An exploratory survey into
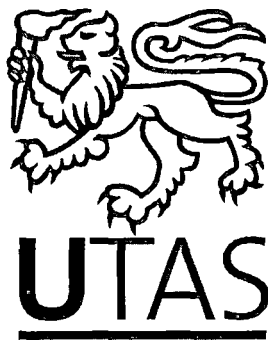
Australian logistics companies' perspectives

and experiences with green logistics

by

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This research explores perspectives and experiences of Australian logistics companies on green logistics. Green logistics is "an integrated management of all the activities required to transfer products through the supply chain with more sustainable balance between economic, environmental and social objectives" (Best Logistics Guide, 2009). This research is looking at 4 aspects related to green logistics; 1) Barriers in achieving ROI and investing on green logistics; 2) Australian logistics companies' expectation on green logistics focusing on ROI; 3) role of information technology in improving ROI from green logistics; 4) Australians logistics companies' experience in green logistics. Unexpected barriers occur during green process inevitably. Most of these barriers are about conceal costs that the organizations have to pay in order to achieve sustainability (Nalewaik & Venters, 2008). According to the issues, this research studies barriers in achieving ROI and investing in green logistics, expectation on ROI from green logistics.

In conducting this exploratory research a quantitative methodology underpinned by an objective ontology and positivist epistemology was adopted as the most appropriate approach to generate data to answer the research questions. Following an extensive literature review, three research questions were developed and a postal questionnaire for data collection prepared. The questionnaire was mailed out to 1,761 logistics companies around Australia. There were 156 responses accounted for 9%. The data collected from the survey was analysed by using descriptive statistical techniques. While the response rate was low, it was still possible to conduct analysis on the data and generate a number of research findings. The key findings from the research are;

1) 69% of Australian logistics companies performing green logistics have conducted in

transportation activities

2) 26% of Australian logistics companies considered cost of fuel bill as the first priority in making decision for conducting green logistics projects

3) 23% of Australian logistics companies do not expect ROI from green logistics

4) 43% of Australian logistics companies consider initial cost for setting up the systems as the most important barrier of achieving ROI

5) 40% of Australian logistics companies view brand image as the most important competitiveness from green logistics

6) 56% of Australian logistics companies have long-term plan to invest in green logistics

7) 59% of Australian logistics agree that IT improve ROI from green logistics

The research has found that;

• Transportation is the first area that Australian logistics companies have started to conduct green logistics (69% of respondents)

• The cost of fuel is the most important factor in making decisions for conducting green logistics projects (26% of respondents)

• Initial cost for setting up the systems is the most important barrier to achieving ROI

• Australian logistics companies perceive that green logistics will improve their brand image (40% of respondents)

• Australian logistics companies are aware of importance of green issues (47% of respondents have conducted green logistics; 56% of respondents have long-term plan to conduct green logistics)

• Information technology was identified as having an important role to play in improving ROI from green logistics (59% of respondents)

The research concludes that future research should focus on improving models for understanding potential for ROI from green logistics, developing more case studies into successful implementation of green logistics and methods for overcoming barriers to investment into green logistics.

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Chapter 1: Introduction

1.1 Introduction

This project aims to explore perspectives and experiences of Australian logistics companies on green logistics. Green logistics is an integrated management of all the activities required to transfer products through the supply chain with more sustainable balance between economic, environmental and social objectives (Best Logistics Guide, 2009). This research is looking at 4 aspects related to green logistics;

1) Barriers in achieving ROI and investing on green logistics

2) Australian logistics companies' expectation on green logistics focusing on ROI

3) Role of information technology in improving ROI from green logistics

4) Australians logistics companies' experience in green logistics

This chapter introduces the readers into the studied area. The chapter is structured in 8 parts:

1) Background

2) Research rationale

3) Definition of key terms

4) Research scope

5) Research objectives

6) Research questions

7) Research contributions

8) Outline of chapters

1.2 Background

While the global economic disaster has declined in the meantime, the growth of greenhouse gas emissions, carbon pollution and the impacts of climate change are increased continuously without awareness (Department of Infrastructure and Transport, 2010). Emission levels per capita of Australia rank among the highest of any OECD country (International Energy Agency 2009b cited in Department of Infrastructure and Transport, 2010). The main reason of the high rate carbon emission is that major industries of Australia are high energy consuming operation such as agriculture, mining and metal products. Moreover, energy production is reliant upon coal fired electricity (Department of Infrastructure and Transport, 2010). In Australia, transport is one of the major sources of carbon dioxide. Rapid growth in the transport's emission is expected to continuously increase around 1.58 per cent a year over the period of 2007 to 2020 (Department of Infrastructure and Transport, 2010). More than half of Australian population aware of green energy indicates upward trend of awareness on climate change.

Attention on the impact of logistics on climate change has been increasing these days as can be seen that pollution and road safety improvement have been controlled strongly in order to lessen the other environmental problems. In addition, new scientific research has illustrated that global warming occurs much greater and more rapid threat than previous thought (McKinnon et al. 2010). Freight transport consumes approximately 8 per cent of energy emitting carbon dioxide globally (Ribeiro & Kobayashi 2007 cited in McKinnon et al. 2010). Amount of energy consumed in freight activities is rising at a more rapid rate than that of private and public transport (McKinnon et al. 2010).

Australian government has been aware of reducing carbon emission. The freight tasks are expected to grow considerably over the next twenty years; government increasingly

comprehends the benefits of improving rail infrastructure (Australian Logistics Council (ALC), 2010). It can be seen that there has been an evolving demand from policymakers for high quality climate predictions (World Climate Research Program (WCRP), 2011). Mode of transport is going to be adjusted in order to increase sustainability in the supply chain. Although there are many advantages from pure road freight solutions such as lower cost, maintaining product quality, safer mode of transport, environmental benefits and less onerous legislative compliance, Australian government's attentions on improving rail infrastructure are increasing (ALC, 2010). Customers demand more cost effective and environmentally friendly transportation solutions; as a result, intermodal rail is composed for sustained growth (ALC, 2010). This implies the more awareness on greenness of the government.

Information Technology's role has been more important in supply chain these days (Husdal, 2011). ICT application has been employed to create sustainability in a smart supply chain (Kilgariff cited in ALC 2010). Consumer awareness and carbon-footprint regulations are expected to considerably increase because they prefer governments and companies to concentrate on climate change issues (Husdal, 2011). Cost savings to consumers and reducing carbon emissions are considered as activities to improve efficiency and productivity in a smart supply chains (ALC, 2010). A productive enhancement comes with a combination between the most economic benefit, reduction of carbon dioxide emission with innovative ICT applications (ALC, 2010). Trend of urbanization for the consumer products and retail industry inclines to reduce carbon footprint and eliminate unproductive inventory (Husdal, 2011).

1.3 Research rationale

Green logistics can be defined as an integrated management of all the activities required to move products through the supply chain with more sustainable balance between economic,

environmental and social objectives (Best Logistics Guide, 2009). Theoretically, green supply chain generates benefits to the organization successfully but it seems to be contrast practically. Unexpected barriers occur during green process inevitably. Most of these barriers are about conceal costs that the organizations have to pay in order to achieve sustainability (Nalewaik & Venters, 2008). Most green projects were rejected because it was considered that it consumed much budget rather than generated profits for the organizations. Some projects were cancelled since the stakeholders considered that it was not worth to invest organizations' resource into a non-guarantee project. According to the issues, this research studies expectation on ROI from green logistics which is one of economic aspects from green logistics projects of Australian logistics companies. A survey conducted by Eyefortransport (2009) demonstrates that long period of return of investment is one of the crucial barriers for adoption of green transportation and logistics initiatives. This information leads to realization on the actual expected period of time logistics companies consider as non-barrier situation. In addition, logistics companies' experiences in green logistics will also be included in the survey in order to explore their awareness and competiveness from green logistics. This will reflect how the logistics companies actually think about green logistics in particular aspects. Green logistics might have been considered as either an origin of valuable benefits or a compulsory element for avoiding being such a laggard in the marketplace.

1.4 Definition of key terms

- *Green logistics*

  An integrated management of all the activities required to transfer products through the supply chain with more sustainable balance between economic, environmental and social objectives (Best Logistics Guide, 2009)

- *Australian logistics companies*

  Australian organization mainly conducting logistics activities such as warehousing

and delivering in their processes

- *Supply chain*

  Transformation of goods from point of origin to point of consumption (Reza, Shabnam & Laleh 2011).

- *Return on Investment (ROI)*

  A financial ratio comparing the amount of income derived from an investment with the cost of the investment

- *Barrier*

  A rule, problem etc than prevents people from doing something, or limits what they can do (Longman Dictionary 2003).

- *Competiveness*: The ability of the company, country, or a product to complete with others (Longman Dictionary 2003)

1.5 Research Scope

This research explores the Australian logistics companies' perspectives on green logistics. The research questions focus on return on 4 aspects related to green logistics;

1) Barriers in achieving ROI and investing on green logistics

2) Australian logistics companies' expectation on ROI from green logistics

3) Role of information technology in improving ROI from green logistics

4) Australians logistics companies' experience in green logistics

1.6 Research objectives

The principle objective of the research is to explore Barriers in achieving ROI and investing on green logistics, Australian logistics companies' expectation on ROI from green logistics

and roles of information technology in improving ROI from green logistics

The secondary objective is to explore the Australian logistics companies' experiences on challenges, opportunities, green logistics competitiveness and awareness of these issues.

1.7 Research Questions

RQ1: What factors impact on Australian logistics companies investing into green logistics?

RQ2: What role does ROI play in Australian logistics companies' decision-making around conducting green logistics?

1.8 Research Contributions

In exploring Australian logistics companies' perspective on green logistics, this research aims to contribute results and insights that are useful for researchers and practitioners aiming to understand green logistics situation in Australia.

1.8.1 Contribution to researchers

This research provides baseline data of perspectives and experiences of Australian logistics companies. The survey received 156 responses accounted for 9% of all 1,761 mailed out questionnaires.

1.8.2 Contribution to Practitioners

The major objective of deploying this study is to provide useful information about green logistics in Australian logistics marketplace. The information acquiring from the survey will present Barriers in achieving ROI and investing on green logistics, Australian logistics

companies' expectation on green logistics focusing on ROI, role of information technology in improving ROI from green logistics and   Australians logistics companies' experience in green logistics.

1.9 Outline of Chapters

There are five chapters in this research as explained below;

Chapter 1- Introduction

This chapter presents the research background, research rationale, definition of terms used in the research, research scope, research objectives, research questions and research contributions.

Chapter 2 – Literature Review

This chapter provides background information for the reader to understand the research topic as outlined below;

1) Drivers for change in logistics systems

   - ROI

   - Sustainability

   - Competitiveness from green logistics

   - Barriers of green logistics

2) Logistics

   - Logistics in Australia

   - Roles of logistics in supply chain

   - Roles of transport in logistics

3) Green logistics

- Green logistics in Global

- Green logistics in Australia

- Roles of green logistics

- Technology in logistics improvement

Chapter 3 – Methodology

This chapter aims to present the research design and methodology employed in this research. It starts with identifying the initial limitations of the study and addresses following issues;

1) Ethical compliance

2) Research Philosophy

   - Ontology

   - Epistemology

3) Research strategy

   - Quantitative Research

   - Identification of business participants

   - Limitations

4) Research design

   - Searching for potential logistics companies

   - Structure of the questionnaire

   - Question types

   - Sampling method

5) Data analysis

   - Data cleaning and data recording

- Descriptive statistics

6) .Reliability and Validity

7) Chapter summary

Chapter 4 – Analysis

In this chapter, an analysis will be undertaken on the collected data. The descriptive analysis will be presented on pie and bar charts. All data collected from the Australian logistics companies regarding to their perspective on green logistics, their expectation from green logistics projects, barriers in achieving ROI, barrier in investing in improving green logistics, experiences of Australian logistics companies in green logistics. The chapter consists of the following topic;

1) Introduction

2) Data cleaning

3) Survey response rate

4) Descriptive Analysis

- Demographic information
    - The organization's revenue
    - The numbers of employee of the organizations
    - The locations of the organization

5) Perception of green logistics

- Current green logistics in Australia
- Respondents' perspective on ROI from green logistics
- Expectation from green logistics

- Barriers of achieving ROI

- Barriers of investing in green logistics

- Competitiveness from green logistics

- Awareness on green issue

- Role of information technology (IT) on ROI from green logistics

Chapter 5 – Results/Discussion

This chapter will use the analysed information from Chapter 4 to answer the research questions and discuss the results to emphasize new knowledge gained from the survey. Limitation on this research will be discussed in this chapter. The contributions of this research and the potential areas will be discussed in order to make suggestion for the further study.

Chapter 6 – Conclusion

This chapter includes summary of finding/results, limitations of the study and future directions for research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents literature review related to the research topic. The chapter is structured in 3 parts:

4) Drivers for change in logistics systems

- ROI

- Sustainability

- Competitiveness from green logistics

- Barriers of green logistics

5) Logistics

- Logistics in Australia

- Roles of logistics in supply chain

- Roles of transport in logistics

6) Green logistics

- Green logistics in Global

- Green logistics in Australia

- Roles of green logistics

- Technology in logistics improvement

2.2 Drivers for change in logistics systems

2.2.1 ROI

Many retailers and manufacturers have been forced to liberalize their returns policies in current years and gladly accept a refund for undesirable goods from the customers (Harvard Business Review 2007). In fact, the companies may not glad to accept a refund. Most

companies view returned products as a costly nuisance and some have formal strategies to deal with those unwanted products (Harvard Business Review 2007). The more reused unit in the supply chain may lead to increase of loyalty and attracting new customers because the environmental image of the companies is built up (Harvard Business Review 2007). It is stated in Harvard Business Review (2007) that products return management can drive more profits for the companies. Moreover, Jayaraman and Luo in Harvard Business Review (2007) say the evidence demonstrates that "a reverse logistics value chain strategy can strengthen a company's competitiveness". EstÈe Lauder's strategic management of its returned goods flow in the first year after investing 1.3 million dollars to set up a system of scanners and other technologies, the company was not only able to sharply lessen the percentage of such products dumped into landfills and also to save half a million dollars in labour costs. It has earned 250 million dollars product line from returned cosmetics and sold them to second stores or retailers in developing countries (Harvard Business Review 2007). A proper managed reverse logistics system enables the firm to maintain relationship with customers and obtain valuable feedback (Harvard Business Review 2007). A survey conducted by Eyefortransport (2008-2009) found that long pay-back period is one of the most important barriers to adoption of Green Transportation and logistics initiatives. Another survey conducted by ABI (2005) found that 23 % of respondents replied that ROI uncertainty was preventing widespread deployment of radio frequency identification in their business. In Middle East and Asia 80 % of respondents consider that financial ROI is important for instigating green transportation and logistics initiatives (Eyefortransport 2008-2009). Majority of organizations in America expect to achieve financial ROI over the next three years (Eyefortransport 2008-2009). Most of barriers are about concealed costs that the organizations have to pay in order to achieve sustainability (Nalewaik & Venters 2008).

2.2.2 Sustainability

Sustainability has been defined in several ways. However, the most common concept is that it should: 'meet the needs of the present without compromising the ability of future generations to meet their own needs' (Jackson 2010, p. 37). Although, being sustainable is sometimes argued that it is a costly exercise, this occurs to be the general public consensus (Jackson 2010, p. 40). A business or operation will be considered that it achieves sustainable concept, if it optimizes quality and cost and minimizes impact. A business failing one of those aspects will not achieve a sustainable concept (Jackson 2010). An element associated with relatively long pay-back periods of capital expenditure is usually required (Jackson 2010). This might be the origin of this perception. (Jackson 2010). The supply chain has been traditionally defined as a one-way, integrated manufacturing process in which raw materials are converted into final products and then delivered to customers. The focus of logistics is the movement of a product from the point of origin to the point of consumption while the focus of reverse logistics is the movement of a product from the point of consumption to the point of origin. Remanufacturing, recycling and reusable packaging are activities overlapping the concepts of logistics and green activities (Rogers & Tibben-Lembke 2001). Sustainability is the main concept of Green Logistics. It considers three dimensions, which are economy, environment and social (Dyllick & Hockerts 2002). To conduct a green logistics project effectively, those three dimensions must be achieved and balanced (Dyllick & Hockerts 2002). A major challenge of logistics in achieving sustainability is integrating supply chains into sustainable systems with minor impact on the environment. The importance of environmentalism and sustainability has led to a broadening of logistics and this was recognised as early as the 1990s. An outstanding example is reverse logistics reducing waste and recycling package. It was the first concept of green logistics in the early 1990s (Byrne & Deeb, 1993; Rodrigue, et al, 2001). Reverse logistics is in contrast to the forward logistics focussing on producer-to-

consumer movement of goods.

2.2.3 Competitiveness from green logistics

Jayaraman and Luo (2007) provided tangible and intangible competitiveness from green logistics as following;

Tangible competiveness

- Provide a good ROI and new markets for returned goods

- Retain environmentally conscious customers and employees and lower future liabilities, insurance rates and customer disposal costs

- Provide detailed insights about merchandising effectiveness, product performance, consumer expectations and product line profitability

- Increase growth in both online and offline shopping

Intangible competiveness

- Improve a corporate image

- Provide multiple benefits such as feedback on magnitude and uncertainty of return flows and potential markets for various recovery operations

- Provide retailers and suppliers opportunity to capture the wealth of information obtained from a returned product

- Provide opportunity to gauge customer reaction, opinion and satisfaction regarding the physical attributes of returned products

2.2.4 Barriers of green logistics

A Survey aiming conducted by Eyefortransport (2008-2009) states that the main barrier is

reluctant to pay a premium of customers. Moreover, there are some noticeable barriers such as high costs, long payback periods and a lack of people driving the process internally.

2.3 Logistics

As per the Council of Logistics Management, logistics has been defined as the part of the process of supply chain that plan, control and implement an effective and efficient flow for the purpose of storage of goods and services and other related information from the point of commencement to the point of final consumption with the aim to satisfy the requirements of its existing and prospective customers (Council of Supply Chain Management Professionals 2000 cited in Reza, Shabnam & Laleh 2011, p. 11). Logistics can be briefly defined as the activities required for transformation and management of products and materials (Reza, Shabnam & Laleh 2011, p. 3-4). Logistics includes processes of inputs, production, distribution, consumption and waste disposal (Bureau of Transport Economics 2001). However, transport, warehousing, order processing and inventory management are considered as the major activities of logistics. Products will be transferred along the supply chain with the right condition of place, time and price. Logistics refers to a set of activities performed to accomplish an organization's business goal of maximizing the profits. Generally, logistics involves purchasing, planning, coordination, transportation, warehousing, distribution and customer service. The freight associated with heavy vehicles and diesel fuel emissions is normally considered as a dirty industry. Achieving cleaner and more efficient transport and logistics leads to more sustainable operations and is necessary in remaining future competitiveness of the industry.

2.3.1 Logistics in Australia

A survey conducted by National Greenhouse Gas Inventory Committee in 1990 and 1999 demonstrates that transport is Australia's third-largest source of GHG emissions and the second-fastest growth sector for emissions. Road transport included passenger and freight accounts for almost 90 per cent of transport sector emissions and is the major source of transport GHG concern in urban areas, reflecting its dominance in both freight and personal movement tasks. Australia's total road transport GHG emissions have increased from 55 Mt in 1990 to approximately 74 Mt in 2007. The Bureau of Transport and Regional Economics (2007b) estimated that the amount of greenhouse gas emissions will be increasing to 90Mt by 2020 accounted for 65 per cent above 1990 levels (Stanley & Hensher 2009).

