes too long to see the benefits from such investment. Even though some managers believed that current supply chain system is not efficient and effective, considering the cost efficiency, it is difficult for small-medium organizations to change current logistics and supply chain strategy without respect to the business performance.

Meanwhile, a lack of capable human resource in this area and limited understanding of the concepts make the management more difficult towards the implementation of environmental sustainability. One company explained that the development of small business is derived from customer requirement. They would not worry about it unless customers were asking them to do it. Another company believed that the survival issues from economic perspective are critical in the current New Zealand economic situation. It is not priority to give a consideration on sustainability perspective. Thus, as for small-medium organizations, at this stage, focusing on economy only is the core driver in business strategy.

Apart from financial capacity, the lacks of information related with this concept and understanding of measurements were brought up constantly amongst large size organizations regarding the sustainable supply chain management. It may explain the reason why it is difficult to change current supply chains towards GSCM in large organizations.

One manager said that they need someone to push it and provide more information on the understanding. The complex organization structure constrains the organizations to develop the business towards GSCM. Time is another issue mentioned by a manager from an international company, the manufacturing in Australia had started to manage the business towards environmental sustainability but not in New Zealand plant yet. The manager from fishing business explained that due to the reality of this industry and the complicated company structure that so many outsourcing parties involved led to the difficulty on the implementation of environmental management in supply chain.

Also, the supply chain function in the organization is another constraint. The organization structures from small-medium organizations are simple and there is no

logistics and supply chain department or specific manager who is in charge in this area. All of the interviewees were holding the position of General Manager or the director and it is part of their responsibilities. With the increase of organization size, the company's structure is more functional. Most of them separate logistics and supply chain section from other functions and pay more attention to logistics and supply chain management. The majority of interviewees from large organizations are holding a position of logistics manager.

General Manager or company director will make decision on this issue from small-medium organizations. Even in large organizations, it is still one person's decision in terms of the development of environmental sustainability in supply chain management, either CEO or operation's manager.

External Factors

External factors such as government, suppliers and customers could contribute to the reason of the managers ignoring the GSCM.

Almost none of the manager from the participating companies in the interview was aware of any requirements or suggestions from government perspective towards the development of environment sustainability. Only one manager mentioned that this year, one local authority from Auckland showed interest in environmental sustainable management from industry perspective. Incentive policies were suggested to encourage organizations to develop environmentally sustainable business. One supplier who is using coal as main energy source mentioned that since last year, carbon taxes on coal consumption and emission taxes were requested by New Zealand government.

There were no pressures from customers or suppliers according to the research results. The reality of the market is another obstacle in the GSCM. In New Zealand, the grocery business is driven by customers. Small businesses have no power to make a change towards collaboration with suppliers and customers. It is needed from bigger organizations to push the change and to alter traditional single utility focused management towards an integrated supply chain management. One manager said that

the organization has no capacity to take more than the company could afford under current economic situation in New Zealand. Small organizations like this are fighting for survival. Environmental sustainability is something to consider when there are no pressures to keep the economic developing.

Through the interview, it was observed that none of the small organizations have been asked regarding company's environment sustainable management from their suppliers or customers, even for the companies with customers from overseas like Australia, UK, and Asia. Although a few large organizations have been regarding environmental sustainable execution such as carbon foot print, due to a lack of understanding on concepts and measurements, these organizations only could focus on the principle of business best practices. One supplier believed that currently environmental sustainable product is not the main stream concern from New Zealand customers.

These external factors can also be the potential drivers on GSCM for organizations in the future. In New Zealand customer requirements dominate the market and the business development direction for most small-medium organizations. Thus, most managers believed that the pressure on the demand of sustainable supply chain management will derive from customers in the future. However, in the current New Zealand markets, cost is the only thing that the customers are looking at. Hence, the managers indicated that in order to satisfy customer expectation, trying to reduce the total costs to keep lower prices could be the main driver for the organization to manage the business towards sustainability.

Considering the pressures in the future, different company perceives it from different point of view from the large organizations in this research. Companies that deal with international markets believed that international customer requirement like McDonald will be the main pressure driving the environmental management. Whereas, for the organizations that only focus on the domestic market, in order to control the increase of operation costs and keep the competitive position in the market, it is more likely that the pressure from competitors on financial performance will drive the organization towards the management of environmental sustainability. One manager commented that "if my competitor is working on it, we will try to catch up on this".

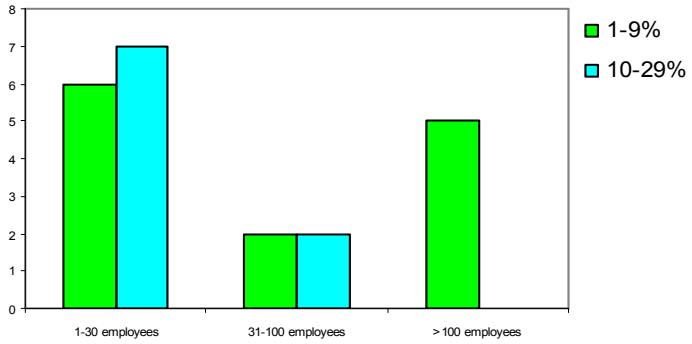
Organizations believed that the pressure from government aspect is not major and it would not happen in the near future.

Overall, the research results revealed that even though a few smaller size organizations did not think that the green supply chain management is important for business development, most of respondents across the three categories believed that there will be challenges on business development without take into account of energy-climate effects in New Zealand.