2.3.2 Roles of logistics in supply chain

In the recent business world, ogistics play a crucial role of corporate strategy, value creation, cost saving, enforced discipline in marketing efforts and increased flexibility in production (Reza, Shabnam & Laleh, 2011, p. 221). To achieve a desirable growth and profitability productively, an organization cannot lose focusing on this sector. These days, there are several examples of companies such as Wal-Mart, Dell and Hewlett Packard (O'Marah & Hofman 2009 cited in Sandberg & Abrahamsson 2010) emphasizing on logistics to drive the firm's strategy for cooperating level profitability and growth (Abrahamsson et al. 2003 cited in Sandberg & Abrahammson 2010). Logistics are utilised as key weapons in these companies to exceed their competitors (Sandberg & Abrahamsson 2010). In term of increasing evidences and number of real-world examples, the logistics' strategic role has also been acknowledged among logistics scholars in recent years (Autryt et al. 2008; O'Marah & Hofman 2009 cited in Sandberg & Abrahamsson 2010). An effective and efficient logistical system is a necessity for providing and delivering quality products to the point of destination in the current scenario of serious competition in the global business environment. The

organization must be aware to eliminate inefficiencies in the supply chain of their operational

performance. An appropriate logistics transport system will considerably benefit the

organization. Logistics has traditionally been considered as an essential operation combined

between the fundamentals set of the marketing and production functions, with only a

secondary role in the firm's strategy (Sandberg & Abrahamsson 2010). Even if the logistics is

not the main focus of an organization, it still supports the other activities. For example, it is

used as a defence stock to push philosophy to support production. It also has to carry a

speculation stock to support a market expansion philosophy with short lead times

(Abrahamsson 2008 cited in Sandberg & Abrahamsson 2010). Hence, logistics operations

have been a crucial key for the creation of operational effectiveness, limited to facilitation of

short-term profitability in a hypercompetitive race towards a productivity frontier (Porter

1996 cited in Sandberg & Abrahamsson 2010). Australian economy also depends on the

performance of the logistics system because it affects the cost structures and revenues of

Australian manufacturers, their competitiveness in delivery times and product quality and

their responsiveness to consumer requirements. Several companies are involved in logistics

services as either users or buyers. For example, the retailing operations of Coles Myer operate

the delivery of products and services from over 13,000 suppliers (Coles Myer 2000, p. 1).

2.3.3 Roles of transport in logistics

Information from International Energy Agency or IEA demonstrates that transport is a major

source of greenhouse gases (Baumert, Herzog & Pershing 2005). It emits greenhouse gases

for 14 % of the global greenhouse gases (Baumert, Herzog & Pershing 2005). Trend of

greenhouse gases from transport has been increasing continuously from 1990 to 2020

(Baumert, Herzog & Pershing 2005). America reaches the highest percentage of greenhouse

gas at 20% of world greenhouse gases followed by China and 25 countries in Europe

respectively. Australia is also on the list at number 16 at 1.5 percent of world greenhouse

gases Baumert, Herzog & Pershing 2005).

Transportation is obviously a crucial activity in supply chains, but there has been argued on the nature of its role in recent years (Bo & Hammervoll 2009). In traditional view, it is a simple cost, which must be initially minimized (Potter 2005, Rushton et al. 2006 cited in Bo & Hammervoll 2009). In contrast, Transportation has been viewed as the potential to play a positive value-adding role in supply chains recently (Lambert et al. 2006 cited in Bo & Hammervoll 2009). Transportation modes are necessary elements of transport systems because they are fundamental of mobility (Rodrigue, Comtois & Slack 2009). It is considered a wide range of modes that may be classified into three broad categories based on the medium they exploit which are land, water and air. Each mode has its own requirements and characteristics, and is adapted to serve the specific demands of freight and passenger traffic (Rodrigue, Comtois & Slack 2009). This gives rise to marked differences in the ways the modes are deployed and utilized in different parts of the world (Rodrigue, Comtois & Slack 2009).

Rail freight

In Western Europe, North America and Japan, rail transportation has been the product of the industrial era, playing a major role in the economic development. It represented a significant improvement in land transport technology and has obviously initiated important changes in the movement of freight and passengers. Rodrigue, Comois and Slack (2009) identified number of strength of rail transport systems such as rapid improvement in travel time and reliable schedules, low level of space consumption, support on gradients, high flexibility in terms of vehicles and a broad range of filling different purposes (Jean-Paul Rodrigue, Claude Comtois & Brian Slack 2009).

Marine freight

Maritime transportation is similar to land and air modes. It operates on its own space, which is a combination of geographic by its physical characteristics, strategy by its control and commerce by its usage (Jean-Paul Rodrigue, Claude Comtois & Brian Slack 2009). The notion of maritime transportation rests on the presence of regular schedules, commonly known as maritime routes.

Air freight

Air transport has been utilized in developing global economic with a significant lower cost of distance. It considerably influences manufacturers, especially that producing high-value microelectronics, because it has been used to bind spatially fractional operations together. Although, air transportation shares only 2% of world trade in products by weight, it serves trading operation for more than 40% by value. For the international operations, freight accounts for 45% of the revenue of a regular airline. It is possible for efficient and affordable air freight to make new products or non-season products usually available in a particular market. Theoretically, arranging route plan of air transport is much more flexible than the other modes. However, it is much more constrained than what supposed.

Road freight

Road transportation both for passengers and freight transportation is the mode that has the highest increasing rate over the last 50 years (Jean-Paul Rodrigue, Claude Comtois & Brian Slack 2009; Baumert, Herzog & Pershing 2005; Kamakate & Schipper 2009). Size and weight constraints imposed by governments and technical and economic limits of engines of all road transport modes have limited potential in achieving economies of scale. Generally, trucks and busses have specific weight and length restrictions in legal which are controlled

for safety reasons. In addition, there are serious limits on the capacities of cars, buses and trucks because of the significant increases in energy consumption following by increases in the vehicle weight. As a result, the capacities of single road vehicles are limited. Road transport not only have limited potential but also abilities to achieve scale economies because the governments force size constraints and technical and economic limits the power sources and allowed net weight. Road transport is expected to be improved in the future by including new materials (ceramic, plastic, aluminum, composite material etc.), fuels (electricity, hydrogen, natural gas, etc.) and information technologies vehicle control, location, navigation and toll collection) in the vehicles in order to improve efficiency of the transport systems. Considerable advantages of road transport are presented in term of low capital cost of vehicles, high speed, and flexibility of route choice. Low costs on vehicles provides convenience for new users for accomplishing entry ensuring that trucking industry is highly competitive and innovations and new technology spread rapidly through the industry. Although road transport's speed is high, it can be constrained by government imposition on speed limits. Flexibility of the route choice is considered as the most important attributes with unique opportunity of road transport providing door-to-door service for both passengers and freight. These multiple advantages have provided road transport mode number of trip purposes and dominance of short distance trips. Although, road transport are costly with occurring of several cost during the process including rights of way, development costs, construction costs, maintenance and administration cost, losses in land taxes, expropriation costs and external costs, this transport mode also generates sources of revenue such as registration, gas, purchases of vehicles, tolls, parking and insurance fees. Moreover, revenue can be in indirect form concerning traffic violations such as speeding using the pretext of public safety to hide revenue generation practices by local government.

2.4 Green logistics

"Green logistics can be defined as an integrated management of all the activities required to transfer products through the supply chain with more sustainable balance between economic, environmental and social objectives" (Best Logistics Guide 2009).   There are two dimensions of green logistics focussing on supply chains' use of energy and environment and achieving compliance with foreign government regulations (IOMA 2007). A crucial challenge for supply chain management is balance between effectiveness and efficiency and being environmental friendly (Rodrique et al, 2001). Technology has been utilized to resolve strain between the need for cost efficiency in supply chain management and improved quality, safety, and environmental sustainability. However, current technologies lack of evidence of the ROI in terms of cost efficiencies or effectiveness of response towards carbon impartiality (O'Connor, 2005). From a research perspective there is also a challenge in how to approach this tension and the generation of insights that can be used meaningfully by multiple stakeholders (industry, governments, community and consumers). Aside from the challenges of a lack of evidence of ROI, the use of technology such as RFIDs presents standardisation and integration issues for global supply chains.

2.4.1 Green logistics in Global

The data collected by AFCOM illustrated that green IT is upward trend (Greengard 2010). Just over 71% of surveyed organizations reveal that those companies are now actively employing green initiatives (Greengard 2010). Recently in foreign countries, the green taxes have been introduced commonly especially in the OECD member states. The most normal taxes are targeting SO2, NOX, carbon emissions, and garbage. EU represents this "Go Green" movement best in its adjustment against the traditional tax system. The EU tax policy promoting full range economy is generally visibly demonstrated in their implementation of green tax charge. Green taxes have been extensively employed in EU countries as a policy

instrument because it has greater compatibility with the market mechanism and functions in correcting misrepresent signal of market price and spreading policy via a price signal (Chen-Kuo & Yeong-Bin 2011). In developed countries, green tax system is one of important measures adopted to stimulate economic and social sustainability. This tax system as a new stage in the development of environmental tax consists taxes from two aspects which are environment and taxation positively impacting environmental protection (Chen-Kuo & Yeong-Bin 2011). The information from Eyefortannsport (2008-2009) shows that European companies realize on importance of greenness as majority of them consider that green issues are important for their overall strategies. However, it was found that the relative importance of green issues depends on annual revenue of the companies (Eyefortransport 2008-2009).

2.4.2 Green logistics in Australia

In Australia, innovative solutions such as warehouse automation, route planning GPS, and special design IT systems reducing paperwork considerably influence on physical distribution efficiencies. In addition, Australia also takes actions to reduce greenhouse gas emissions including improvements in the design of truck trailers providing fuel savings in return (Henderson 2008). In Australia, smart supply chains are also utilized in order to improve efficiency and productivity, provide cost saving to consumers and reduce carbon emissions (ALC 2010). Increase in use of rail freight implies that Australia realizes on reduce carbon emission by alternating their supply chain because it offers a safer, greener and cost-effective (ALC 2010).

2.4.3 Roles of green logistics

Green Logistics accomplishes awareness among researchers and practitioners of operations and supply chain management (Srivastava 2007). This issue is driven by deterioration of the environment such as diminishing of raw materials and natural resources, overflow of waste sites, increase levels of pollution and environmental awareness (Srivastava, 2007). Joe

Parrino stated that a green data centre plays an important role in organization for running business (Gary cited in Greengard 2010). It is not only cost saving but also image of the organization (Greengard 2010). Cnen-Kuo and Yeong-Bin (2011) supported that economies in the developed countries demonstrated that green tax policy solves economic externalities of developed countries effectively. The imposition of green tax gives the organizations benefits on technology advances and environmental protection. In addition, if it is undertaken under a framework of same supervision, it will certainly provide greater outcomes and simplify goal realization. However, it can also cause disadvantages to the realization if it is performed under poor supervision with confused tax/charge items (Chen-Kuo & Yeong-Bin 2011). The immediate expansion and innovation in environmental technologies increases chances for accomplishing a cleaner and more efficient freight logistics industry.

2.4.4 Technology in logistics improvement

IT influences the organization in improving the current logistics functions of the organization and changing the structure of logistics operations (Reza, Shabnam & Laleh 2011, p. 221). Advances in information systems renovating management of logistics improve customer services and storage of more information for later analysis (Reza, Shabnam & Laleh 2011, p. 233). Reza, Shabnam & Laleh, (2011, p. 233) briefly explains two technologies for logistics improvement including DSSs and EDI. DSSs is a systems helping in improve managers' decision-making and forecasting capabilities (Reza, Shabnam & Laleh 2011, p. 233). EDI is technology for transferring information in an efficient, secure and lower –cost (Reza, Shabnam & Laleh 2011, p. 233). Reza, Shabnam & Laleh (2011, pp. 233-234) mention IT application used in different purposes as listed below;

- Data collection; optical scanning, electronic-pen note pads, voice recognition, and robotics

- Identification: barcodes, radio frequency (RF) tags and antennas, smart cards and magnetic strips, and vision systems

- Positional systems (GPS-MPSGIS-Navigator)

- Communication networks and data exchange (EDI-XML-Internet-Satellite-LAN-WAN-EPOS)

- Data storage: data marts and data warehouses

- Software: DSSs, artificial intelligence, general software, and LIS modules

Moreover, there is new software to help measure and manage the carbon footprint of supply chains (Eyetransport 2008-2009). Recently, the software such as Supply Chain CarbonCheck and CarbonView are narrowly used for the purpose of measuring and managing carbon footprint (Eyetransport 2008-2009). Although, technology is currently not used for green logistics, some researches aiming to find out the most appropriate software have been conducted considerably (Eyetrapsport 2008-2009).

2.5 Chapter Summary
This chapter has presented methodology of the research. The chapter has highlighted:

- **Drivers for change in logistics systems**

  - ROI: Finding about ROI of previous studies has been included in this part.

  - Sustainability: This part explains mainly sustainability concept, major challenge of logistics and outstanding example of green logistics.

  - Competitiveness from green logistics: Tangible and intangible advantages were listed in this part.

  - Barriers of green logistics: This part mentioned main barriers noticed by

previous study.

- **Logistics:**

  - Logistics in Australia: The logistics in Australia has been explained in order to give picture of current logistics situation.

  - Roles of logistics in supply chain: Logistics effectively provides several benefits for the organization.

- **Green logistics:**

  - Green logistics in Global: Green logistics has been explained in order to give benchmark when compare with green logistics in Australia.

  - Green logistics in Australia: Green logistics in Australia has been explained in order to highlight major focus of Australian logistics companies in conducting green logistics

  - Roles of green logistics: This part provides roles of green logistics for the organizations in several aspects.

  - Technology in logistics improvement: Information Technology has been included in the systems to improve the supply chain effectively.

CHAPTER 3- METHODOLOGY

3.1 Introduction

This chapter presents methodology of the research. The chapter is structured in 7 parts:

8) Ethical compliance

9) Research Philosophy

   - Ontology

   - Epistemology

10) Research strategy

   - Quantitative Research

   - Identification of business participants

   - Limitations

11) Research design

   - Searching for potential logistics companies

   - Structure of the questionnaire

   - Question types

   - Sampling method

12) Data analysis

   - Data cleaning and data recording

   - Descriptive statistics

13) .Reliability and Validity

14) Chapter summary

3.2 Ethical compliance

The ethical conduct of research and the possible influence of research on the contributors is a significant consideration. The University of Tasmania requires that research be submitted to the University of Tasmania Human Ethics committee for approval prior to the research being conducted. This means that it was conducted according to the guidelines specified by a letter of approval. The letter's guidelines declare that information about the participants and their employer organization will be protected and any information they provide during their participation will be confidential.

3.3 Research Philosophy

The research philosophy is researcher's beliefs that have gone behind the scenes of the study (Springer, 2001). Philosophy is divided into two different categories including ontology and epistemology. The ontology and epistemology will be discussed to provide a general view about the philosophical stance in the research area. The appropriate methodology bases on the research objectives.

3.3.1 Ontology

Ontology studies or concerns about entities in the universe (Larose & Kruse, 2004). It is subclass of metaphysics dealing with the nature of being and considers about types and structures of the objects, properties and relations in every area of reality (Floridi, 2003). Criteria for distinguishing various types of objects such as concrete and abstract, existent and non-existent, real and ideal, independent and dependent and their tie such as relations, dependences and predication are provided by unfolding of ontology (Corazzon 2006).

3.3.2 Epistemology

Epistemology refers to "the assumptions about knowledge and how it can be obtained" (Myers, 1997). It can be defined as approaches and methods employed in the research (Tichehurst & Veal, 1999). The knowledge gained from the research is unacceptable if the

approach and method adopted to gain the knowledge is faulty. There are numbers of epistemologies relating to information systems which are positivism and interpretivism.

Positivism

Positivism is the approach closely aligning with the position adopted in the natural sciences. It is an approach assuming that the reality is fixed and stable (Ticehurst & Veal, 1999). There are scientific methods readily available to represent and measure. This usually includes the use of survey, statistics and quantitative data (Neuman, 2003).

Interpretivism

Interpretivism takes the view that the environment is studied socially, constructed and subjective and there is no reality outside of people's perception and their experience of the event (Ticehurst & Veal, 1999; Walsham, 1993). Interpretivist researchers usually involve in the research process because they have to gather information from the people's mind. Interpretivism usually involves qualitative methods and an inductive approach (Ticehurst & Veal 1999).

The positivist epistemology was used in this research to address the research questions because the nature of this research such as the approaches and methods is closely related to positivism than interpretivism. Moreover, the researcher's personal belief in an objective ontological stance is considerably aligned with positivist epistemology.

Furthermore, given that the objective of this research is to explore perspectives and experiences of Australian logistics companies on green logistics, a positivist approach is the most appropriate as it involves quantitative analysis.

3.4 Research strategy

This research is quantitative research collecting data from logistics companies in Australia.

The samples' contact details were downloaded from the database of Company360 web-site. Questionnaires were sent to the participants by post. The survey will be arranged within 6 weeks. After collecting the data from the respondents, the data will be analysed statically.

Plan of data analysis

- Organize data base structure

- Organize data calculation and presentation

- Check completed questionnaires (Pass = all question is answered)

- Sort the pass questionnaires into categories

- Enter data into calculating program

- Calculate data as organize

- Draw bar charts for each question

- Analyse information

3.4.1 Quantitative Research

Quantitative research is one type of scientific research. Newman (2005) gave characteristics of quantitative research as the following;

- Test hypothesis that the researcher begins with

- Concepts are in the form of distinct variables

- Measures are systematically created before data collection and are standardized

- Data are in the form of numbers from precise measurement

- Theory is largely causal and is deductive

- Procedures are standard, and replication is assumed

- Analysis proceeds by using statistics, tables, or charts and discussing how what they show relates to hypothesis

3.4.2 Identification of business population for the survey

With the purposive sampling in selecting the logistics managers to be the samples, it is ensured that the information from the survey relates to the research questions. Therefore, the analysis can be conducted productively. The samples will be gained from the Company360's database. The downloaded samples are in the category of transportation services and subclass of arrangement of transportation of freight and cargo. The total numbers of sample accomplished from the database is 1,761. As the result will be more accurate if the samples' size is bigger so all the samples gained from the data base will be used in order to achieve high accuracy as much as possible.

3.4.3 Limitations

Although purposive sampling leads to effective framing on the target respondents, there are some limitation occurred in the sampling process. As this method allows the researcher to select the sample with his or her judgement or knowledge of the population, some unexpected errors may occur. For example, there might be the other stakeholders who provide better information than the selected samples. Logistics junior staffs may have more knowledge in practice rather than the managers. The purposive sampling leads to overlooking those respondents inevitably.

Another limitation is caused by density of logistics companies in each state. As can be seen in table 3.1 that numbers of sample from different states are different. It is assumed before sending out the questionnaires that the response rate is the same from every state at about 10 to 20 percents. As a result, the numbers of respondent are different. Response rates of the 8 states arrange from 0 to 15 percent. Multiple responses are companies located in more than state. Replies form those companies reach the highest numbers of respondent at 60.

Table 1. (3.1.)Numbers of sample, numbers of respondent and response rate

STATE	NUMBERS OF SAMPLE	NUMBERS OF RESPONDENT	RESPONSE RATE (%)
ACT	13	0	0
NSW	823	27	3
VIC	460	28	6
QLD	232	17	7
WA	94	13	14
NT	23	0	0
TAS	41	6	15
SA	75	5	7
MULTI-RESPONSE	NA	60	NA
TOTAL	1,761	156	9

3.4 Research design

3.4.1 Searching for potential logistics companies

The samples are people relating transportation for logistics. In this research the samples are people working in Australian logistics companies conducting freight transport in their supply chains. Subclasses of Company360 database including arrangement of transportation of Freight and cargo were selected.

3.4.1.1 The selection criteria

The selected participants should meet needed characteristics in order to be suit the research's requirements:

- The participants must be a person working in an organization conducting freight transport in

their supply chain.

- The participants must be a person directly relating in logistics operation in the organization. They should be the person playing important roles in making decision of logistics projects such as supervisors, manager or COEs.

3.4.1.2 The attempting to invite the potential logistics companies

The potential logistics companies narrowed down from the database of Company360 were invited to participate this survey by an inviting letter. The letter tells the participants the research objectives, participants' involvement and benefits from the findings of the research and the researcher's contact details. Every logistics company on the list will receive a posted mail consisting of an inviting letter, a participant information sheet, a questionnaire, a receiver contact detail form and a separate self-addressed envelope. There is neither specific risk on the participants nor consequences to non-participants as mention clearly in the participant information sheet. 1,761 questionnaires will be sent out to Australian logistics companies in each state with expectation of 10-20 percent in return. Newman (2003, p. 232)

It is impossible to force the target audiences to complete the questionnaires and send them back within a specified period of time. What can be done to gain as many as replies is providing plenty of spared time for data collecting process and making the questions easy to answer.

3.4.2   Structure of the questionnaire

The questionnaire is divided into 2 parts with a total of 13 questions. Section 1 containing 3 questions is company demographics information asking the participant general questions about the companies such as the revenue, numbers of employee and locations. Section 2 containing 10 questions is perspective section asking the perspectives and experiences on

green logistics. The questions ask the respondents about barriers in achieving ROI and investing on green logistics, expectation on green logistics focusing on ROI, role of information technology in improving ROI from green logistics and experience in green logistics. Question 1, 2, 4, 7, 9, 11 and 12 are classified as single items, Question 3, 5, 8 and 10 are classified as multi-items and Question 6 and 13 are classified as Likert Scale (Appendix A). The characteristic of each question types will be clearly explained in the following subject.

3.4.3 Question types

Patton (1987) recommended that questions should be clear and the language of the subject should be used to help in choosing the clearer reaction. This approach was applied in setting up the questions in the questionnaire so the participants can understand the questions clearly. In addition, the clear questions can assist in collecting the data transparently because the participant will not be embraced they could not understand the questions. The screen questions located in section 1 of the questionnaire ask the participants their organization's details such as revenue, numbers of employee and companies' locations. This gives the researcher demographic information about the samples. The more specific questions located in section 2 ask the participants about barriers in achieving ROI and investing on green logistics, expectation on ROI from green logistics, role of information technology in improving ROI from green logistics and experience in green logistics. The questions in the questionnaire will obviously reflect the Australian logistics companies' perspective and experience on the particular aspect.

The answers on each question reflecting respondents' perspectives on both expectations on ROI from green logistics and their experiences in green logistics will be compared across different categories. There are three parameters to classify categories which are locations of

the organization, companies' revenue and numbers of employee. The results from this research including Australian logistics companies' expectation on ROI from green logistics, actual barriers in achieving ROI and investing in green logistics of Australian logistics companies and their experiences in green logistics demonstrate the direction and possibility of green logistics projects in Australia. This will be crucial information for planning strategy to include and improve green logistics in Australian logistics companies' supply chain.

To gain sufficient response from the participants, the questions have to be attractive, clear and easy to answer. Therefore, all questions in the questionnaire will provide choices for the participant to answer by ticking the selected answers. There are 3 main types of questions in the questionnaire as mentioned below;

- *Single response items*: Respondents are only allowed to select one of the alternatives provided.

- *Multi response items*: Respondents are allowed to choose multiple options for the questions.

- *Likert Scale*: This satisfaction scale required the respondents to select on response to present their satisfaction or discontent with the statements. The scales are set up with five options consisting of very important, important, average, less important and not important.

3.5 Data analysis

Data from the survey will be organized systematically by entering into a calculating program —Microsoft Excel. As the collected data is quantitative data with one variable result, the results will be calculated and presented in percentages. The percentages of respondent selecting one or more choice from listed answers in each question will be compared across different categories. It is easy to identify outstanding results and compare data across

different categories on a bar chart because all data will be revealed vitally and systematically. Moreover, quantitative data is expected to imply interesting point for data analysis. However, there is a limitation of the quantitative analysis.

3.5.1 Data cleaning and data recording

Data accuracy is very important for coding quantitative data. Data errors accidently occurred during coding or entering process impacts the validity of the measures and cause misleading results (Nueman 2003). Importing data for a mail survey conducted manually; therefore, human errors cannot be avoided. In order to accomplish a high accuracy data, double checking the data entered in to the calculating program is necessary and important.

3.5.2 Descriptive statistics

Descriptive statistics are used to present quantitative descriptions in a systematic form. The data organized into this form is easy to understand. Descriptive statistics also provided simple summaries. In section 1 of the questionnaire, the participants will be asking about the demographic information such as their organization's revenue, the numbers of employee and the location of the operational site. The result of the research can be presented on a table, pie chart or bar chart to demonstrate the figures with descriptive labels.

According to question type subject, there are 3 types of question including single response items, multi response items and Likert Scale. This paragraph will describe the methodology to deal with those types of question. The information gathered from the questionnaire will be contributed to assist in answering the research questions. Some information will be gathered to provide information for secondary objectives.

3.5.2.1 Single response items

This type of question in the questionnaire asks the respondents with singular noun.

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Question 1 and 2 in section 1 and question 4, 7, 9, 11 and 12 in section 2 are classified as single response items. The selected answer will be counted and recorded in a table manually. The data will be calculated into percentage and put on bar charts called 100% stack column. This kind of bar chart compares the percentage that each value contributes to a total across categories by vertical rectangles. It is used to emphasize the proportion of each data series. The data from this type of question will be presented in correlation with the demographic information. The demographic information will be put on axis X and the percentages of respondent selecting one of the provided choices on each question will be put on axis Y. The information from the questions in the questionnaire provides answers for the research question. Some answers provide information for the secondary objectives. Single response items contribute data to assist in answering the research questions and providing information for the secondary objectives are identified in table 3.2.

Table 2. (3.2.) Identify single item questions in the questionnaire contributing data to assist in answering the research questions and providing information for the secondary objectives

QUESTION	PRINCIPLE OBJECTIVES		SECONDARY OBJECTIVES	
	RQ1	RQ2	Competiveness	AWARENESS
4				▨
7		▨		
9			▨	
11	▨			
12	▨			

3.5.2.2 Multi response items

This type of question in questionnaire asks the respondents with plural noun. Question

3 in section 1 and question 5, 8 and 10 in section 2 are classified as multi response items. Numbers of respondent choosing each answer will be counted and recorded in a table manually. The data will be calculated into percentage and put on bar chart called clustered column. This kind of bar chart compares values across categories by using vertical rectangles. In this research, the researcher aims to demonstrate frequency of respondents choosing the particular answers. The provided choices will be put on axis X and the percentages of respondent selecting the provided choices on each question will be put on axis Y. The information from the questions in the questionnaire provides answers for the research question. Some answers provide information for the secondary objectives. Single response items to contribute data to assist in answering the research questions and providing information for the secondary objectives are identified in the following;

Table 3. (3.3)Identify multi-response item questions in the questionnaire contributing data to assist in answering the research questions and providing information for the secondary objectives

QUESTION	PRINCIPLE OBJECTIVES		SECONDARY OBJECTIVES	
	RQ1	RQ2	Competiveness	AWARENESS
5		▨		
8	▨			
10				▨

3.5.2.3 Likert Scale

This type of question in questionnaire asks the respondents to rate the particular aspect. Questions 6 and 13 in section 2 are classified as Likert scale. Numbers of respondent rating the items will be counted and recorded in a table manually. The data will be calculated into percentage and put on bar chart called clustered column. In this research, the researcher

aims to present frequency of respondents rating the particular items. The demographic information will be put on axis X and the percentages of respondent rating the particular aspects in one of the five levels will be put on axis Y. The information from the questions in the questionnaire contributes to assist in answering the research questions. Some answers provide information for the secondary objectives. When analysing the data from this type of question, some data will be grouped in order to clearly emphasize the results. Numbers of respondents ranking the particular aspect in very important and important level will be grouped together. Similarly, the numbers of respondents ranking the particular aspect will be treated in the same way. This makes importance of the particular aspects into 3 levels which are important, average and not important level. Likert scale contributing data to assist in answering the research questions and providing information for the secondary objectives are identified in the table 3.4.

Table 4 (4.4) Identify multi-response item questions in the questionnaire answering the research questions and providing information for the secondary objectives

QUESTION	PRINCIPLE OBJECTIVES		SECONDARY OBJECTIVES	
	RQ1	RQ2	Competiveness	AWARENESS
6		▨		
13				▨

3.6 Reliability and Validity

Reliability and validity concern about connection between concrete measures and constructs (Neuman 2003, p. 178). In quantitative research, numerical results produced by an indicator do not vary because of characteristics of the measurement process or the measurement instrument (Neuman 2003, p. 179). Reliability's matter is whether a particular technique, applied repeatedly to the same object, gives the same result each time (Babbie 2003). A

reliable indicator should provide the same measure each time. Bobbie (2003) stated that validity considers whether an empirical measure adequately reflects the real meaning of the concept. It is what the research is measuring or explaining (Mason 1978).

3.7 Chapter summary

In this chapter, the researcher has outlined the philosophical stance behind the research. The purpose of this chapter is revealing the actual route in conducting this research. The reader will get ideas of how the research has been conducted in order to gain findings in the next chapter. The research method addresses the objectives of the research. A mailed-out questionnaire was the major method of collecting data in this research. The logistics companies in Company360 database received a survey envelope consisting of an invitation letter, an information sheet, a questionnaire, a reply envelope and a contact detail form. This research also achieves the ethical compliance addressed by Social Sciences Research Services, University of Tasmania. The main focus of this chapter is explaining the instruments and processes of the research. The data collection and analysis were discussed in the last section.

CHAPTER 4- ANALYSIS

4.1 Introduction

This chapter demonstrates finding from the collected data. The quantitative results will be

presented statistically on pie chart and bar chart in order to explore the Australian logistics

companies' expectation on ROI from green logistics, the actual barrier in achieving ROI, the

Australian logistics companies' opinion of competitiveness from green logistics projects and

awareness of Australian logistics on green issue. The chapter is structured in 5 parts:

1) Introduction

2) Data cleaning

3) Survey response rate

4) Descriptive Analysis

- Demographic information

  - The organization's revenue

  - The numbers of employee of the organizations

- The locations of the organization

5) Perception of green logistics

- Current green logistics in Australia

- Respondents' perspective on ROI from green logistics

- Expectation from green logistics

- Barriers of achieving ROI

- Barriers of investing in green logistics

- Competitiveness from green logistics

- Awareness on green issue

- Role of information technology (IT) on ROI from green logistics

4.2 Data cleaning

As mentioned in Chapter 3 that the data had been collected by mail survey. The collected data were initially recorded manually on a paper work and then the completed data was entered into Microsoft Excel. At this stage, all data were double checked in order to ensure its accuracy. There are some of the questionnaires were not completed. Those are considered as fail response and will not be included in the database.

4.3 Survey response rate

Survey response rate of this research is 9 per cent. The questionnaires were posted to 1,761 Australian logistics companies in the Company360 database. Forsgren (1989) stated that low response rate of the mail survey is considered as a serious shortcoming. Expectation on return of a mail survey is normally between 10 and 50 per cent (Neuman 2000). According to Forsgren (1989), the response rate of this survey is quite low because there are inevitable

problems occurring during the process. Some information in the database is out of date. 54 envelopes were returned by the post office because the address does not exist. In addition, duplication also occurs in both sending out and receiving in process. These cause a low response rate significantly. It is also evident that green logistics is still a new area and the low response may also indicate a generally low level of activity in green logistics in Australia.

The questionnaires were sent out on 15 August 2011. The first lot of reply arriving within two weeks and weeks four account for 127 and 35 responses, respectively. The receiving box was closed on 30 September 2011. This provided six weeks for the participants to consider whether they would like to participate this survey. The exact closing box day were decided after the response rate has declined until there was no more response. The descriptive statistics of the overall response rate are show in Figure 4.1.
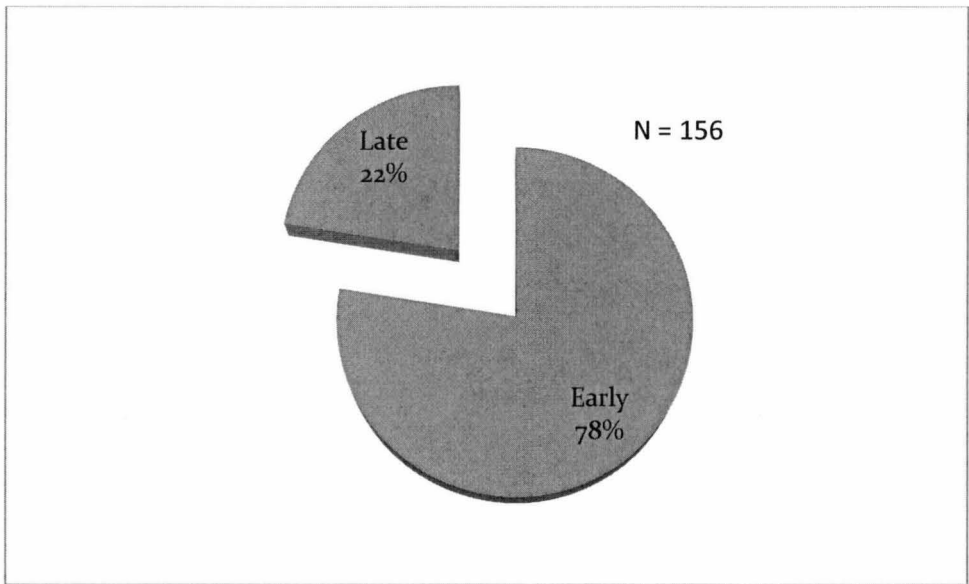
Figure 4.1 Survey Responses

4.4 Descriptive Analysis

The descriptive analysis can be divided into two main sections according to the structure of the questionnaire. Section 1 contains three demographic questions which are the

organizations' revenue, the numbers of employee and the locations of the organization. Section 2 consists of seven questions asking the participants about their perspectives on green logistics. The questions attempt to gain information based on specific terms such as barrier of achieving ROI and investing in green logistics, expectation on ROI from green logistics and experiences of Australian logistics companies. For more detail on data analysis, please refer to section 3.6 in the methodology chapter.

4.4.1 Demographic information

In this section, the descriptive statistics were collected to present the background information of the respondent. The demographic information includes 4 parts as following;

- The organizations' revenue

- The numbers of employee of the organizations

- The locations of the organization

4.4.1.1 The organization's revenue

Figure 4.1 represents the classification of respondents by the organizations' revenue in total of 156 respondents. The highest numbers of respondent is the companies with 10 to 50 million dollars accounting for 53 respondents (34 per cent). This is followed by the organizations with 1 to 5, 5 to 10, more than 100, less than 1 and 50 to 100 million dollars revenues accounting for 35 (22%), 23 (15%), 19 (12%), 14 (9%) and 12 (8%) respondents, respectively.
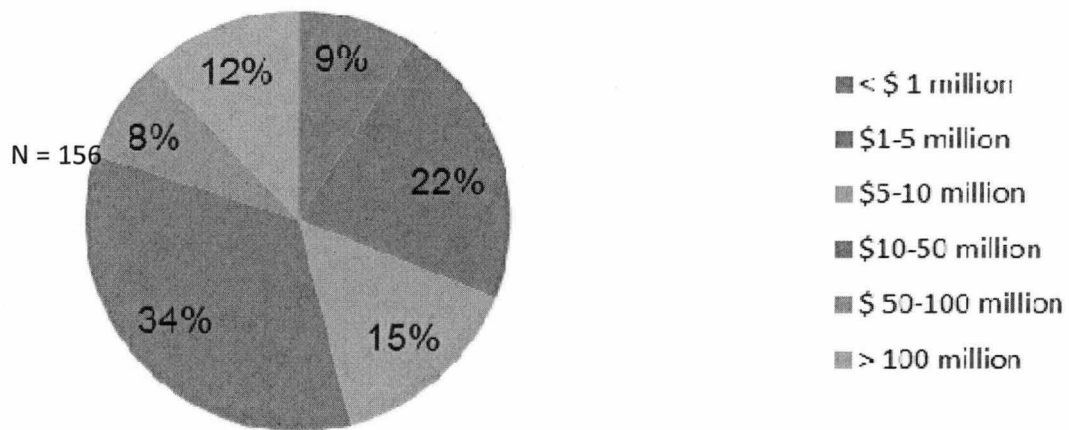
Figure 4.1 Ratio of respondents from logistics companies classified by revenue

Figure 4.2 demonstrates the category of respondents classified by the numbers of employee of the organization. The two largest proportions of respondent are the categories of numbers of employee 21-100 and 1-20 accounting for 61(39%) and 47 (30%), respectively. The numbers of respondent from the companies with 101-200, more than 500 and 201-500 employees are 21 (13%), 14 (9%) and 13 (8%), respectively.

N = 156
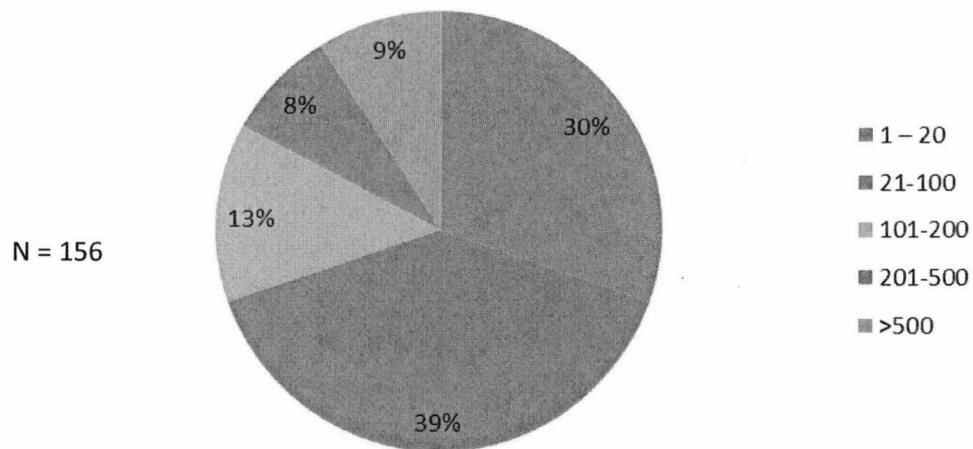
Figure 4.2 Ratio of respondents from logistics companies classified by numbers of

employee

Figure 4.3 shows proportion of respondents located in 8 states of Australia. The companies located in more than 1 state are called multi-response in this research. 60 respondents are from the multi-response category weight at 38 per cent of all respondents in this survey. Numbers of respondent from VIV, NSW, QLD, WA, TAS and SA are 28 (18%), 27 (17%), 17 (11%), 13 (8 %), 6 (4%) and 5 (3%) respectively. There is no response from ACT and NT.
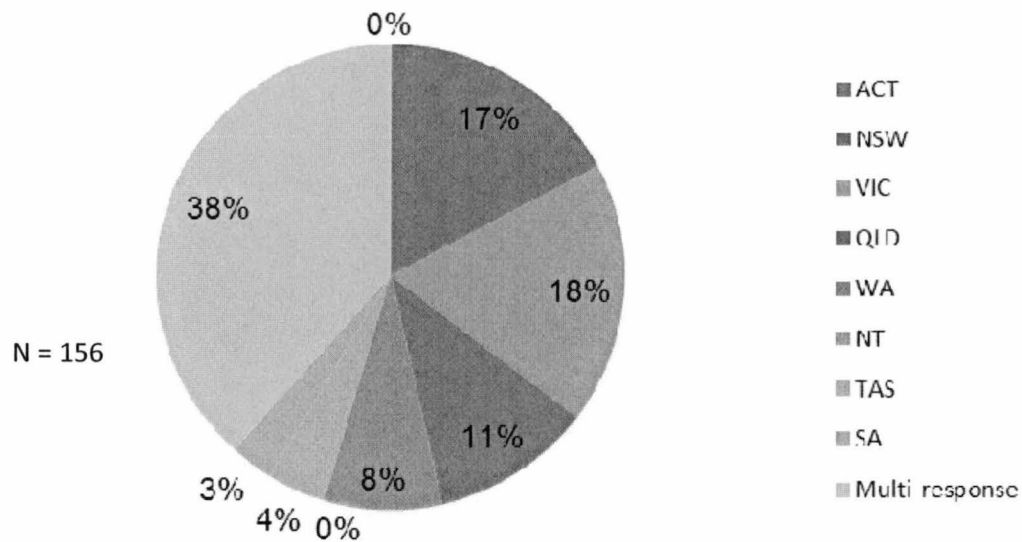
Figure 4.3 Distribution of respondents located in seven states of Australia

4.5 Perception of green logistics

In this part, outstanding information demonstrated by the survey data will be pointed out.

Each aspect will be analysed and presented by correlating with those three demographics.

4.5.1 Current green logistics in Australia

The data will be analysed and presented in categories classified by the demographic

information of the companies such as the firm's revenue, numbers of employee and companies' location. This information is gathered from question 4 in the questionnaire. The numbers of firm conduction green logistics reflects awareness of Australian logistics companies on green issue. In total, proportion of companies conducting green logistics is bigger than ones not conducting at 47% and 53%, respectively (Figure 4.4, 4.6 and 4.8). Specifically on what part of supply chain has been conducted green logistics; it is obviously shows in Figure 4.5, 4.7 and 4.9 that green logistics has been conducted in transportation activities (69%) rather than warehouse (19%) and others (12%). There are some implications appear to show different results during different categories when classified respondents by the demographic information. Each result of analysis was deeply explained in the following.