4.3.2 Performance of Logistics Costs and Activities

It is noticeable from the research results on logistics costs that the rising costs are the fact in logistics activities, especially the transportation cost, which indicated the increase from every organization as shown in Figure 4.9. It was the effects of the rising oil prices. Meanwhile, in terms of transportation cost, with the rise of transportation cost reached to nearly 30% increase in the last 3 years, there will be more pressures on the organizations with less than 100 employees. As pointed out previously by one organization in this research that transportation cost has risen to 50% of total cost this year.

Figure 4.9 Increase of Transportation Cost



The electricity cost has been increased rapidly these couple of years because of the emission tax happened in 2009. It has dramatically driven the increase of storage costs. One manager mentioned that frozen logistics is costly.

Figure 4.10 and 4.11 indicated a similar tendency in inventory and warehousing costs, which have increased by 30% for some of the small and medium size respondents.

The lighting systems cost only takes 30% of the overall costs in some organizations. Overall, the average increase on these logistics costs were in a range of 1-9% increase in the last 3 years.

Figure 4.10 Increase of Warehousing Cost

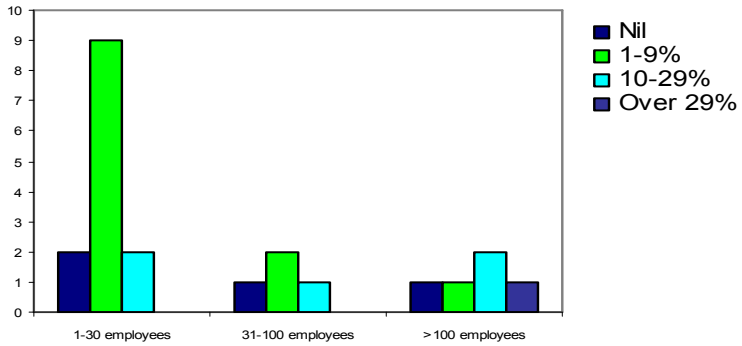


Figure 4.11 Increase of Inventory Cost

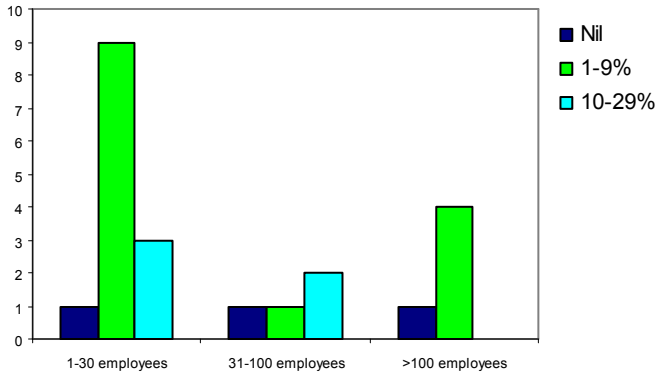
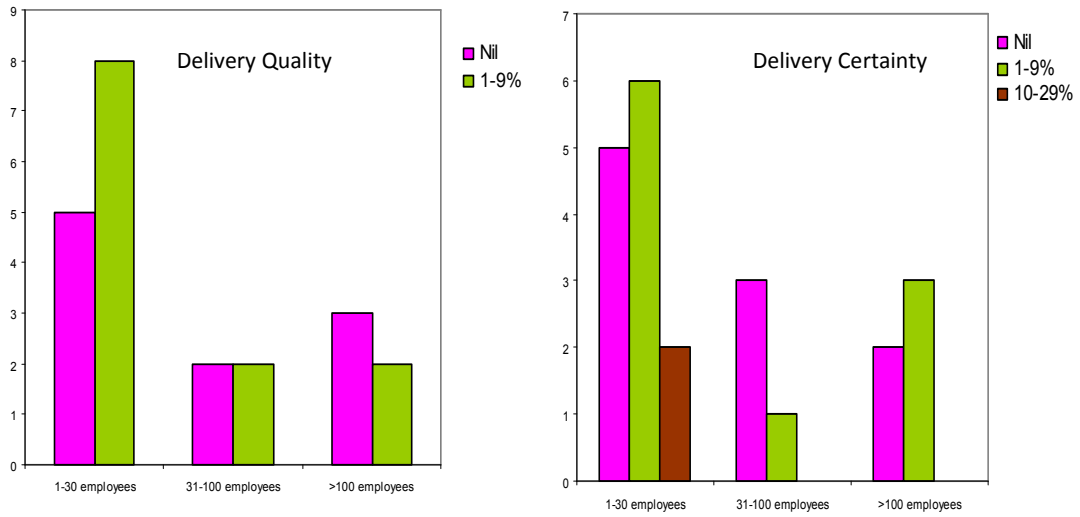


Figure4.12 gives the impression that the majority of small organizations have been influenced on both delivery quality and delivery certainty performances. A decrease on the delivery certainty performance was more obvious as a 30% decrease appeared in smaller organizations. With regard to the large size organizations, there was a slightly different tendency on the results of these two performances. The respondents have experienced the failure on the performance of delivery certainty more than the performance of delivery quality.

It may imply that to keep a good quality performance could be managed by applying various technology or quality HRM (human resource management). But it cannot prevent any uncertainty happening during the delivery. Therefore, the new supply

chain management strategy is needed to cope with the increased uncertainty in the global market in order to improve the overall business performance.