4.5.1.1 Respondents classified by companies' revenue
Figure 4.4 shows for 156 respondents 53% of companies with 10-50 million dollars revenue, 50% of companies with 50-100 million dollars revenue and 58% of companies with more than 100 million dollars revenue have conducted green logistics. The categories of the 3 largest grouping of companies by revenue appear to be doing green logistics more than the

smaller companies. Among companies with below 1 million dollars revenue, there is a low numbers conducting green logistics (29%). This suggests that larger companies are more able to conduct green logistics than smaller companies.
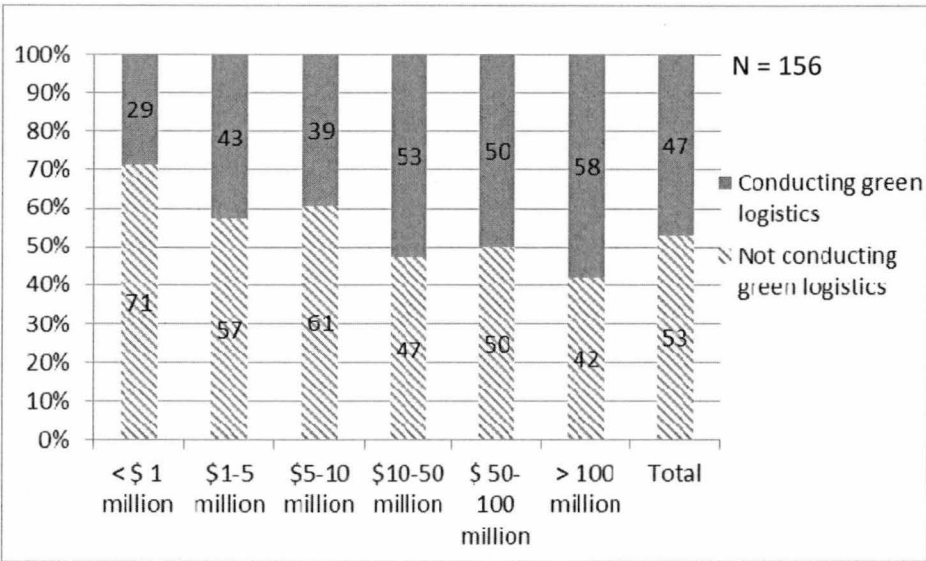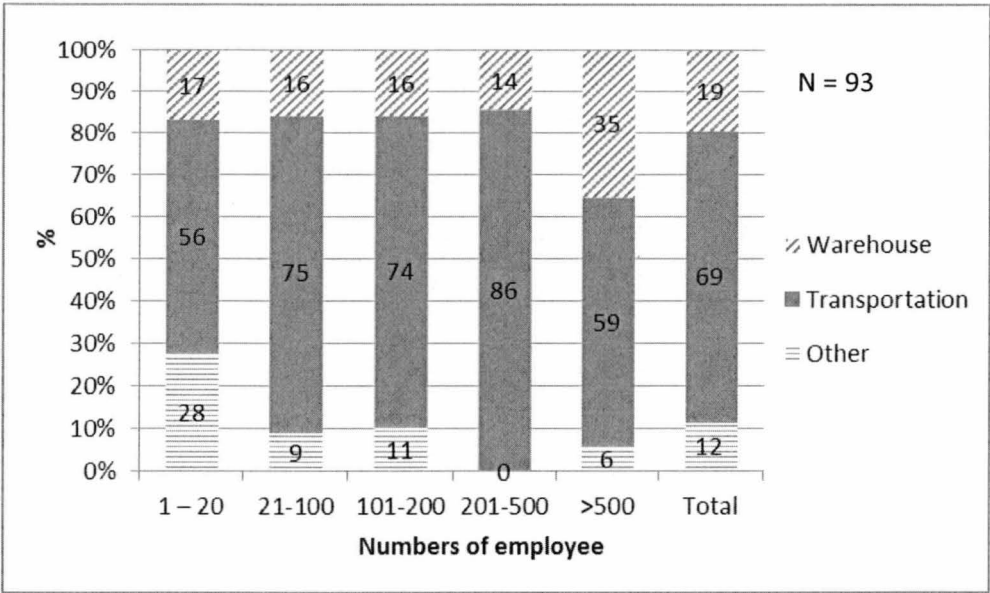

Figure 4.4 Percentage of green logistics being conducted in the respondents' supply chain of respondents classified by revenue of respondents

Figure 4.5 refers to the numbers of respondent at 93 conducting green logistics out of 156 of total respondents. The figure shows that the percentage of transportation conducted in the respondents' supply chain of each category is the largest proportion arranging from 56% in the companies with more than 100 million dollars to 86% in the companies with 50-100 million dollars revenue. This suggests that transportation is the priority to conduct green

logistics among the others.
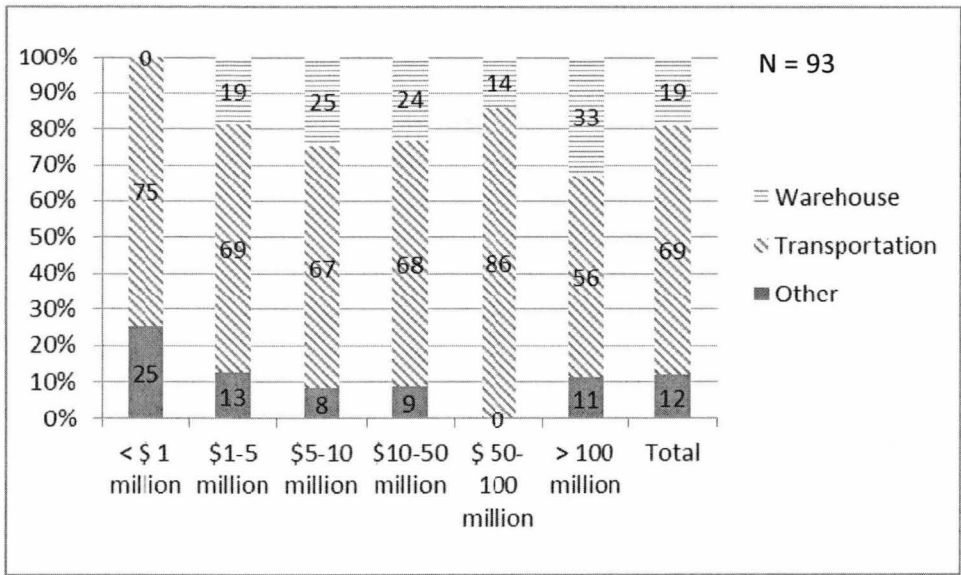
Figure 4.5 Percentage of green logistics activities including warehouse, transportation and other being conducted in supply chain of the respondents classified by revenue of respondents

4.5.1.2 Respondents classified by numbers of employee

Figure 4.6 shows for 156 respondents 80% of companies with 101-200 employees, 54% of companies with 201-500 employees and 71% of companies with more than 500 employees have conducted green logistics. Similar to the analysis of data classified by companies' revenue, the categories of the 3 largest grouping of companies by numbers of employee appear to be doing green logistics more than the smaller companies. Among companies with

1-20 employees, there is a low numbers conducting green logistics (34%). This suggests that larger companies are more able to conduct green logistics than smaller companies.
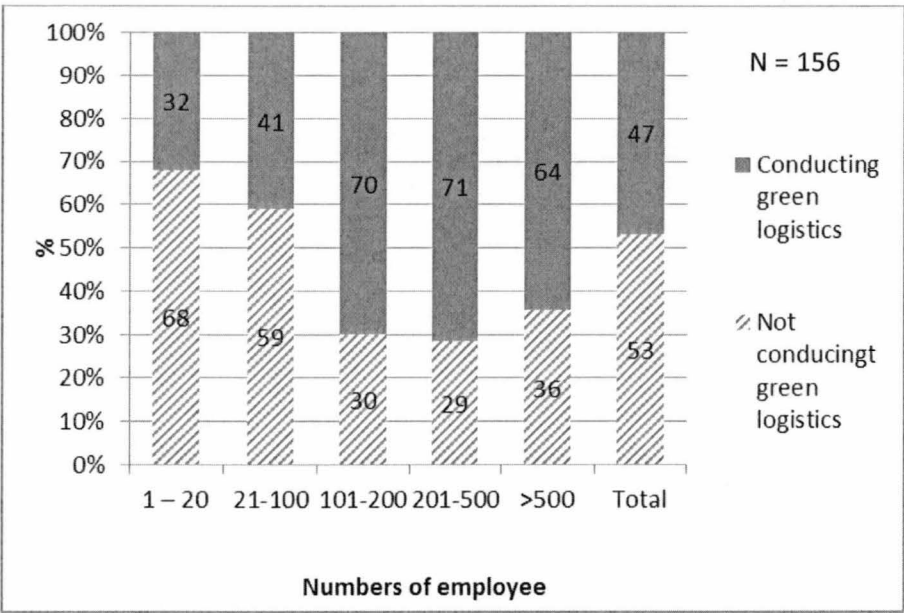
Figure 4.6 Percentage of green logistics being conducted in the respondents' supply chain of respondents' classified by numbers of employee of companies

Figure 4.7 refers to the numbers of respondent at 93 conducting green logistics out of 156 of total respondents. The data classified by numbers of employee presents the similar pattern in conducting green logistics as can be seen in Figure 4.7 that the percentage of transportation conducted in the respondents' supply chain of each category is the largest proportion arranging from 56% in the companies with 1-20 employees to 86% in the companies with 201-500 employees. This suggests that transportation is the priority to conduct green logistics

among the others.

Figure 4.7 Percentage of green logistics activities including warehouse, transportation and other being conducted in supply chain of the respondents classified by numbers of employee

4.5.1.3 Respondents classified by companies' location

Figure 4.8 shows for 156 respondents the proportion of companies conducting and not conducting green logistics around Australia is different in different states. 65% of logistics companies located in QLD and 53% of multi-response companies have conducted a green logistics. 50% of companies located in TAS have conducted green logistics. In contrast, majority of the companies from the other states including VIC (75%), SA (60%), NSW

(56%) and WA (54%) have not conducted green logistics. The difference in location of companies does not reflect considerable points in conducting green logistics of Australian logistics companies.
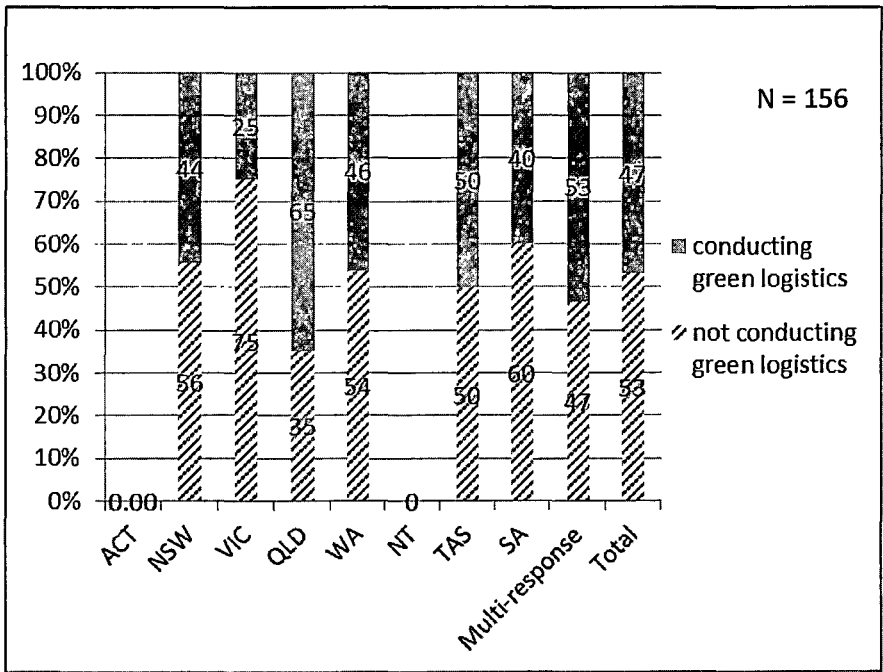
Figure 4.8 Percentage of conducting and non-conducting green logistics of companiess located in 8 states and multi-response companies

Figure 4.9 refers to the numbers of respondent at 93 conducting green logistics out of 156 of total respondents. Specific information about which part of the supply chain has been processed to conduct green logistics is illustrated in Figure 4.9. Most of the respondents from every state has conducted green logistics in their transportation process. As can be seen in Figure 4.9 that percentage of green logistics in transportation activities of every category is

the largest proportion arranges from 59% (Multi-response) to 100% (TAS).
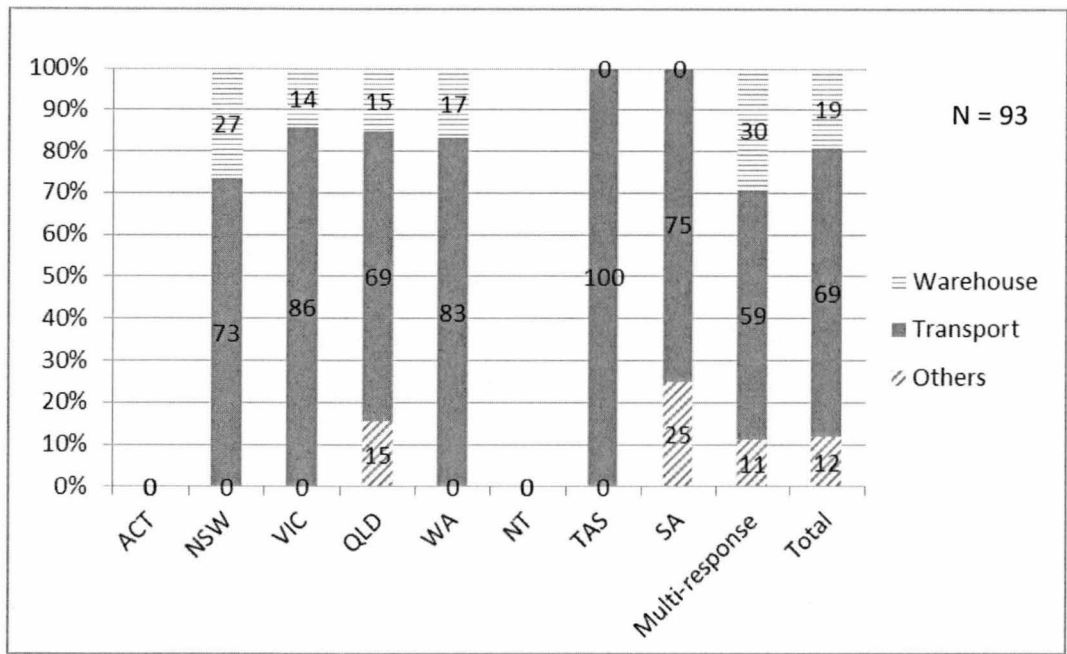
Figure 4.9 Percentage of conducted green logistics in the respondents' supply chain of

companies located in 8 states and multi-response companies

4.5.2 Respondents' perspective on ROI from green logistics

This section focuses on importance of ROI in making decision to conduct green logistics in the supply chain. This information is gathered from question 5 and 6 in the questionnaire. Numbers of respondent selecting the provided choices in question 5 indicate the most important factor in making decision to conduct green logistics and numbers of respondent

choosing question 6 represents importance of ROI in making decision for green logistics.

4.5.2.1 Respondents classified by companies' revenue

Figure 4.10 shows for 156 respondents the proportions of respondent considering cost of fuel

bill and financial ROI as the most important factor in making decision to conduct green

logistics are similar with slight higher percentages of cost of fuel bill. 22% of companies with

50-100 million dollars revenue to 33% of companies with 1-5 million dollars revenue

consider cost of fuel bill as first priority to make a decision to conduct green logistics. 15% of companies with lower 1 million dollars revenue to 27% of companies with 5-10 million dollars revenue consider financial ROI as the first priority to make a decision to conduct green logistics. The following sequences of factors in making decision to conduct green logistics are customer relations improvement (18% in total), government compliance (16% in total) and supply chain efficiency (10% in total), respectively. This suggests that the main factors in making decision to conduct green logistics are the one relating to finance. Figure 4.10 clearly indicates that both financial factors including cost of fuel bill and financial ROI is more important in making decision to conduct green logistics among the other factors.
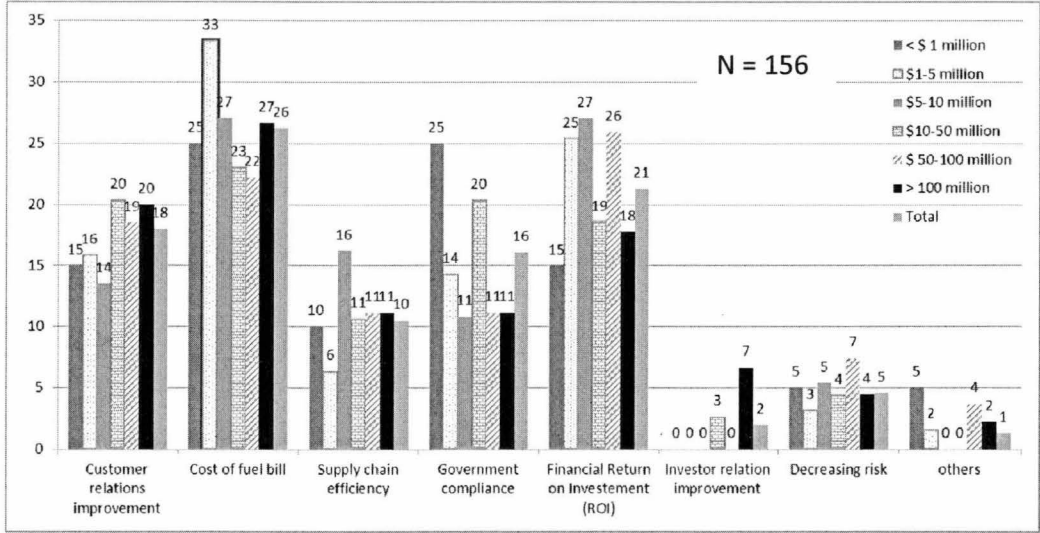
Figure 4.10 Percentage of respondents from companies classified by revenue selecting the provided choices as the first priority in making decision to conduct a green logistics project

Figure 4.11 shows percentages of respondent rating ROI as a very important factor in making decision to conduct a green logistics project is the highest proportion in five categories accept category of companies with over 100 million dollars revenue. However, the proportion of companies considering ROI as an important factor in making decision to conduct green logistics significantly higher than that of companies considering ROI as unimportant factor.

Refer to 3.6.2.3 in methodology chapter that the data will be analysed in 3 levels of importance of the particular aspect, Figure 4.11 clearly shows that proportion of companies in every category classified by companies' revenue consider that ROI is important in making decision to conduct green logistics. This supports the information from Figure 4.10 that ROI is one of the most important factors in making decision to conduct green logistics.
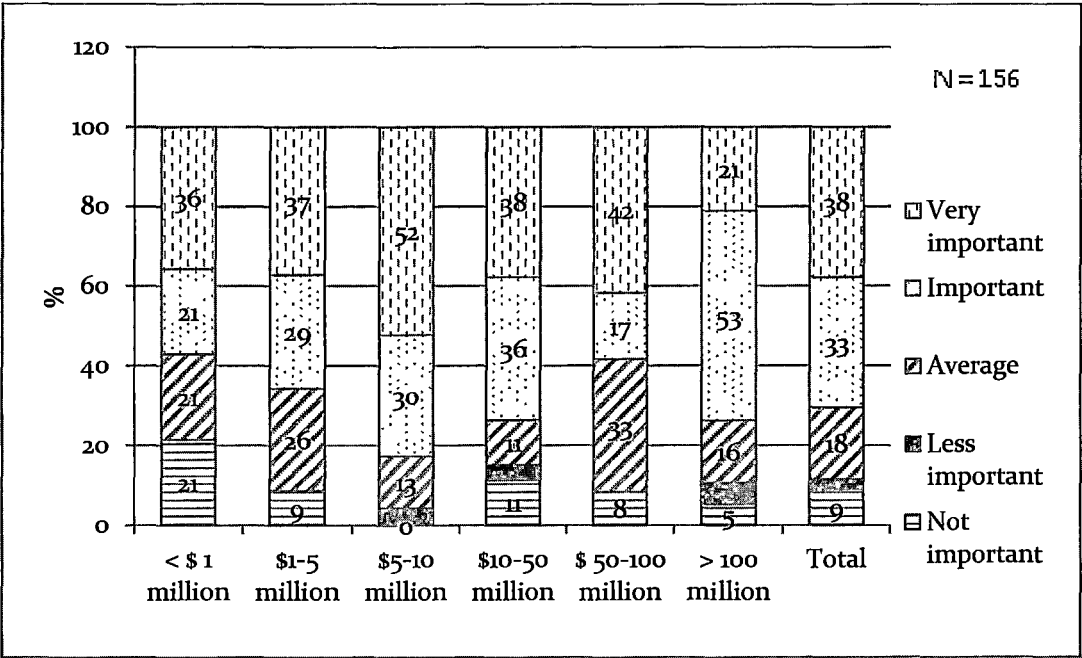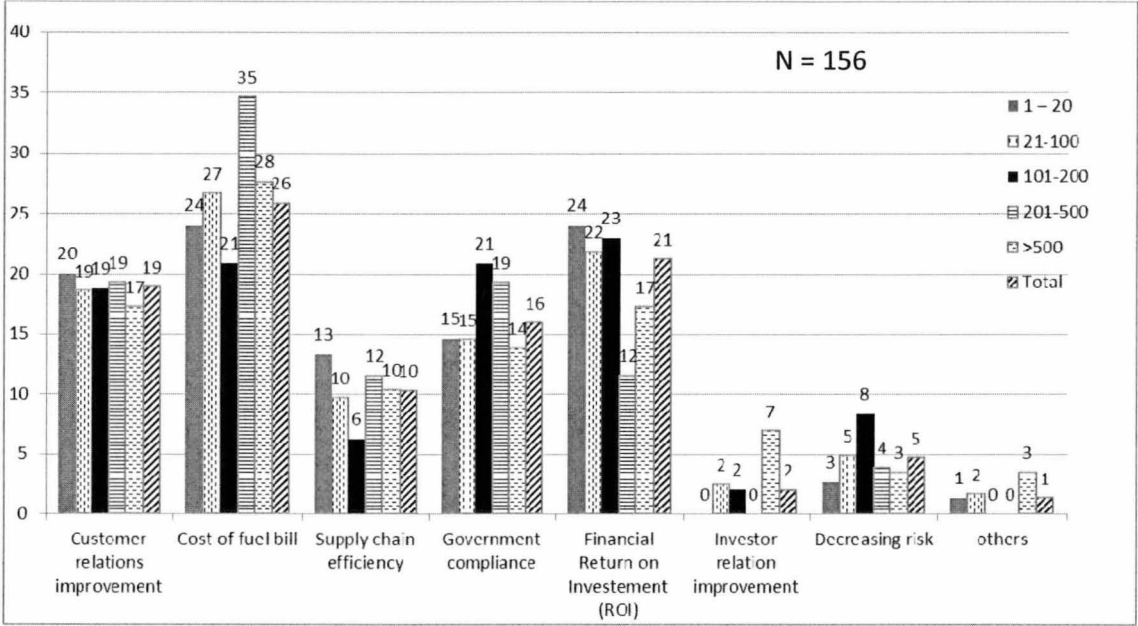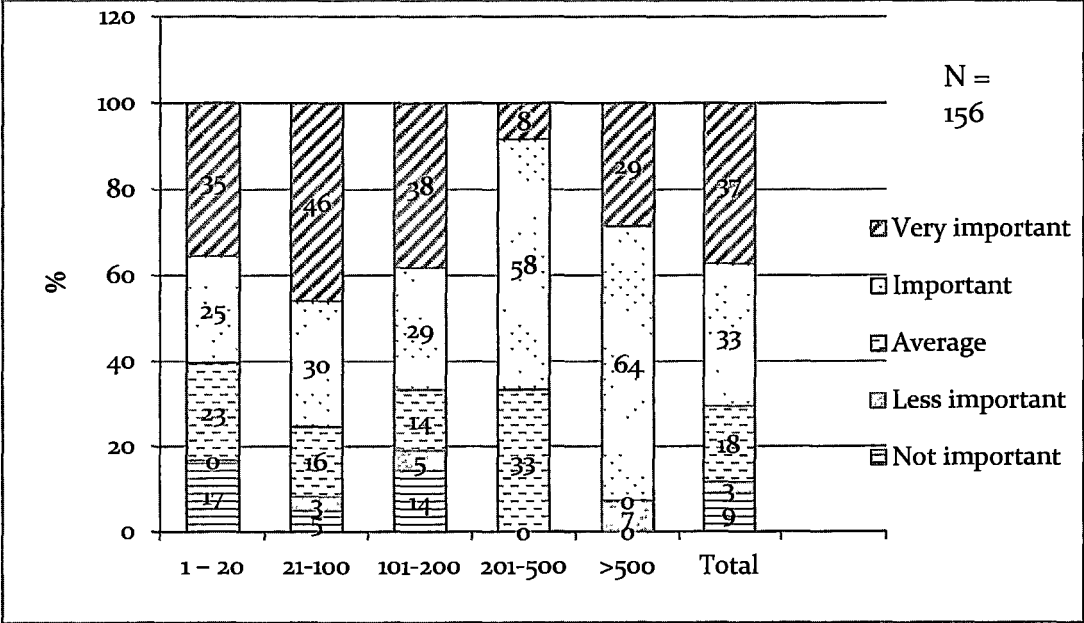

Figure 4.11 Percentage of respondents from companies classified by revenue rating the

importance of ROI in making decision to conduct a green logistics project

4.5.2.2 Respondents classified by companies' numbers of employee

Figure 4.12 shows for 156 respondents the proportions of respondent considering cost of fuel bill as the most important factor in making decision to conduct green logistics among the other factors. 21% of companies with 101-200 employees to 35% of companies with 201-500 employees consider cost of fuel bill as the first priority to make a decision to conduct green

logistics. The following sequences of factors in making decision to conduct green logistics are financial ROI (21% in total), customer relations improvement (19% in total), government compliance (16% in total) and supply chain efficiency (10% in total), respectively. Refer to the analysis result of Figure 4.10; this strongly supports that the main factors in making decision to conduct green logistics are the one relating to finance. The information from Figure 4.12 suggests that Australian logistics consider that short term financial benefit (cost of fuel bill) is more important than long term financial benefit (Financial ROI).

Figure 4.12 Percentage of respondents from companies classified by numbers of employee selecting the provided choices as the first priority in making decision to conduct a green logistics project

Figure 4.13 shows percentages of respondent rating ROI as a very important factor in making decision to conduct a green logistics project is the highest proportion in five categories accept categories of companies with more than 200 employees. However, the proportion of companies considering ROI as an important factor in making decision to conduct green logistics significantly higher than that of companies considering ROI as unimportant factor.

Refer to 3.6.2.3 in methodology chapter that the data will be analysed in 3 levels of importance of the particular aspect, Figure 4.13 clearly shows similar pattern to Figure 4.11 that proportion of companies in every category classified by companies' numbers of employee consider that ROI is important in making decision to conduct green logistics. This supports the information from Figure 4.12 that ROI is one of the most important factors in making decision to conduct green logistics.
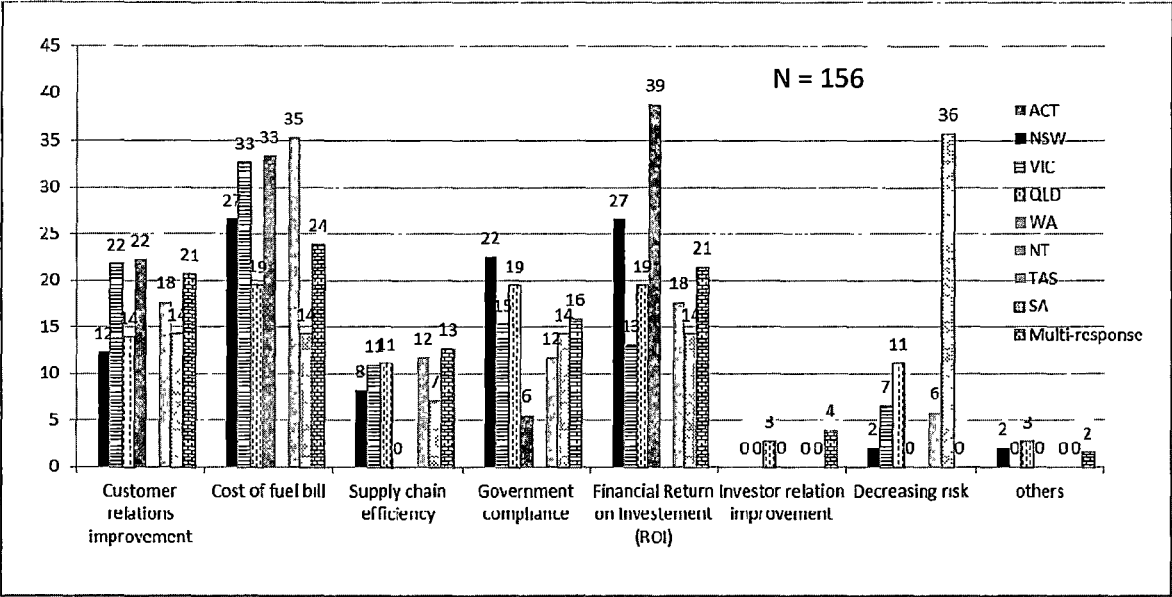

Figure 4.13 Percentage of respondents from companies classified by numbers of respondent rating the importance of ROI in making decision to conduct a green logistics project

4.5.2.3 Respondents' classified by companies' location

Figure 4.14 shows similar pattern as data classified by numbers of employees in Figure 4.12. However, there are outstanding percentages of companies located in WA and SA considering factors for making decision to conduct green logistics in different way to the companies from the other states. Companies from WA consider financial ROI (39% of respondents) as the

66

most important factors rather than cost of fuel bill (33% of respondents). In contrast, companies from SA consider decreasing risk (36% of respondents) as the most important factor in making decision to conduct green logistics. This suggests that companies from WA consider that long term financial benefit (financial ROI) is more important than short term financial benefits (cost of fuel bill). On the other hand, companies from SA considerable concern about risk rather financial benefits in making decision to conduct green logistics.

Figure 4.14 Percentage of respondents from 8 states of Australia selecting the provided choices as the first priority in making decision to conduct a green logistics project.

Figure 4.15 shows similar proportion as data classified by companies' size (companies' revenue and numbers of employee). Refer to 3.6.2.3 in methodology chapter that the data will be analysed in 3 levels of importance of the particular aspect, proportion of respondents from every state rating ROI as a very important and important is more half of the respondents from

each state. This supports the information from Figure 4.14 that ROI is one of the most

important factors in making decision to conduct green logistics.
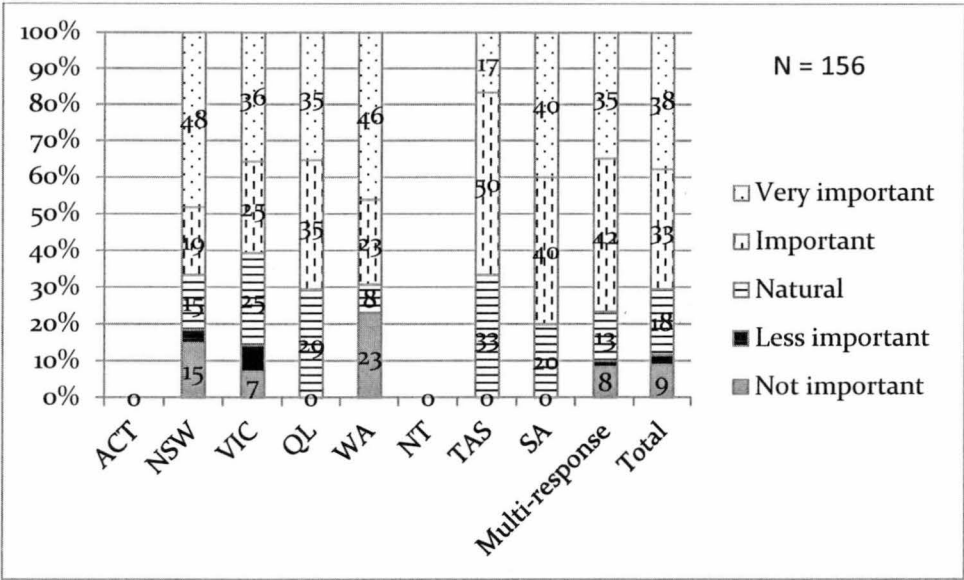
Figure 4.15 Percentage of respondents from 8 states of Australia rating the importance of

ROI in making decision to conduct a green logistics project

4.5.3 Expectation from green logistics

This section focuses on expectation on ROI from green logistics. The respondents were asked

about period of time they expect to meet ROI. This information is gathered from question 7

in the questionnaire. Numbers of respondent selecting the provided choices in question 7

identify period of time Australian logistics expect to achieve ROI. In overview, Figure 4.16-4.18 demonstrates that 21% of respondents expect to achieve ROI from a green logistics project in long-term and 22% do not expect a ROI. Interestingly, the percentages of respondent expecting ROI from green logistics decrease from long-term to short-term. This suggests that Australian logistics companies view investment in green logistics as long-term investment.

4.5.3.1 Respondents classified by companies' revenue

Figure 4.16 shows that about 19% to 27% of most categories classified by revenue (except companies with 50-100 million dollars revenue) expect to achieve ROI in long-term (5 years or more). Interestingly, the highest percentage of companies not expecting ROI from green

logistics belong to small companies (lower 1 million dollars companies' revenue) at 55% of

respondents. This suggests that small companies may expect to get other benefits from green

logistics rather than financial ROI.
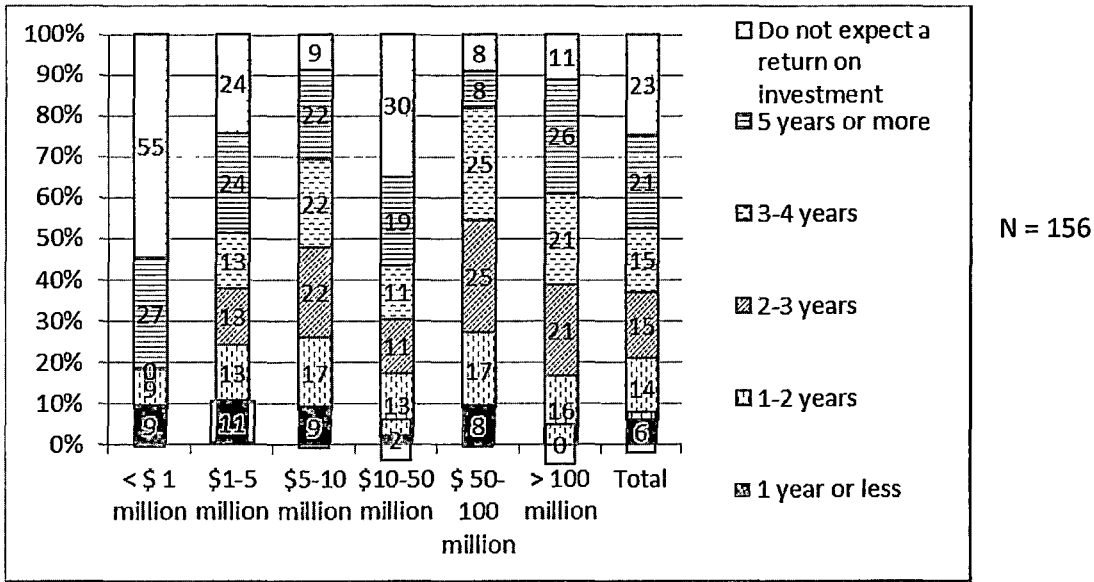
Figure 4.16 Periods of time the companies expect to achieve ROI from a green logistics

project (The respondents classified by revenue of respondents)

4.5.3.2 Respondents classified by companies' numbers of employee

Figure 4.17 shows that the highest percentages of companies expecting ROI in long-term (5

years or more) and not expecting ROI from green logistics belong to group of small

companies (1-20 employees). The lowest percentage of companies with no expectation from green logistics is in category of large companies (over 500 employees). In addition, the highest percentages of 2 largest groups are the expectations within short terms (31% of companies with 201-500 employees expect to achieve ROI within 1-2 years; 29% of companies with over 500 employees). This suggests that large companies have stronger expectation on ROI from green logistics than small companies.
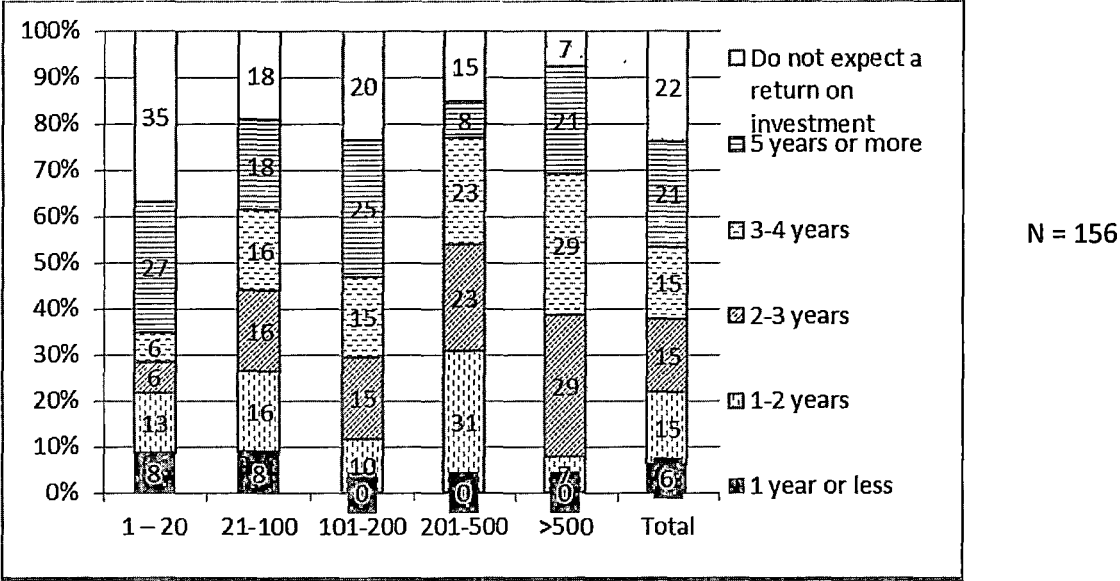
Figure 4.17 Periods of time the companies expect to achieve ROI from a green logistics project (the respondents is classified by numbers of employee)

4.5.3.3 Respondents classified by companies' location

Figure 4.18 does not shows pattern as the data classified by companies' size in Figure 4.16

and 4.17. Interestingly, 20% of companies from SA expect ROI from green logistics in very short term while such a few of companies from the other states (0-7%) expect ROI in that period. 38% of companies from WA do not expect ROI from green logistics and 50% of companies from TAS expect ROI in long-term (5 years or more).
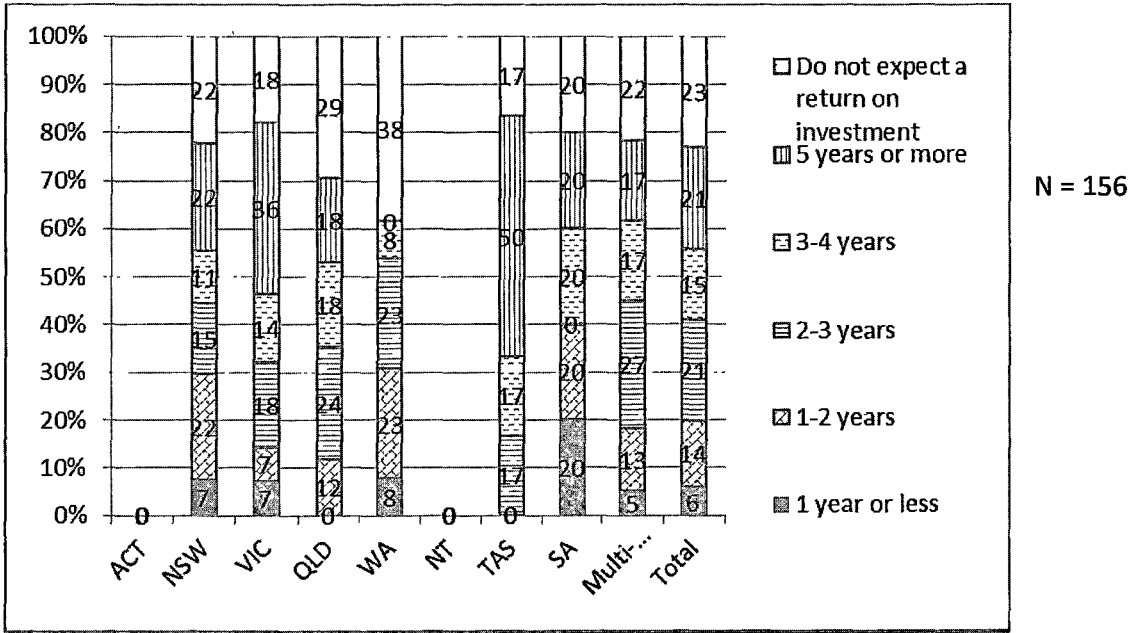

Figure 4.18 Percentage of respondents from 8 states of Australia expecting ROI from a green logistics project in different periods of time
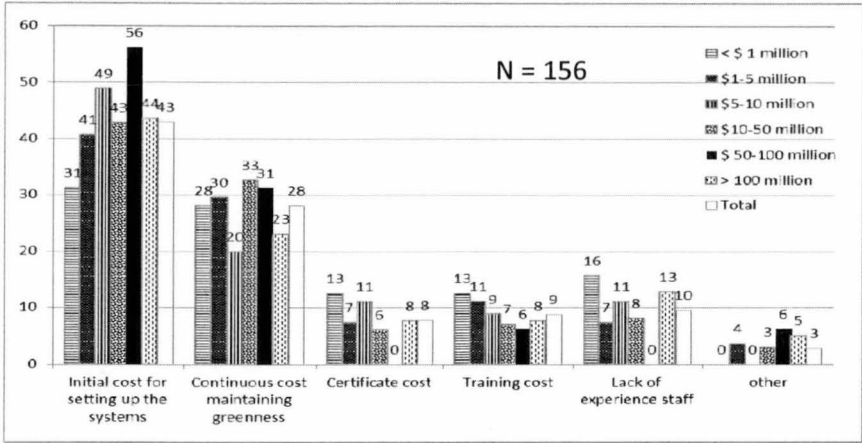
4.5.4 Barriers of achieving ROI

This section focuses on barriers of achieving ROI from green logistics. The potential barriers

were provided in Question 8 in the questionnaire. The respondents can choose one or more answers from the provided choices. Numbers of respondent selecting the provided choices in question 8 contribute to assist in finding the main barriers of achieving ROI from green logistics in Australian logistics companies' perspective.