Figure4.12 Decrease on performance



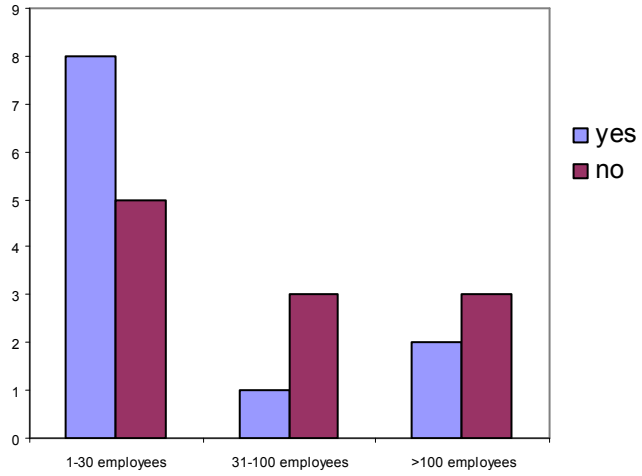
Furthermore, it is observed through the interviews that most organizations are outsourcing the logistics section to third-party logistics companies and the issue of the logistics performance mainly stem from road and sea freight aspects. The interviews explored that even though the managers were aware of the logistics performance issues, they did not really know what caused them since logistics aspect belongs to different business utilities. They argued that it is out of the range they could reach. It may imply that there is a lack of understanding of the concept regarding supply chain management.

4.3.3 Green Initiatives

Interestingly, as to the implementation of green initiatives within supply chain system in the future, the questionnaire results showed a positive consideration on this matter from small size organizations, in which nearly 3/4 of the respondents were keen to take it into account as shown in Figure 4.13. But by contrast, responses from medium and large size organizations were holding a completely opposite opinion, which is the majority are not going to develop the green initiatives in the near future, even though they noticed and considered the effects of energy-climate issues towards business

development. It may derive from the performance on logistics costs and activities that more affect smaller organizations than larger organizations.

Figure4.13 Concerning Green Initiatives



However, the impression from the interviews is that most of the managers from small and medium organizations were not sure what the impacts would be on the business without implementing environmental initiatives. In larger organizations, considering global competition, public image and financial benefits, managers understood that it will be the tendency in business development and showed the interest to drive down this path. They argued that currently to establish green initiatives is not an urgent issue in business development. They believed they are doing the best of business practices. The interview indicated that only limited actions were taken at simple stage like recycling packaging, gradually update machinery, and update lighting system in most organizations. But no formal strategies or specific actions have been set up towards the goal of environmental management such as policies, initiatives and measurements.

All respondents believed that at this stage the 'green business' is not priority to take place in a short term. It is more about economic and cost concerns. A few managers believed that there will be no problems for a long-term development without environmental initiatives regardless of the barriers of human resources and financial capacities.

4.3.4 Recommendations from Managers

One manager from small and medium organization emphasized that government should invest more on efficient logistics system such as to improve the rail systems. Other ideas are revert back to regional manufacturing instead of centralized plant; improve communication and cooperation between suppliers and customers and build up trust system; change lead times or order quantities.

Few ideas were proposed by the managers from large organizations in order to improve logistics performance in the future without respect to various constraints.

A. With the ocean freight costs increasing, changing to manufacturing locally would be considered instead of import products from overseas. Change to direct delivery from manufacture to supermarket could help in reducing carbon foodprint and cost by avoiding using third-party warehouse and wholesale middle medium.

B. Using more rail transportation rather than rely on the road systems only to reduce the consumption of fuel energy.

C. Building own warehousing for flexibility and capacity to replace the contract warehouses or consolidate warehousing function.

D. Improving the information technology achieves better forecasting and controls producing stock levels.

However, all of the ideas were focusing on own business cost reduction point of view. None of them gave a solution towards collaborated supply chain management with their suppliers and customers. It is argued that there is a lack of understanding of the supply chain management theory in most New Zealand food industry organizations.

4.3.5 Summary

The majority of the organizations in this research are without GSCM. It demonstrated that maximize profit by focusing on economic benefits only is still the priority that the managers are pursuing in New Zealand food companies. They tend to focus on how much costs needed rather than think about it as a business value driver.

With regard to the environmental aspects, it was found that in order to reduce the total costs, to a certain extent every company is more or less managing energy efficiency on some little things, like recycling paper and packaging or turn off the light by using common sense without specific environmental policies, initiatives or measurements to monitor and manage the environmental performance.

It has shown that managers were aware of the environmental sustainable issues in this research, but it seems like it has always been left at the back of the business agenda due to various internal and external reasons. One small company indicated that the stakeholders have given concerns on this issue but the progress is very slow due to the lack of human resources and finance support. So no dramatic actions have been taken except some small things.

Most of the organizations believed that best business practices principle should benefit not only economic but also environmental and social aspects. One manager commented that it is very hard to find time to focus on both economic and environmental perspectives.

Furthermore, the research revealed that every company focused on own economic benefit. There is a lack of understanding of the supply chain system and management within the organizations without GSCM. There is no tendency to work on solutions in order to mitigate the impacts caused by energy-climate issues. Restricted by the capacities of human resource and finance, it would not be the priority to take environmental sustainable management into consideration, especially in small-medium organizations in New Zealand. Cost issues are pivotal to motivate managers and they are not worried too much about the indirect affects in the business caused by energy-climate issues.

For those who believe they are doing the best of the practices without green supply chain strategies or plans, the actions on energy efficiency are limited. Most of the organizations are waiting for the competitor's actions on this issue which will be the main driver for them to pay more attention to environmental sustainability in supply chains. Nevertheless, some managers also mentioned that more efforts will be put in

once the business expands into global market but there is no need for domestic market.

Even though few energy consumption taxes are implemented, there is a lack of relevant policies such as incentive policy from government perspective to push the efficient logistics development and to encourage environmentally sustainable management in industry field. From a company perspective, it is extremely important to start to put it in the business agenda considering a long term development instead of waiting for things happing.

As Millar and Puckey (2008) pointed out that ignoring environmental issues will limit economic growth and damage the consequences of economy. GSCM is not only for the purpose of environmental conservation, but also provides opportunities for organizations to develop the business under current risks from the world economy.

4.4 Organizations with Green Supply Chain Management (GSCM)

There were only five out of twenty-eight responding companies towards the GSCM. The small number of organizations with GSCM implies that the GSCM still has not been completely accepted and it is underdeveloped compared with other developed countries.

Within these five organizations as shown in Table4.3, one respondent is under 30 employees; one is from the medium organization (31-100 employees); three of them were derived from the large organizations which were over 100 employees.

Table 4.3 Ratio of GSCM

Organization size	Ratio	% with GSCM
>100 employees	3:5	60%
31-100 employees	1:5	20%
<30 employees	1:13	7%

It is noticeable that organization size could serve as a dominate factor on the implementation of GSCM. The research results demonstrated the link between organizations size and the capacity on monitoring the environmental performance.

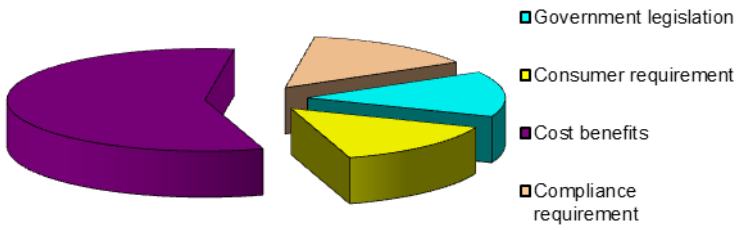
Due to limited employee numbers in small and medium organizations, there are no specified people or department to monitor the green supply chain performance. It is under the CEO or other managers duties. By contrast, large size organization structures were established explicitly and comprehensively. There are specific teams or people to monitor the performance of green supply chain system within these large companies.

It is argued that, due to the limited financial and human resource capacities, organization size could be one of the main barriers for small and medium size organizations to develop the business towards sustainable supply chain management. Since small-medium organizations take a huge percent in New Zealand industry field, it may imply that to accept GSCM completely will be difficult in New Zealand.

4.4.1 The Drivers of Adopting GSCM

The results of the questionnaires depicted in Figure 4.14 show that cost benefit was the leading driver towards GSCM. The primary purpose of the implementing of environmental management is aiming at the reduction of the increasing total costs mentioned by the managers from the telephone interview.

Figure4.14 Reason for GSCM

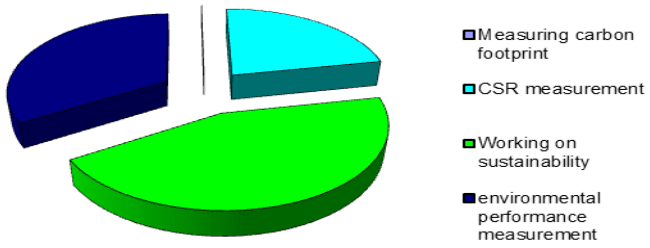


There was only one respondent considered government legislation and consumer requirement as part of reasons for executing a green supply chain system. It is apparent that, there was not much pressure from government and consumer perspectives towards the food industry organizations.

4.4.2 Green Initiative Choices

From small and medium size organizations, the responding companies tended to focus on one type of green initiative. However, large size organization responses were more variable showing a combination of two or three green initiatives: working on sustainability, corporate social responsibility measurement and environmental performance measurement. Working on sustainability was observed with popularity from this research as shown in Figure4.15. It seems like measuring carbon footprint has been left out of concern from all of the respondents.

Figure4.15 Green Initiative Choices



Considering the company's size, financial and employer capacities in New Zealand food industry organizations, it can be argued that compared to other types of initiative, working on sustainability is relatively less complicated approach to start with for small and medium size organizations as it is easy to understand. It explains that the complicated approach—measuring carbon footprint—was not the one these respondents would take into account.

New Zealand companies tend to target at areas like waste and energy usage deductions in terms of environmental management. The initiatives include the controls on noise, smoke, packaging, harmful gas from refrigerator and water. One company said that the environmental performance is measured using cost saving analysis system to measure electricity and water energy usages each day.

4.4.3 Financial Performance

In terms of the costs, the results went to totally different directions between company size under 100 employees and over 100 employees in the organizations with GSCM. Company image, consumer requirement, industry requirement (organic company) were taken into account instead of cost benefit as the core driver towards GSCM in the companies under 100 employees. Thus, for the small and medium size organizations, it revealed a rise of cost after the green supply chain implemented. It may imply that without the pressure from consumer or industry requirement, organizations would not choose GSCM as part of strategy. By contrast, driving by the cost benefits in the large organizations, there were a horizontal tendency and even towards a way of gradually decreasing costs.

Whereas, in terms of the profit performance, none of these responding companies had a result of profit rising but it was on a steady tendency. As the respondent explained, there were other factors influencing the result on profit and also because of the short history on green supply chain development, as the financial benefits of green supply chain would not emerge in a short term period. Three respondents have implemented a green supply chain system over three years. It reflects that it is still a developing field in New Zealand food industry.