Figure 4.17 obviously shows that most logistics companies in the categories classified by revenue, numbers of employee and location give similar pattern of the bar charts. The percentages of initial cost for setting up the systems and continuous cost maintaining greenness choosing by respondents in categories classified by companies' revenue arrange from 31-56 and 20-33%, respectively (Figure 4.17a). Similarly, the percentages of those two provided choices for group of respondents' classified by numbers of employee arrange from 36-55 and 23-33%, respectively (Figure 4.17b). The percentages of the initial cost for setting the systems and continuous cost for maintaining greenness are also significantly higher than the others. The percentages of initial cost for setting up the systems arrange from 33-71% with the dominant proportion in SA (71%) and TAS (60%) (Figure 4.17c). The percentages of continuous cost maintaining greenness selecting by respondents from the responding states remain steady pattern from 26-33% (Figure 4.17c). This suggests that cost especially initial cost for setting up the systems and maintaining cost are the most important barriers to achieve ROI in Australian companies' perspective.

(a)
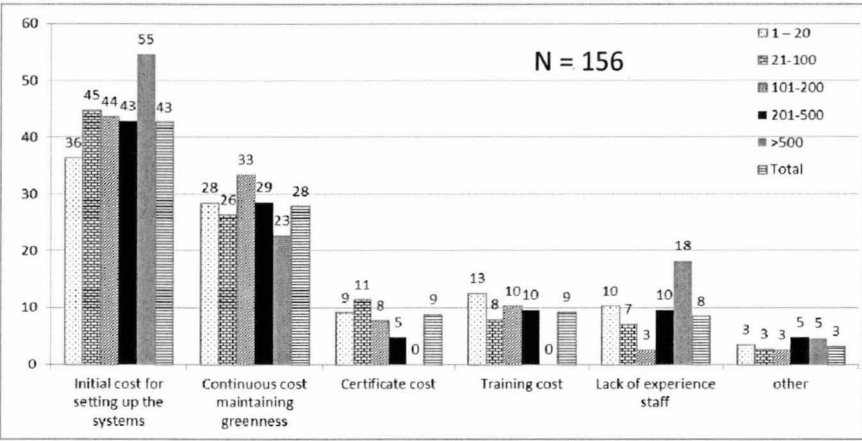
(b)
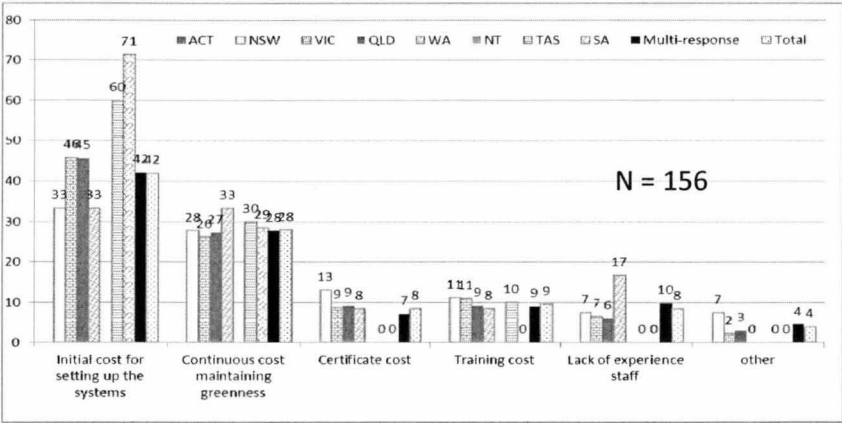
(c)

Figure 4.17 barriers of achieving ROI in perspective of Australian logistics companies

a) Data classified by location, b) data classified by revenue, data classified by numbers of
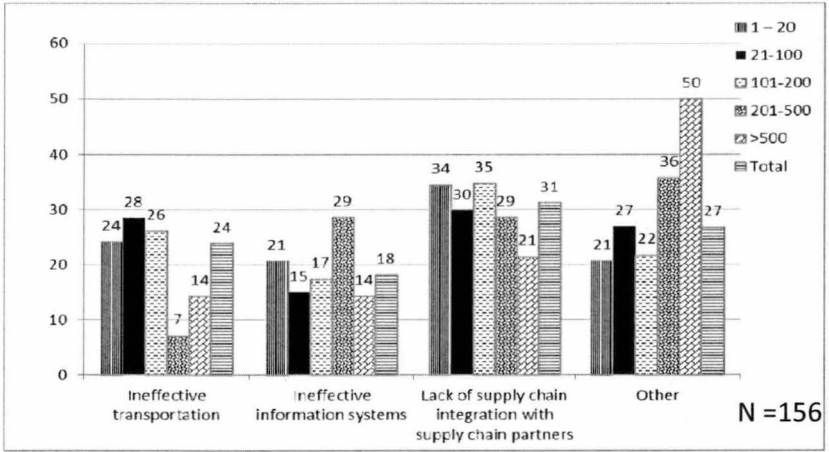
employee

4.5.5 Barriers of investing in green logistics

This section focuses on barriers of investing in green logistics. The potential barriers were provided in Question 10 in the questionnaire. The respondents can choose one or more answers from the provided choices. Numbers of respondent selecting the provided choices in question 10 identify main barriers of investing in green logistics in Australian logistics companies' perspective.

Figure 4.18 shows no outstanding percentage of the barriers when asked the respondents about the main barriers to investing in green logistics. The largest proportions of respondents classified by companies' revenue, numbers of employee and location consider lack of supply chain integration with supply chain partners as the main barrier. However, the percentages of respondent selecting are slightly higher than the others. The data suggests that similar challenges and barriers are faced by companies of all reason. Interestingly, regional and national areas do not appear to have strongly different pattern (Figure 4.18c).
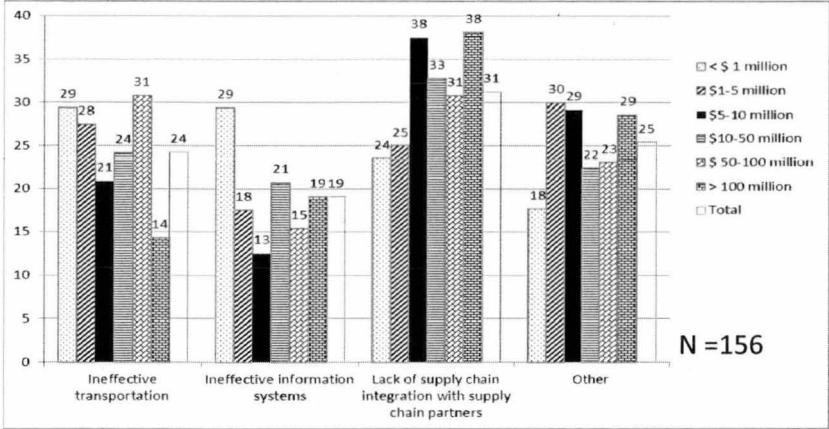
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b
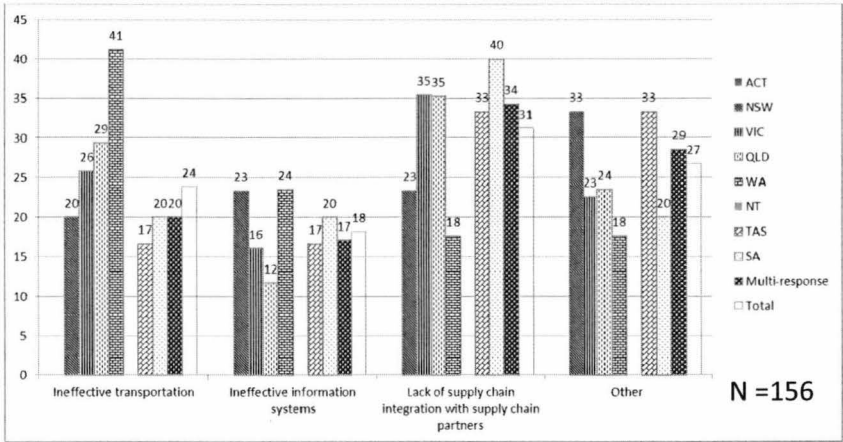
c

Figure 4.18 main barriers to investing in green logistics a) data classified by companies'

revenue b) data classified by companies' numbers of employee c) data classified by

companies' location

4.5.6 Competitiveness from green logistics

This section focuses on experiences on competitiveness from green logistics of Australian logistics companies. Question 9 in the questionnaire asks the respondent whether green logistics create competiveness for their organizations and what is the most important advantage from green logistics. The respondents can choose one or more answers from the provided choices. Numbers of respondent selecting the provided choices in question 9 identify main advantages of green logistics in Australian logistics companies' perspective. In total, percentage of Australian logistics companies considering that green logistics does not create competiveness (52%) is slightly higher than percentage of those seeing competiveness from green logistics (48%). There are some implications appear to show different results during different categories when classified respondents by the demographic information. Each result of analysis was deeply explained in the following.

Figure 4.19 shows for 156 respondents 71% of companies with below 1 million dollars revenue and 60% of companies with 1-5 million dollars consider that green logistics does not create competitiveness for their companies while the others provide contrast outcome with similar proportion among those categories. This suggests that small companies do not see competitiveness from green logistics as larger companies do.
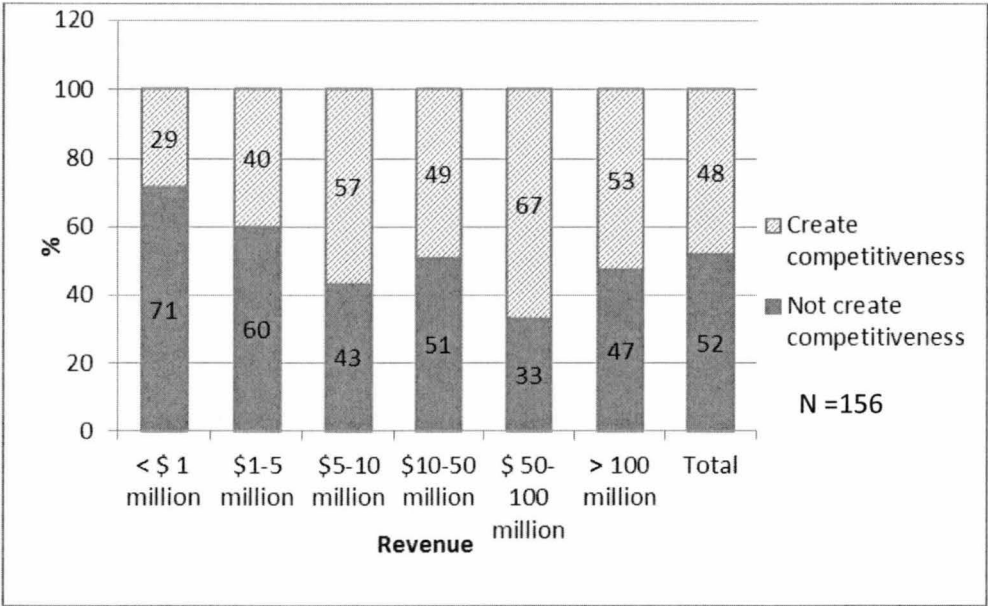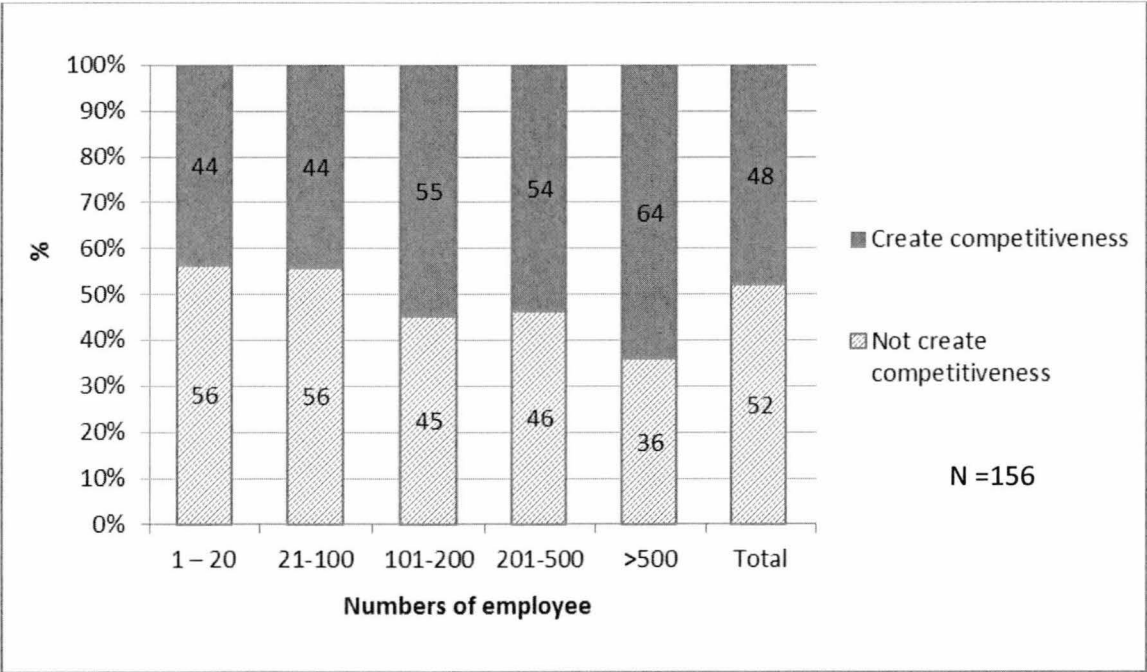

Figure 4.19 Competitiveness created by green logistics in Australian logistics organizations' perspective (data classified by companies' revenue)

4.4.6.2 Respondents classified by companies' numbers of employee

Figure 4.20 shows the same proportions of companies seeing and not seeing competiveness from green logistics of small companies (companies with 1-20 and 20-100 employees). 55% of companies with 101-200 employees, 54% of companies with 201-500 employees and 64% of companies with over 500 employees see competitiveness from green logistics while 56% of the other two categories considered as small companies do not see competiveness from green logistics. This supports the analysis result from Figure 4.19 that small companies do not see competitiveness from green logistics as larger companies do.

Figure 4.20 Competitiveness created by green logistics in Australian logistics

organizations' perspective (data classified by companies' numbers of employee)

4.4.6.3 Respondents classified by companies' location

Figure 4.21 shows considerable difference between the numbers of those two perspectives on competiveness from green logistics. Percentages of companies from NSW (56%), QLD (53%), TAS (67%) and multiple responses (52%), seeing competitiveness from green logistics are higher than percentages of companies not seeing competitiveness from green logistics. The respondents of companies from the other states gave opposite results. The data suggests that different experiences in competiveness from green logistics are faced by companies from different states.
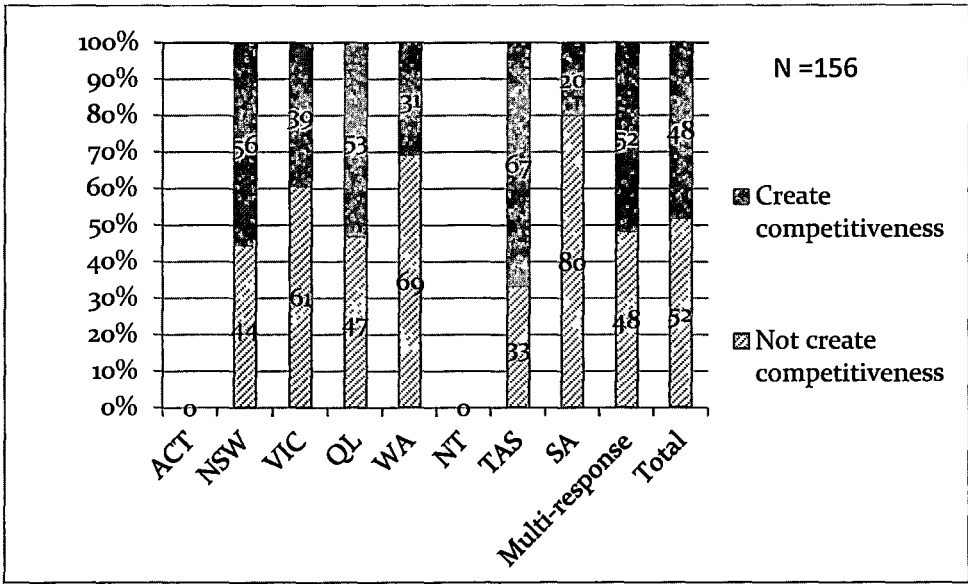

Figure 4.21 Competitiveness created by green logistics in Australian logistics organizations' perspective (data classified by respondents' location)