4.4.4 The Adjustments

The uncertainty caused by energy-climate issues is fact and is not a temporary shock. In order to adapt into today's turbulent business environment, traditional SCM established during the period of stability is encountering the challenge of new development on supply chain management (Christopher & Holweg, 2011).

Three out of five responding companies implemented the GSCM based on original structure of the system without much adjustment. In this regard, the other two responding companies which reviewed and re-established original supply chains have appeared having the best results on the performance of costs and profit.

It may imply that following traditional SCM structure will be difficult to improve overall business performance, even though organizations are adapting green supply

chains. In order to survive in current volatile and uncertain business environment, traditional SCM structure needs adjustment to be more adaptable towards constant changes of global markets.

4.4.5 Comparing the Implementation of GSCM

Three companies with GSCM attended in the interview stage. Two of them are New Zealand food suppliers targeting New Zealand domestic markets only and one an international none food company. Even if all of them are working on the GSCM, there are huge differences in the implementation between New Zealand companies and international organization regardless of the difference of industry background, except the primary purpose of the implementing of environmental management reducing the increasing of total costs by focusing on manufacturing perspective mainly for all of them.

One of the differences is organization's structures. Each company allocated sustainable management into different department. New Zealand companies are under engineering or operation managers but the international company manages it as part of supply chain manager's responsibility. These led to the result that New Zealand organizations manage it separately from supply chain management which is not an integrated environmental sustainable supply chain management.

The areas on which the companies are focusing are different. Both New Zealand companies tend to aim at internal issues only, such as waste and energy deductions. At current stage, there is no concern towards business partner's environmental performance including upstream and downstream of the supply chain.

With respect to the international company, apart from focusing on internal issues, they also generate environmental initiatives towards all of suppliers and customers involving all of raw materials, packaging and transportation to strive to achieve carbon dioxide reduction within the supply chain systems. They not only measure company's environmental performance but also the suppliers operation in terms of environmental management. It also reflects the international company implements the

environmental sustainable supply chain management more integrated and collaborated than New Zealand food companies.

The difference also emerged in the sustainable policy and targets aspects according to the resources from company's website. The international company's sustainable policy explicitly indicates that the sustainable development is taking all economic, environmental, social issues into consideration and assesses the product's environmental impacts at every stage including each party in supply chain system. In addition, in terms of the domestic organizations there is no clear environmental policies been written, the attention on environmental management is still not much from domestic organizations compared to international company. There is no review on policy or strategy since it was established four or five years ago in domestic companies, while there are quarterly meetings on each target area and monthly report as well for the international company.

In terms of the goals from the implementation of GSCM, all of the organizations have more or less achieved the goal of reduction on costs since the implementation of environmental management. But one of New Zealand companies does not really know if the products have competitive advantage. While, considering the achievement on the execution of environmental management, New Zealand companies could not give a specific percentage and they estimated probable about fifty per cent. By contrast, the international company knew exactly how much has been achieved because they have set up five year targets on each initiative.

Furthermore, compared with the international company, none of New Zealand organizations have environmental standard certification ISO14001.

All of organizations believed that the green strategies have been introduced within every department in the organization.

Chapter 5 Conclusions

5.1 Introduction

This chapter presents the conclusions of the research objectives. Limitations of the study and further research directions are also written in this chapter.

5.2 Objectives

- To investigate the development of environmental management in supply chains in New Zealand food industry;
- To examine the effects of energy consumption and the climate issues in the food industry supply chains by focusing on the energy costs, logistics costs and logistics performances;
- To examine the implementations of green supply chain management in New Zealand food industry supply chains;

- Sub-objective 1: To identify the drivers and barriers towards green supply chain management practices;
- Sub-objective 2: To indicate the differences of environmental management between domestic companies and international company;

5.2.1 Objective 1: To investigate the development of environmental management in supply chains in the New Zealand food industry

The results of this research demonstrated that the environmental management in supply chains is underdeveloped within New Zealand food industry—chilled and frozen food companies. The majority of the organizations are without green supply chain management.

Theoretically, environmental management should be integrated with supply chain management. The reality is that managers are still not paying much attention to environmental protection within supply chain management from the food industry perspective in New Zealand.

Even though most of the managers were aware of the importance of energy-climate issues, organizations are taking a pivotal consideration on economic growth. As Millar and Puckey (2008) commented that in New Zealand, there are load voices in favour of putting the economy first regardless of the environmental consequences, especially, the current economic situation in New Zealand would definitely pull back the progress towards the environmental management in supply chains, as every organization is striving to keep a position in current domestic markets.

This research indicated that within New Zealand food organizations, not only is the gap between theory and practice in terms of environmental management in supply chains huge compared to other developed countries, but also the understanding on supply chains and environmental management is limited.

Previous research (Basnet, 2000; Basnet et al., 2005; Sankaran, 1998) on supply chain management in New Zealand indicated that supply chain management is underdeveloped and fragmental. Through the study from these cases, the impression on this issue has not been changed. The supply chain management has not been improved as the time goes by.

Two capacities play a contribution role helping organizations to improve environmental performance in supply chain management: technical and relational capabilities (Parmigiani et al., 2011). From this research it is revealed that New Zealand organizations are facing both challenges. Most of the organizations indicate that the majority of machinery needs to be updated in the manufacturer. Thus, to update current facility and improve technology would be the primary option towards the improvement of sustainable supply chains.

The green supply chain systems adapted in New Zealand food industry is individual function or organization focused. The organizations were prone to focus on technical perspective (greening manufacturing operation). The development of a green supply chain system is at the early stage.

5.2.2 Objective 2: To examine the effects of energy consumption and the climate issues in the food industry supply chains by focusing on the energy costs, logistics costs and logistics performances

The impression received from the research result was that the overall impacts of climate issues in New Zealand food industry supply chains are not as serious as the energy issues despite the climate issues have influenced supply chain activities more in the larger organizations than in the smaller companies.

The majority of the organizations have not considered this issue because there is no direct impact on the business. However, energy issues have drawn more attention in the discussion from managers because the impacts of energy issues are more obvious and it directly reflects on the annual profit and costs.

Chilled and frozen manufacturers have huge consumption of energy. In addition, Due to the global pressures of energy crisis and climate change, various energy-related taxes were introduced which have contributed to the increase of total costs. A majority of the smaller organizations without green supply chain management are facing the result of increasing annual energy costs. They are more vulnerable and could be attacked more severely than the larger companies in terms of financial performance because of constraints of organization size and financial capacities. By contrast, the large organizations with green supply chain management have resulted in a positive outcome in the control of the increasing energy costs.

The research also examined the impacts on logistics costs and performances. The increasing electricity cost has contributed to an average 10% increase of the storage cost in the last three years. Increased oil prices caused a huge pressure on transportation costs. The decrease on delivery certainty is more apparent than the delivery quality for all of the organizations.

5.2.3 Objective 3: To examine the implementations of green supply chain management in New Zealand food industry supply chains

Environmental sustainability is part of strategy for business beyond cost reduction. Environmental management in supply chains includes environmental initiatives or measurements to monitor and control environmental performance in the supply chains.

The impression received from this research was that the organizations without green supply chain management tend to see it as an impediment in business development by focusing on costs issue rather than thinking about it as a value driver. The pivotal concern is on economy only. For most of the smaller organizations, since they are struggling to survive in the current economy surroundings, green supply chain management is not part of company policy. Various factors, financial capacity, human resources and limited understanding of relevant concepts have also constrained the implementation of green supply chain management in smaller organizations. Thus, there was no concern of energy-climate impacts in business from most of them.

In terms of the larger organizations, the main reason without green supply chain management is the difficulty to change current logistics and supply chains. The complex structures and a lack of information and understanding on the measurements are the barriers which constrained the implementation of green supply chain management in larger organizations.

In addition, a number of organizations are choosing green supply chain management for compliance reason, the external factors such as government, suppliers and customers could also be the reason result in this issue without green supply chain management since there was not much pressure to push these organizations from external drivers at this stage.

The results from the organizations with green supply chain management indicated that the implementation of the environmental management is driven by the purpose of cost reduction. Working on sustainability as an easy approach is the popular initiative adopted by most of the organizations. Since most of the green supply chain management is still under traditional supply chain management structures, the improvements on costs and profit was limited.

Compared with international organizations, the implementation of green supply chain management from New Zealand companies was uncompleted. They only focus on internal issues ignoring the collaboration with suppliers and customers. A collaboration supply chain with suppliers and customers has not been considered as a strategy of green supply chain management in the New Zealand food industry. Organizations still manage the supply chains separately focusing on single section of the supply chain. There is no explicit structure and responsibility in these organizations. Also, the policies or targets of environmental sustainability were not specific and explicit towards the achievement of the management.

5.2.4 Sub-objective 1: Identify the drivers and barriers towards green supply chain management practices

Potential drivers for organizations without green supply chain management:

- Customers expectation on costs for small-medium organizations
- International customer requirements and competitors performance for larger organizations

Drivers for organizations with GSCM:

- Cost benefits
- Government legislation

The research results revealed few obstacles towards the implementation of green supply chain management:

- Organization size obstacle

In New Zealand, the majority of the organizations are small-medium size companies which result in the limited human resources and financial capacities leading to the difficulty towards the development of green supply chain management and monitoring the performance.

- Organizations structure obstacle

This research indicated that even in the large organizations New Zealand companies have no explicit organization structures and clear responsibilities to specify the environmental management in supply chains.

- Understanding obstacle

Most of managers have limited understanding with respect to the value of the environmental sustainability in supply chain management in the business development. Similar as Gehrke's research (2000) stated that small-medium organizations do not consider the relationship between good environmental management and better business opportunities.

- Market obstacle

Furthermore, less competition within food distribution channel led to the result that a couple of wholesales organizations control the food industry supply chain system in New Zealand. Small food companies have no power to change current supply chain operation. In addition, these wholesale organizations are focusing on own economic benefits only and the wholesale's buyer behaviour is driving the food industry supply chain systems. In New Zealand, currently two big wholesale organizations, as the main customers in food consumer market, control the food supply delivery channels. The limited customer scale led to the result that customer requirement dominate the food industry logistics and supply chain development.

- Legislation obstacle

Even though few energy consumption taxes are implemented, there is a lack of relevant policies such as incentive policy from government perspective to push the efficient logistics development and to encourage environmental sustainable management in all industry ranges.

5.2.5 Sub-objective 2: Indicate the differences on the implementation of green supply chain management between domestic companies and international company

Compared with international company which proactively deliver sustainable solutions, this research indicated that New Zealand food industry companies are acting as reactive green marketers which are driven by government or consumer beliefs regarding the environment (Closs et al., 2011). As Closs et al, explained that " reactor leadership approach including firm financial health, business processes that make many aspects of sustainability a less immediate priority and leadership that sees the non-economic dimensions of sustainability as irrelevant or low priority" (p. 107).