Figure 4.24a and 4.24b show similar trend among categories classified by companies' size (revenue and numbers of employee). The two largest proportions of competiveness from green logistics belong to brand image and reduce expense/cost with slight higher percentage of brand image. Figure 4.24c shows a similar pattern with some outstanding percentages in some states. When classified the respondents by companies' location brand image are considered as the main competiveness from green logistics. However, respondents from some states see different competiveness from green logistics from the others. 50% of companies from SA consider sales increase as one of competiveness from green logistics with the same proportion as brand image. Interestingly, respondents from TAS do not consider brand image as competiveness from green logistics. On the other hand, they consider reduce expense/cost (40% of respondents) and improve process's efficiency (40% of respondents) as the main competiveness from green logistics.
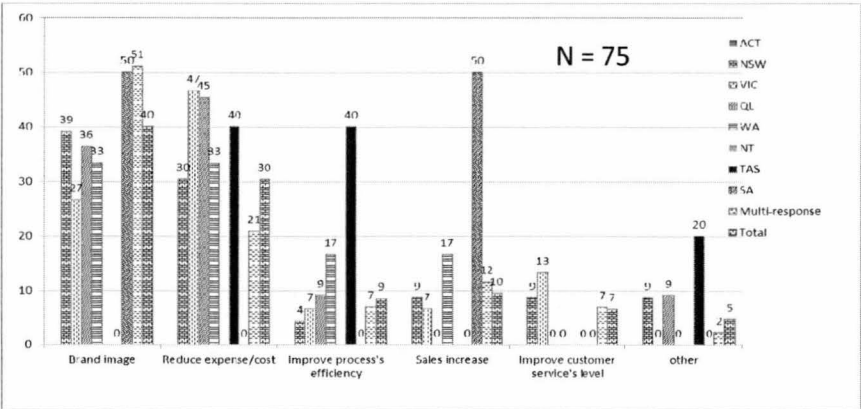
This suggests that brand image and reducing expense are considered as the most important competiveness from green logistics in Australian logistics companies' perspective.
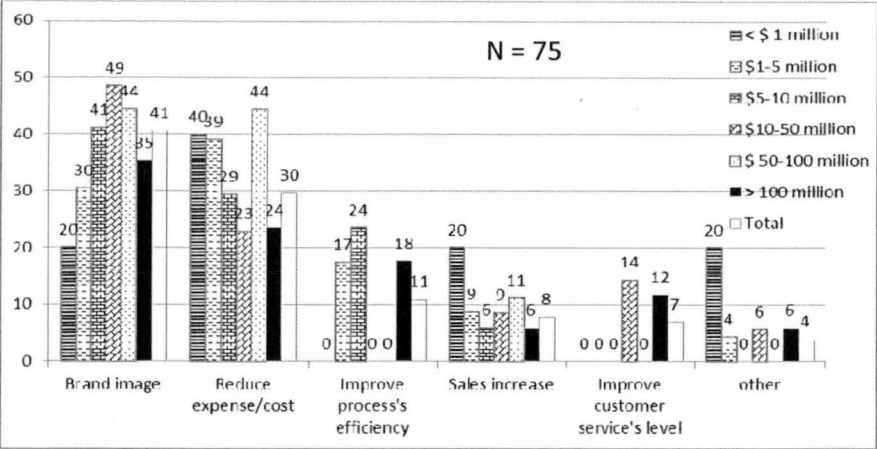
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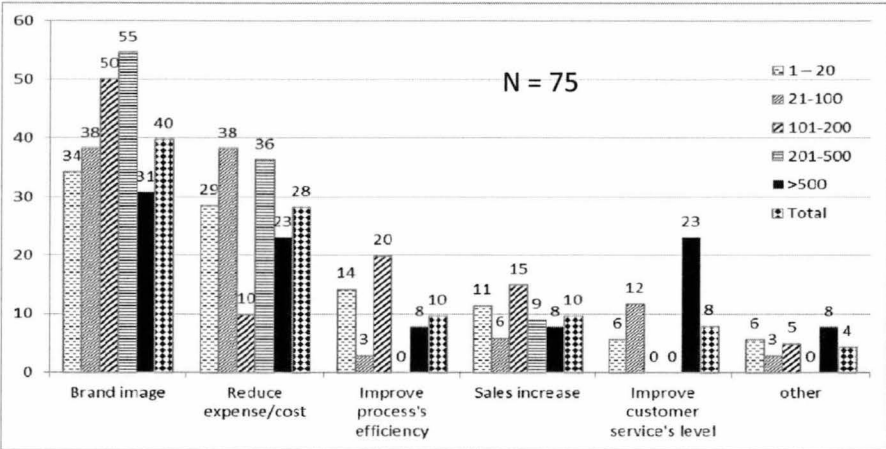
b


c

Figure 4.22 Advantages from greenness for the organizations in Australian logistics companies' perspective a) data classified by companies' location b) data classified by firm's revenue c) data classified by numbers of employee

82

4.5.7 Awareness on green issue

This section focuses on Australian logistics companies' awareness on green issue. Question 10 in the questionnaire asks the respondent whether green logistics create competiveness for their organizations and what is the most important advantage from green logistics. The respondents can choose one or more answers from the provided choices. Numbers of respondent having a long-term plan for investing in green logistics reflect awareness on green issue of Australian logistics companies. Question 10 also specifically asks particular activities in which the organizations plan to conduct green logistics. Moreover, the respondents were asked to rate green issues as a business priority. Their answers on question 13 in the questionnaire directly represent their awareness on green issues.

Figure 4.23a shows that majority of companies with less than 10 million dollars revenue do not have a plan investing in green logistics while majority of the companies with more than 10 million dollars revenue do. 71% of companies with below 1 million dollars revenue, 54% of 1-5 million dollars revenue and 61% of companies with 5-10 million dollars revenue do not have a long-term plan for conducting green logistics in their supply chain. On the other hand, 60% of companies with 10-50 million dollars revenue, 75% of companies with 50-100 million dollars revenue and 74% of companies with over 100 million dollars revenue have a long-term plan for conducting a green logistics project. This suggests that the larger companies aware of green issue more than smaller companies.

Figure 4.23b shows the similar proportion of companies will be investing in recycling programs, transport routing and scheduling optimisation, transport mode optimisation and waste reduction.
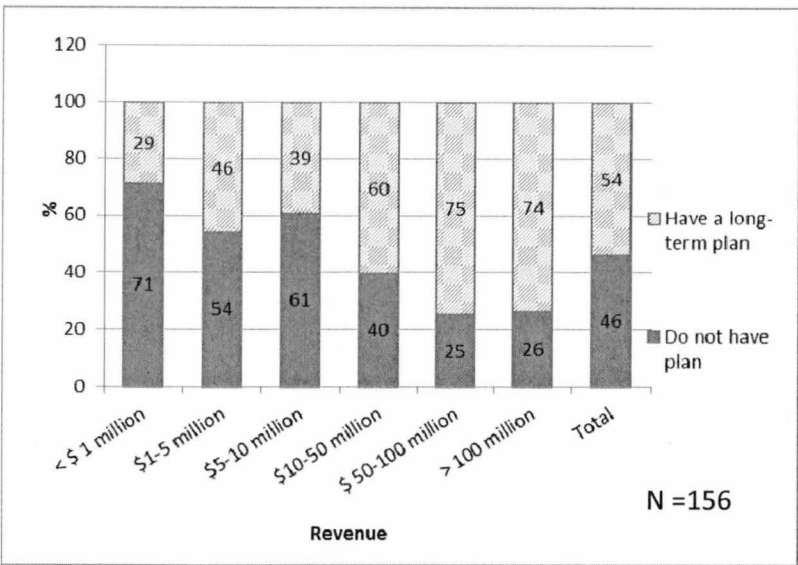
(a)
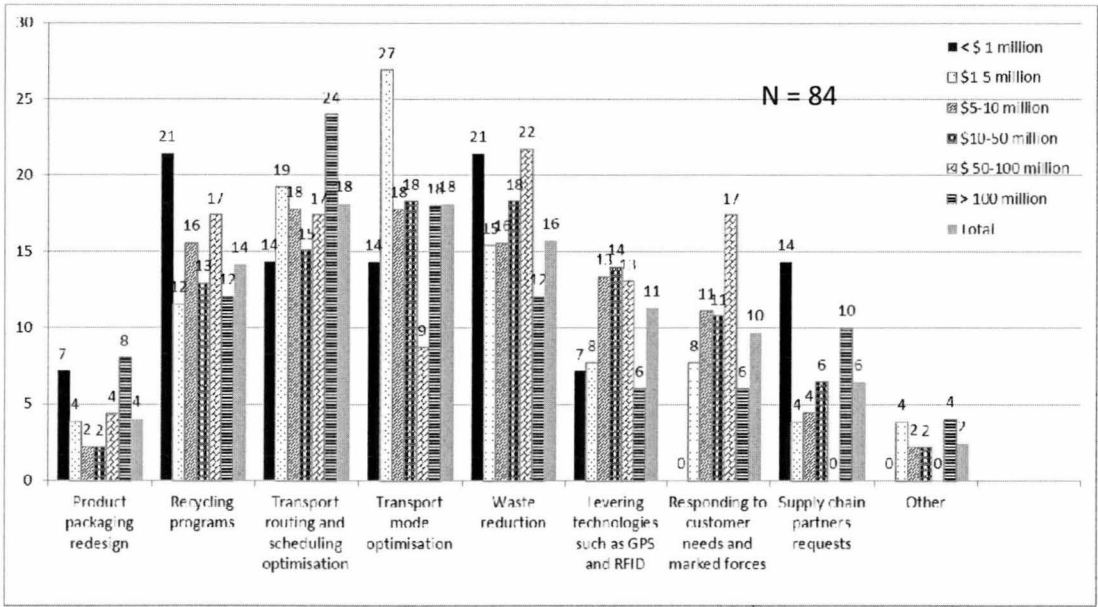
(b)

Figure 4.23 Long term of conducting green logistics project of Australian logistics companies and the activities that will be invested in order to achieve greenness (Data classified by companies' revenue)

Figure 4.24 shows that majority of most categories except the one with 1-20 employees have a long-term plan to invest in green logistics. 63% of companies with 1-20 employees do not have a plan for conducting a green logistics project while 59% of companies with 21-100 employees, 75% of companies with 101-200 employees, 69% of companies with 201-500 employees and 86% of companies with more than 500 employees have a long-term plan for a green logistics project. This strongly supports the analysis result of Figure 4.23 that the larger companies aware of green issue more than smaller companies.

Figure 4.24b shows the similar proportion of companies will be investing in recycling programs, transport routing and scheduling optimisation, transport mode optimisation and waste reduction.
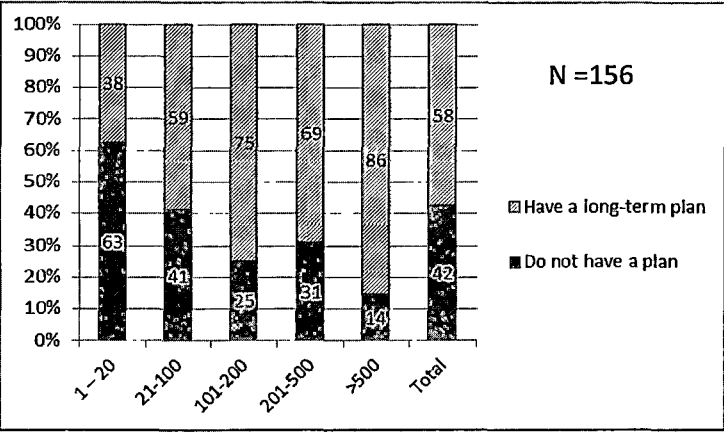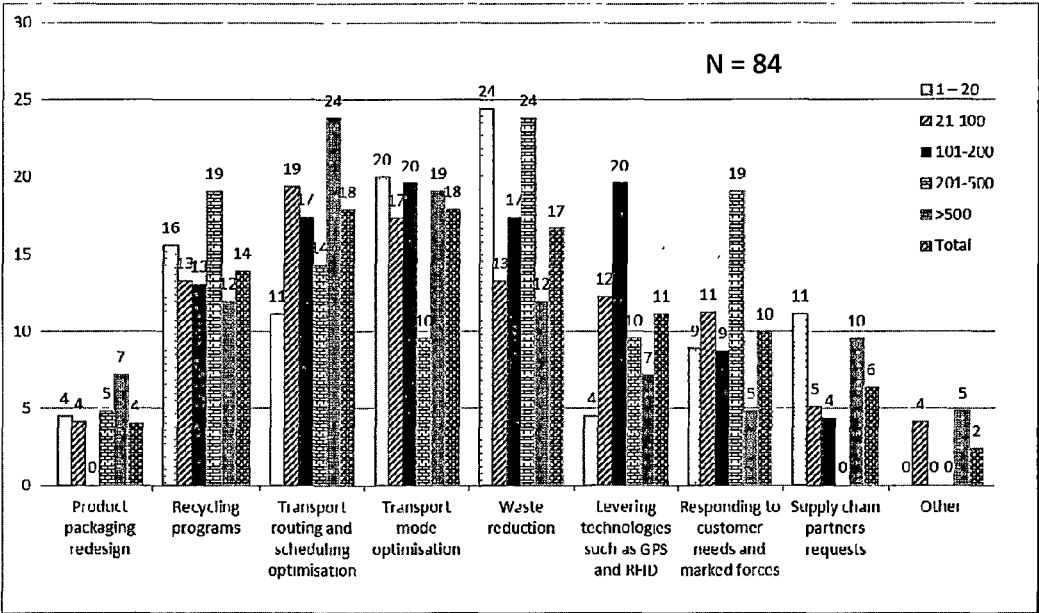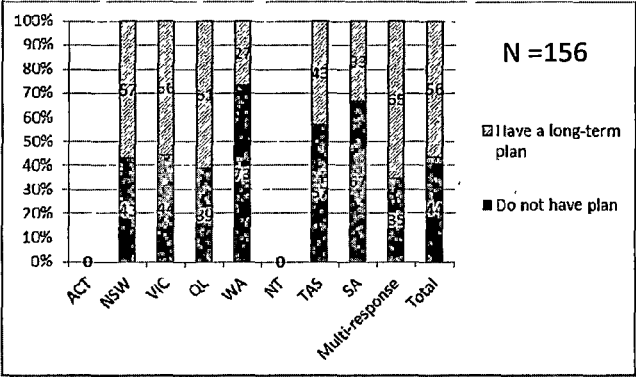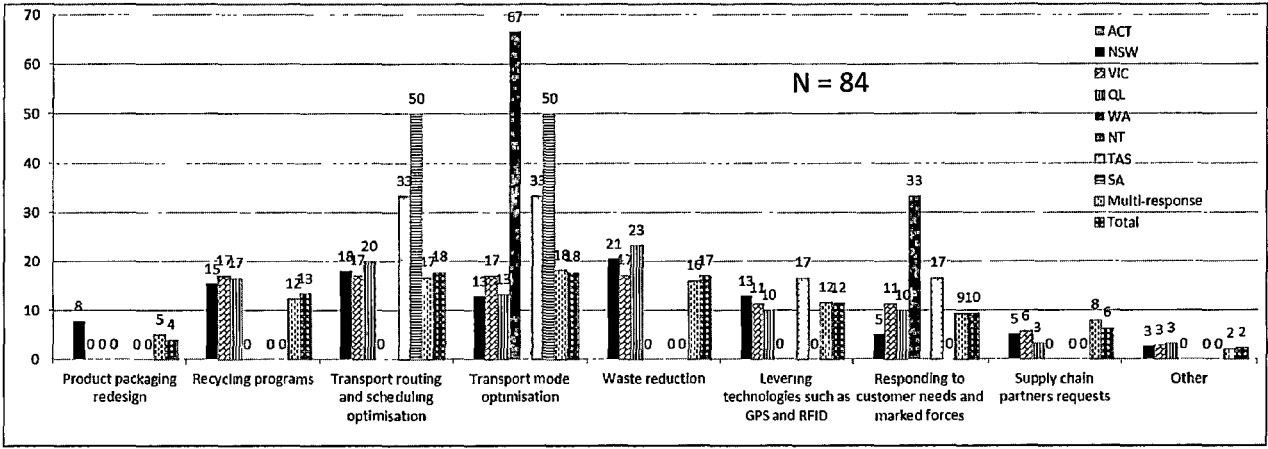
a

b

Figure 4.24 Long term of conducting green logistics project of Australian logistics companies and the activities that will be invested in order to achieve greenness (Data classified by companies' numbers of employee)

Figure 4.25a shows that majority of companies located in the states containing high numbers of respondent including NSW (57%), VIC (56%), QLD (61%) and multi-response (65%) have long term plan to invest in green logistics in place. In overview, there are no outstanding percentages on the proportions of the logistics activities that will be invested in order to achieve greenness. Figure 4.25b shows that 67%, 50% and 33% of respondents from companies located in WA, SA and TAS have a long-term plan to invest in transportation mode optimisation while percentages of companies from the other states having long-term plan to invest in this activity are much lower. Similar to percentages of transport routing and scheduling optimization that 33% of companies from TAS and 50% of companies from SA having a long-term plan to invest in this activity among much lower percentages of companies from the other states.

a

b

Figure 4.25 Long term of conducting green logistics project of Australian logistics companies and the activities that will be invested in order to achieve greenness (Data classified by companies' location)

Figure 4.26a shows the highest percentages of awareness of green issue are mostly in the average range of the business priority. The percentages of medium (5-50 million dollars revenue) and large companies (over 50 million dollars revenue) rating green issue in the important plus very important level are bigger than that of small companies (below 1 million dollars revenue and 1-5 million dollars). Figure 4.26b shows the similar pattern as Figure 4.26a that percentages of the larger companies (over 100 employees) rating green issue in the important plus very important level are bigger than that of smaller companies (below 100 employees). This suggests that the larger companies have more awareness on green issue than the smaller companies. Figure 4.26c does not significantly show different proportion between the companies rating green issue as an important and unimportant issue. Similar to the information classified by companies' size that the biggest percentage of every category classified companies' location is that of average range of awareness. However, WA is the only state showing considerable different proportion between the two sides of awareness. The proportion of companies in WA rating green issue as an unimportant issue is much bigger of that of those rating green issue as an important issue. This strongly suggests that companies located in WA have less awareness on green issue than those from the other states.
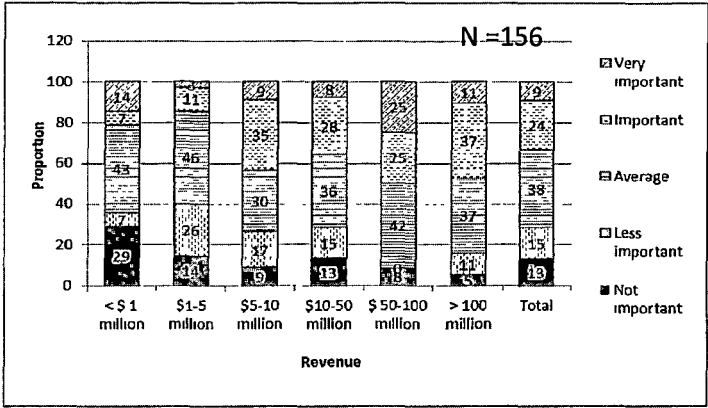
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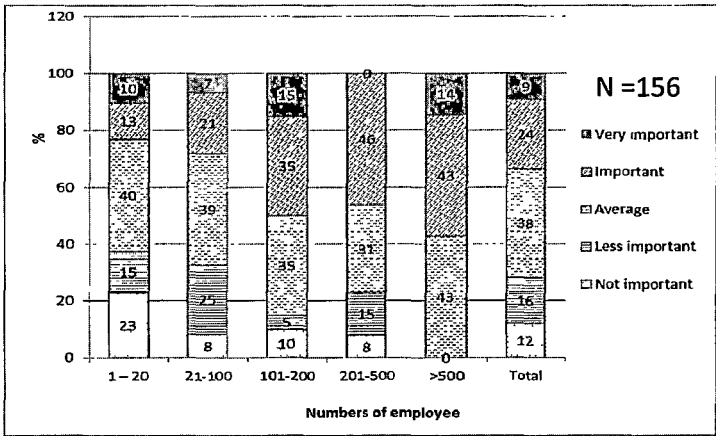
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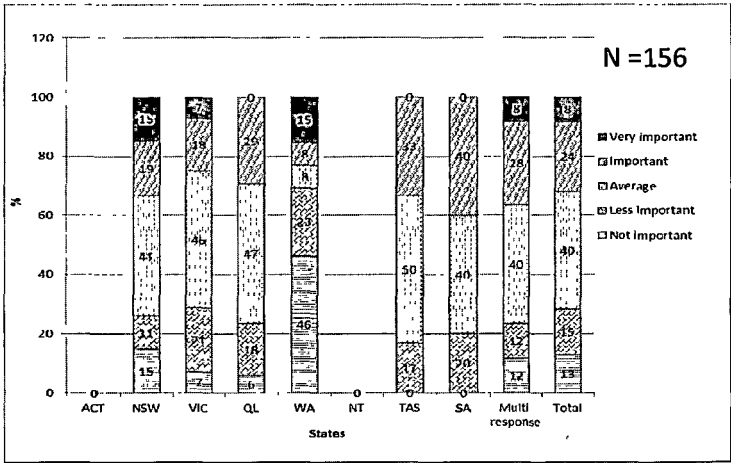
c

Figure 4.26 Percentage of respondents rating the importance of green issue a) data

classified by companies' revenue b) data classified by numbers of employee c) data

classified by companies' location

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4.5.8 Role of information technology (IT) on ROI from green logistics

This section focuses role of IT on ROI from green logistics in Australian logistics companies' perspective. Question 11 in the questionnaire directly asks the respondent whether the use of IT improve the anticipated ROI for investing in green logistics for the organizations. The result of this question reflects role of TI on ROI from green logistics and this can be considered as a barrier in achieving ROI from green logistics.