As a result, the international company with green supply chain management not only pays attention to internal management but also takes actions on the management of vendors, using environmental management as a value driver. However, New Zealand organizations still just focus on internal issues without the consideration of other part of the supply chain. Table 5.1 illustrates the differences on the implementation of green supply chain management between New Zealand companies and international company.

Table 5.1 Differences between New Zealand Owned Food Companies and International company

Differences	Domestic	International
Start time	4 or 5 years	10 years
Manager	Engineering or operation	Supply chain
Department	Engineering or operation	Sustainability
Certifications	none	ISO14001, ISO26000
Review	none	quarterly
Targets	none	5 years
Environmental management	Own facility	Integrated management
Achievement	50%	100%
Policy	General	Explicit

5.3 Limitations

As is the case for most research, this study has several limitations that effect the interpretations. Firstly, this research only focuses on frozen and chill food organizations in New Zealand and is not taken into account other types of food industries. Secondly, manager's comprehension on the concepts from this research also limited the interpretation of the results. Thirdly, due to the limitations of the sampling, timeframe and funds, therefore this research study does not represent the true population.

5.4 Further Research

Further research is needed towards the study of logistics development in the challenges of environmental sustainability; the study of the measurements on environmental management and the study of government legislation effects on environmental performance. Also, further research could extend into the whole New Zealand food industry or other types of industries such as furniture manufacturers.

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Appendix A: Questionnaire

Research of energy-climate issues within logistics and supply chain system of New Zealand

Questionnaire section one: General Information (please tick the appropriate box)

1.1 The approximate number employees of the organization

A: 1-30 ☐ B: 31-100 ☐ C: over 100 ☐

1.2 Average annual turnover

A: < $1m ☐ B: $1m-$10m ☐ C: > $10m ☐

1.3 Are you a

A: New Zealand company ☐ or B: International company ☐

1.4 Does your organization

A: Manufacture in New Zealand only ☐

B: Manufacture in NZ and import products – both ☐

C: Import products only ☐

1.5 Which of following activities involved in the organization's logistics and supply chain system?

A: Importing product ☐ B: Manufacturing product ☐

C: warehousing ☐ D: transportation ☐

Others please specify: _____

1.6 The percentage of loss on annual profit caused by energy or climate issues in the last 3 years is:

A: Nil ☐ B: 1-5% ☐ C: 5.1-10% ☐ D: over 10% ☐

1.7 What's the percentage of increase on annual energy cost in the last 3 years?

A: Nil ☐ B: 1-9% ☐ C: 10-29% ☐ D: over 20% ☐

1.8 What are the main energy consumption cost in the organization's logistics and supply chain system?

A: Oil ☐ B: Electric ☐ C: Water ☐ D: Gas ☐

Others please specify: _____

1.9 What's the forecast of the energy cost increase (%) in the next 3 years?

2011: _____ % 2012: _____ % 2013: _____ %

1.10 How often the organization's supply chain activities influenced by climate change issues compared to 3 years ago?

A: None ☐ B: Occasionally ☐ C: Often ☐ D: Constantly ☐

1.11 Does the organization have a green supply chain system or operate energy efficient system?

Yes (Please go to section two) ☐

No (Please go to section three) ☐

Questionnaire Section Two: Organizations with Green Logistics and Supply Chain system (please tick the appropriate box)

2.1 What's the main reason for adoption green supply chain system?

A: Government legislation ☐

B: Consumer requirement ☐

C: Cost benefits ☐

2.2 Which one of the following green initiatives is the organization adopting?

A: Measuring carbon footprint ☐ B: Corporate Social Responsibility measurement ☐

C: Working on sustainability ☐ D: Environmental performance measurement ☐

Others please specify: _____

2.3 In the current situation of energy crisis and climate change, are there environmental strategies within company development strategy?

A: Yes ☐ B: No ☐

2.4 Is there an environmental sustainability strategy within the company?

A: Yes ☐ B: No ☐

2.5 Which department within your organization is monitoring the green supply chain performance?

_____

_____

2.6 Is the organization concerned whether or not your suppliers or partners have similar environmental performance?

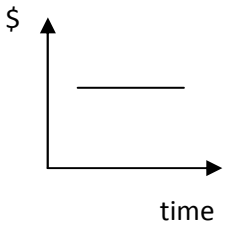
A: Yes ☐ B: No ☐

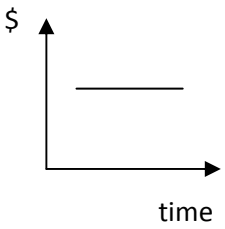
2.7 How long has the green supply chain system been implemented?

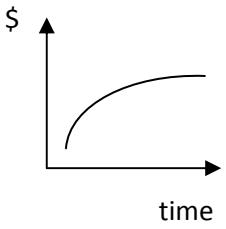
A: < 1 year ☐ B: 1-3 years ☐ C: over 3 years ☐

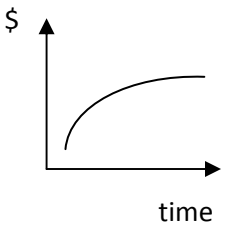
2.8 What's the tendency on cost or profit since the green supply chain taken place? (please circle appropriate letters)

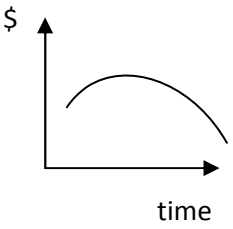
COST ☐ **PROFIT** ☐

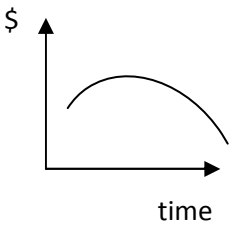
A: 

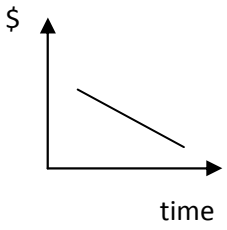
A: 

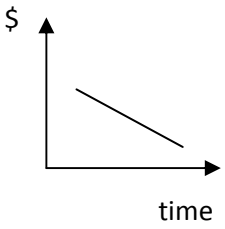
B: 

B: 

C: 

C: 

D: 

D: 

Other please specify: _____ Other please specify: _____

2.9 Is there energy-efficiency or environmental sustainability involved within the organization's green supply chain activities?

A: Yes ☐ B: No ☐

2.10 In order to implement a green supply chain system, to what extent has the original logistics and supply chain strategies been adjusted?

A: Nil ☐ B: A little ☐ C: over 50% ☐ D: totally ☐

2.11 Do you think in the future, it is necessary to develop businesses with green logistics and supply chain system in New Zealand?

A: Yes ☐ B: No ☐

Thank you for your time!

Questionnaire Section Three: Organizations without Concerns for Green Supply Chains (Please tick the appropriate box)

3.1 What's the main reason for no concerns of green supply chain?

A: Too complicated ☐

B: Costing ☐

C: Not part of company policy ☐

D: Difficult to change current logistics and supply chain strategy ☐

3.2 Has the organization considered the effects on business development caused by energy crisis or climate change?

A: Yes ☐ B: No ☐

3.3 Do you think there will be more pressure in the future for companies to develop business for energy-climate effects in New Zealand?

A: Yes ☐ B: No ☐

3.4 Please answer the following questions using the scales provided:

	Tendency in the last 3 years	A: Nil	B: 1-9%	C:10-29%	D: over 29%
1	Increase of warehousing cost (including contract warehousing)				
2	Increase of transportation cost (including in-bond/out-bond transportation)				
3	Increase of inventory cost				
4	Decrease of performance on delivery quality				
5	Decrease of performance on delivery certainty				

3.5 Is the organization likely to implement environmental sustainability or environmental performance measurement in the near future (3 years)?

A: Yes ☐ B: No ☐

Thank you for your time!

Appendix B: interview questions

Introduction: We are here to discuss issues relating to energy--environment impacts in logistics and supply chain system. I want to say that there are no right or wrong answers, but rather differing points of view. Both negative comments and positive comments can be very helpful.

Interview questions for companies without green supply chain system

1. What are the barriers for the organization towards the development of sustainable supply chain strategies? Why is it difficult to implement environmental sustainable supply chain system? (Such as Organization size? Financial capacity? Human resource? The understanding of the concept? Organization structure?)

2. Have the organization been asked by suppliers or customers about environmental sustainable policies executed for sustainable development? If yes, please specify what they were asking for?

3. Currently, are there any pressures or requirements from government perspective on how the organizations should develop environmental sustainability?

4. Where do you think the pressures will come from in the future on the demand of sustainable logistics and supply chain system? (Such as from outside of the organization: Government? Customer? Competitor? Or inside of the organization: financial performance? Requirement of business development?)

5. In your organization, were there any decreases of logistics performance on delivery and quality in recent years? What issues caused it?

6. Will the climate issues influence logistics and supply chain activities in the future? How?

7. Have energy issues (shortage and cost) affected organization's logistics and supply chain activities? How? What will be the impacts in the future?

8. Do you think current logistics and supply chain strategy without environmental initiatives will fit in the long-term business development? Why/why not?

9. What is driving the company development? Pursuing economic benefit: maximize the profit or towards trade-off between economic, social and environment aspects.

10. If the performance of logistics and supply chain activities kept decreasing and the costs kept increasing, what do you think need to be changed in current strategies?

11. Which department manager is the most important in the decision making of sustainable supply chain system?

Introduction: We are here to discuss issues relating to energy--environment impacts in logistics and supply chain system. I want to say that there are no right or wrong answers, but rather differing points of view. Both negative comments and positive comments can be very helpful.

Interview questions for companies with green supply chain system

1. What are the main environmental issues in the organization? (such as from manufacturing, transport, packaging, suppliers). Which part(s) of the logistics and supply chain management are you focusing on to achieve the 'green' supply chain?

2. What is the organization's environmental sustainable policy? Please specify organization's environmental initiatives?

3. What benefits or business performance improvement have been achieved from the environmental efforts in the supply chain system? (Such as financial or customer service aspect) How do you measure the benefits of environmental initiatives? If none, how long do you think it will be before benefits into the business?

4. What is the interest level you have towards your suppliers or business partners regarding the environmental sustainability performance? Is it a collaboration supply chain system?

5. Has the implementation of green supply chain system resulted in a competitive advantage in the market compared with other competitors?

6. What kind of climate issues will influence the logistics and supply chain activities in the future? Please give example.

7. Have energy issues (shortage and cost) affected organization's logistics and supply chain activities? How? Is there any energy-efficiency plan or strategy in the logistics and supply chain system?

8. To what extent does the logistics and supply chain manager involved in sustainable performance? Who or which department is making the decision on the implementation of environmental sustainability? Do you review or meeting regularly regarding the implementation?

9. Has the green strategies been introduced within the whole organization in every department?

10. What percentage do you think have been achieved so far from the implementation of the green supply chain system? From your point of view, which part(s) of the supply chain system could make a change in order to improve the environmental performance in the future? Please give example.