4.5.8.1 Respondents classified by companies' revenue

Figure 4.27 shows the bigger proportion of companies seeing role of IT in improving ROI from green logistics in small companies (below 5 million dollars revenue) while the proportion of medium (5-50 million dollars revenue) and large companies (over 50 million dollars revenue) show contrast patterns. This suggests that IT play more important role to improve ROI from green logistics in smaller companies than in larger companies.
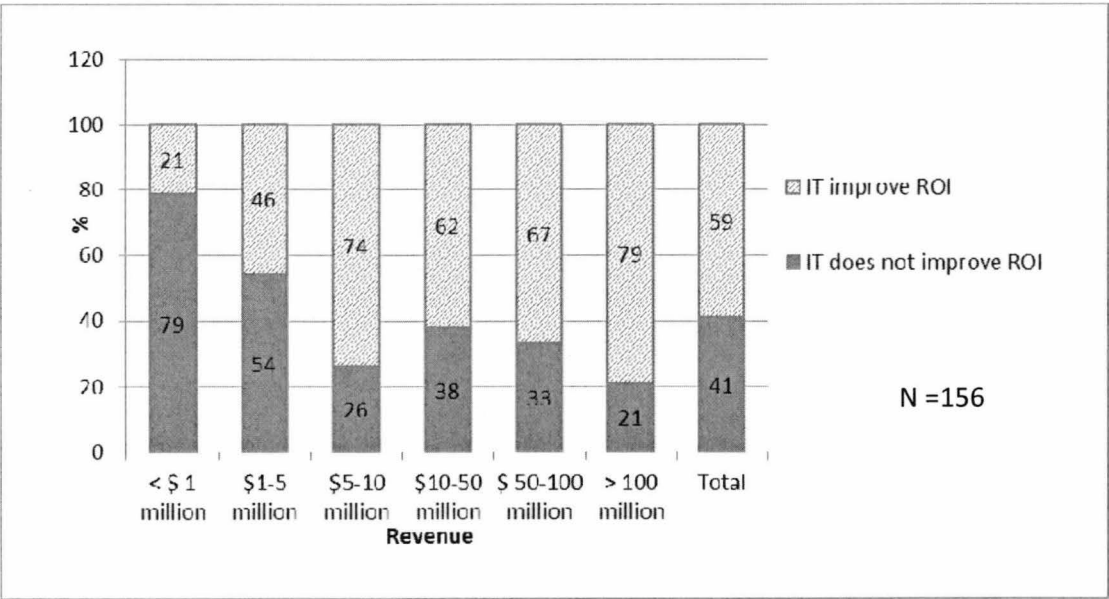
Figure 4.27 Role of IT for improving ROI from green logistics in Australian logistics

organizations' perspective (Data classified by companies' revenue)

Figure 4.28 shows similar pattern of proportion as the data classified by companies' revenue.

This strongly supports in analysis result in Figure 4.27 that IT play more important role to

improve ROI from green logistics in smaller companies than in larger companies.

Figure 4.28 Role of IT for improving ROI from green logistics in Australian logistics

organizations' perspective (Data classified by companies' numbers of employee)

Figure 4.29 demonstrates that 63% of companies located in NSW and more than one state, 64% of companpies located in VIC and 53% of companies located in QLD, 46% of companies located in WA, 40% of companies located in SA and 33% of companies located in TAS consider that IT improve the anticipated ROI form investing in green logistics. This suggests that IT play an important role to improve ROI from green logistics in perspective of companies from NSW, VIC, QLD and multi-response companies.

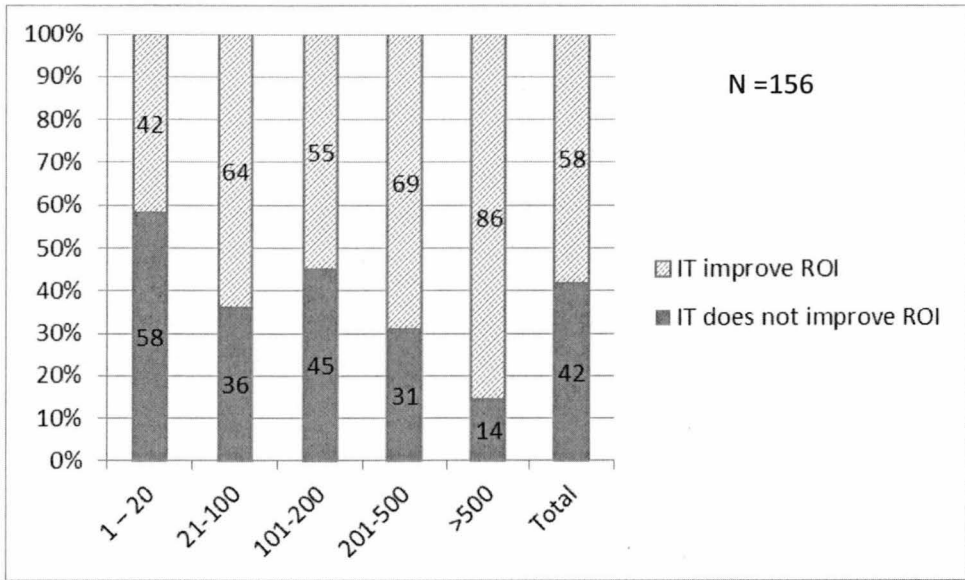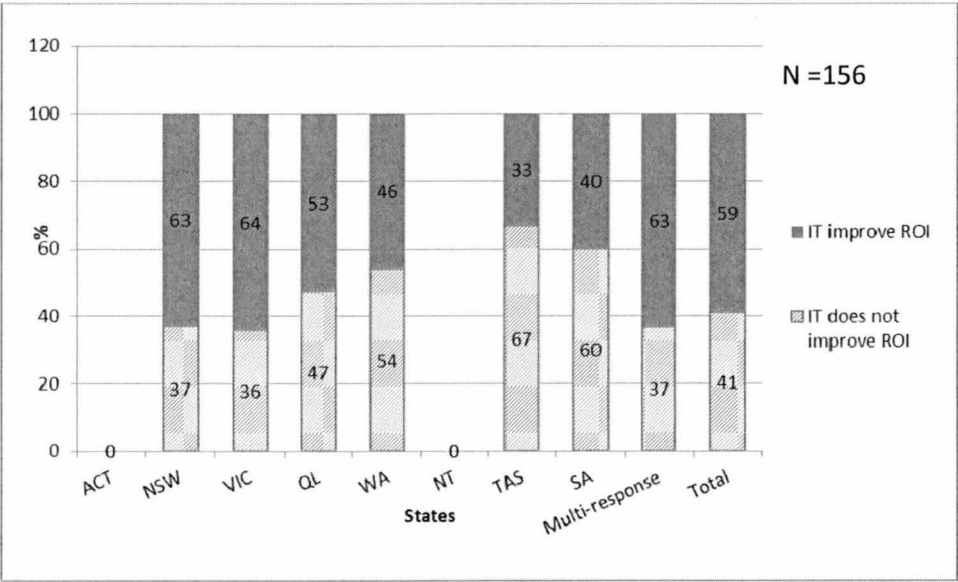***Figure 4.29 Role of IT for improving ROI from green logistics in Australian logistics organizations' perspective (Data classified by companies' location)***

4.6 Chapter Summary

From the analysis it can be highlighted that:

- 69% of Australian logistics companies performing green logistics have conducted in transportation activities

- 26% of Australian logistics companies considered cost of fuel bill as the first priority in making decision for conducting green logistics projects

- 23% of Australian logistics companies do not expect ROI from green logistics

- 43% of Australian logistics companies consider initial cost for setting up the systems as the most important barrier of achieving ROI

- 40% of Australian logistics companies view brand image as the most important competitiveness from green logistics

- 58% of Australian logistics companies have long-term plan to invest in green logistics

- 59% of Australian logistics agree that IT improve ROI from green logistics

CHAPTER 5- RESULTS/DISCUSSION

5.1 Introduction

This chapter will present results of the survey. The information from Chapter 4 will be discussed in order to clearly clarify the research questions. The analysed data of survey questions will explore all aspect relating to the principle objective and secondary objective. The principle objective of the research is to explore Barriers in achieving ROI and investing on green logistics, Australian logistics companies' expectation on ROI from green logistics and roles of information technology in improving ROI from green logistics. The secondary objective is to explore the Australian logistics companies' experiences on challenges, opportunities, green logistics competitiveness and awareness of these issues. The chapter is structured in 2 parts:

1) Results

- The principle objective

- The secondary objective

2) Discussion

- The principle objective

- The secondary objective

5.2 Results

5.2.1 The principle objective

To achieve main purposes of this research, there are 2 research questions asking about barriers of achieving ROI and investing for green logistics, expectation on ROI from green logistics and roles of information technology to improve ROI from green logistics. In this section, each question will be answered clearly by using analysed information from chapter 4.

RQ1: What factors impact on Australian logistics companies investing into green logistics?

Barriers of achieve ROI from green logistics.

Cost for setting up the systems and maintain costs are obviously considered as the most important barriers to achieve ROI in Australian logistics companies.

Barriers of investing for green logistics

Barriers of investing for green logistics are varieties as can be seen the analysed information that proportion of provided choices such as ineffective transportation, ineffective information systems and lack of supply chain integration with supply chain partners are insignificantly different. Surprisingly, regional and national areas do not appear to have strongly different pattern.

Role of IT on ROI from green logistics

The information from the exploratory survey clearly demonstrates that IT plays an important role to improve ROI from green logistics. Additionally, IT play more important role to improve ROI from green logistics in smaller companies than in larger companies.do not consider IT as a key factor to improve ROI from green logistics.

RQ2: What role does ROI play in Australian logistics companies' decision-making around conducting green logistics?Barrier of achieving ROI

Australian logistics companies' expectation on ROI from green logistics

This research asks the respondents about period of time the logistics companies expect to achieve ROI. It is found that such a few (6%) of logistics companies expect to achieve ROI within short period (1-2 years) while many logistics companies(21%) expect to achieve ROI within long period (5 years or more). Moreover, a lot of logistics organizations (23%) do not expect to get return from green logistics. The analysis information suggests that Australian logistics companies view investment in green logistics as long-term investment.

Importance of ROI in making decision for conducting a green logistics project

Australian logistics companies consider cost of fuel and financial ROI as the first priority for making decision on a green logistics, respectively. Although, percentage of respondents choosing cost of fuel more than ROI, percentages of some groups of respondent such as logistics companies located in WA and companies with 50-100 million dollars revenue exceed percentages of cost of fuel. Moreover, when ask the respondents to rate importance of ROI in making decision on a green logistics project, most of respondents in every category classified by all three demographic information rank ROI as a very important and important factor. This implies that ROI is one of important factors in making decision to conduct a green logistics project.

5.2.2 The secondary objective

This research also explores Australian logistics companies' experiences on green logistics including competitiveness of green logistics for the organizations and awareness of the

organization on green issues.

Competiveness

In total, Proportion of Australian logistics companies considering that green logistics does not create competiveness create competiveness are insignificantly different with a slight higher percentage of non-competiveness. Focusing on what is the main competiveness from green logistics in Australian logistics companies' perspective; brand image (41%) and reducing expense/cost (30%) are respectively considered as the most important advantage for the organizations.

Awareness

In total, Proportion of Australian conducting green logistics (46%) in their supply chain is marginally lower than that of ones who have not conducted (54%). Percentage of Australian logistics companies having a long-term plan to conduct green logistics (56%) is higher than companies who have not planned (44%). Focusing on what is the activities that will be invested to conduct green logistics; transportation areas such as transport mode optimisation and transport routing and scheduling optimisation are the prior activities among the others. When asked the respondents to rate the importance of green issue for their organization, it is found that Australian logistics companies do not rank this issue as the priority in their organization.

5.3 Discussion

5.3.1 The principle objective
RQ1: What are barrier of achieving ROI and investing for green logistics in Australian logistics companies' perspectives?

Barrier of achieving ROI

The crucial barrier for achieving ROI from green logistics in Australian logistics companies is its cost such as cost for setting up the systems and maintains costs. This implies that Australian logistics companies have limited budget for conducting green logistics in their supply chain and consider economic dimension as the first priority rather than the other two dimensions of sustainability.

Barriers of investing for green logistics

Ineffective transportation, ineffective information systems and lack of supply chain integration with supply chain partners equally influence in inhibiting investment for green logistics. This implies that Australian logistics companies have not productively prepared their supply chains to conduct green logistics.

RQ2: How are the expectations on ROI of Australian logistics companies on green logistics and importance of ROI in making a decision for conducting a green logistics project?

Australian logistics companies' expectation on ROI from green logistics

With such a few proportion of logistics companies expecting to achieve ROI within short period (1-2 years) and a large proportion of logistics companies expecting to achieve ROI within long period (5 years or more) and not expecting to get return from green logistics, it can be assumed that Australian logistics companies do not expect to accomplish economic advantage from green logistics as prior.

Importance of ROI in making decision for conducting a green logistics project

Australian logistics companies consider cost of fuel and financial ROI as the first priority for making decision on a green logistics, respectively. In addition, ROI is rated in important and very important rank for making decision to conduct green logistics. This implies that ROI is

one of important factors in making decision.

RQ3: Does information technology (IT) improve ROI from green logistics?

Role of IT on ROI from green logistics

As the proportion of respondents agree and disagree that IT play an important role to improve ROI from green logistics is slightly different and some perspectives from some categories disagree with the role of IT on ROI, it cannot be clearly conclude in this research. To gain clearer picture in this aspect, further study is recommended.

5.3.2 The secondary objective
Competiveness

Although green logistics referring sustainable concept which aims to theoretically generate high benefit for the companies, a lot of Australian logistics (52%) do not see its competitiveness. The main competiveness from green logistics in Australian logistics companies' perspective which are creating brand image and reducing expense/cost indicate that many Australian logistics view green logistics as a tool to approach two dimensions of sustainability including sociology and economic. Improving brand image and reducing expense/cost can be considered as approaches to meet social and economic objective, respectively.

Awareness

In total, Proportion of Australian conducting green logistics (46%) in their supply chain is marginally lower than that of ones who have not conducted (54%). In addition, the importance of green issue in Australian logistics companies' perspective is not the priority in their organization. However, percentage of Australian logistics companies having a long-term

plan to conduct green logistics (56%) is higher than companies who have not planned (44%). These indicate that although Australian logistic companies have not aware of green issues considerably, many of them start thinking about improving this issue in their processes and transportation areas such as transport mode optimisation and transport routing (18% of respondents) and scheduling optimisation (18% of respondents) are the prior activities among the others.

5.4 Chapter Summary
The research has found that;

- Transportation is the first area that Australian logistics companies have started to conduct green logistics (69% of respondents)

- The cost of fuel is the most important factor in making decisions for conducting green logistics projects (26% of respondents)

- Initial cost for setting up the systems is the most important barrier to achieving ROI

- Australian logistics companies perceive that green logistics will improve their brand image (40% of respondents)

- Australian logistics companies are aware of importance of green issues (47% of respondents have conducted green logistics; 56% of respondents have long-term plan to conduct green logistics)

- Information technology was identified as having an important role to play in improving ROI from green logistics (59% of respondents)

CHAPTER 6 CONCLUSION

6.1 Summary of findings

Exploratory survey found that many Australian logistics companies are aware of importance of green issues as they have been conducting green logistics in their supply chain (47% of respondents). Moreover, some Australian logistics have long-term plan to conduct green logistics (56% of respondents). The first area have started to conduct green logistics is transportation. In making decision to conduct green logistics, there are several factors influencing on the decision. The cost of fuel is the most important factor in making decisions for conducting green logistics projects in Australian logistics companies' perspective (26% of respondents). ROI is of the main factors in making decision to conduct green logistics. Barriers influencing decision occur before conducting green logistics. Major barriers relate to cost for setting up the systems and cost for maintain greenness. However, many Australian logistics companies (40% of respondents) realize that green logistics will improve their brand image productively. Finally, the information from the survey identifies that Information technology has an important role to play in improving ROI from green logistics (59% of respondents).

Survey response rate of this research is 9 per cent. The questionnaires were posted to 1,761 Australian logistics companies in the Company360 database. Forsgren (1989) stated that low response rate of the mail survey is considered as a serious shortcoming. Expectation on return of a mail survey is normally between 10 and 50 per cent (Neuman 2000). According to Forsgren (1989), the response rate of this survey is quite low because there are inevitable problems occurring during the process. Some information in the database is out of date. 54 envelopes were returned by the post office because the address does not exist. In addition, duplication also occurs in both sending out and receiving in process. These cause a low

response rate significantly.

The questionnaires were sent out on 15 August 2011. The first lot of reply arriving within two weeks and weeks four account for 127 and 35 responses, respectively. The receiving box was closed on 30 September 2011. This provided six weeks for the participants to consider whether they would like to participate this survey. The exact closing box day were decided after the response rate has declined until there was no more response. The descriptive statistics of the overall response rate are show in Figure

6.2 Limitation of the research

- Low response rate of survey: The response rate of this survey is quite low at 9 % in return with 1,761 mailed out questionnaires and 156 replies. The low response rate is caused by numbers of uncontrollable factors including;

  - Database error: There are considerable reputations in the list of contacts. Moreover, many of the contact details in the database are out of date.

  - Time frame: The limited time frame at 6 weeks is sufficient for collecting the returned questionnaires but is not enough for sending reminding letters for more replies.

  - Budget: Budget is also one of the main limitations. The researcher has to plan carefully before download the contact list because every single data gathered from database of Company360 costs the school some moneys. In addition, sending reminding letters double costs of survey without guarantee of considerable numbers of more replies. Therefore, the research decided not to mail out the letters.

- Nature of survey

To make the questionnaire attractive, it is necessary to provide choices for the respondents.

Researchers generally finish questions in one shot in survey; as a result, there is no adding or correcting once the questionnaires are sent out. There might be some possible answers in which the researchers do not realize to. Although providing choices for the respondents lead to a productive data analysis and offer convenience for the respondents, it inhibits possible answers from respondents' mind. The information gained from survey represents the result statically. The knowledge acquired from survey is interpreted from the figures; therefore, what can be reported is the numbers of sample choosing a specific choice in each question. Additional knowledge which is out of researchers' background will not occur in survey. On the other hand, interview provides opportunities to accomplish in-depth information.

6.3 Directions for future research

The research concludes that future research should focus on;

- Improving models for understanding potential for ROI from green logistics

  There were numbers of weakness occurred in this survey. This might impact the outcome significantly. It is suggested that the further studies should improve models for understanding potential for ROI from green logistics by lessen potential errors appeared in this research.

- Developing more case studies into successful implementation of green logistics

  There are many logistics companies have been conducting green logistics. Some of them are successful in doing so. It is recommended to develop more case studies into those successful implementations of green logistics.

- Overcoming barriers.

  This research has found actual barriers of Australian logistics companies in achieving ROI and investing on green logistics. Designing strategies to overcome those barriers will be useful to develop green logistics in Australia.

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Appendix A: Research Questionnaire

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There are two sections to this survey

Section 1. Company Demographics

Please answer all the questions as only a fully completed questionnaire can be used in the analysis.

Q1. How much revenue in your business?	☐	< $1 million
	☐	$1-$5 million
	☐	$5-$10 million
	☐	$10-50 million
	☐	$50 - $100 million
	☐	Over $100 million
Q2. How many employees does your company have?	☐	1 to 20
	☐	21 to 100
	☐	101 to 200
	☐	201 to 500
	☐	Over 500
Q3. Respondent's Location. Multiple responses are allowed.		
	☐	ACT
	☐	NSW
	☐	Victoria
	☐	Queensland
	☐	Western Australia
	☐	Northern Territory
	☐	Tasmania
	☐	South Australia

Section 2: Perception of Green Logistics

Q4. Has your company's logistics processes been conducted to achieve greenness? ☐ Yes	If yes, which part of the supply chain? a. Warehouse b. Transportation c. Other..

☐ No	—
Q5. If your company is making a decision on a green logistics project, which <u>factors</u> do you consider as the first priority?	a. Customer relations improvement b. Cost of fuel bill c. Supply chain efficiency d. Government compliance e. Financial Return on Investment (ROI) f. Investor relation improvement g. Decreasing risk h. Other
Q6. How would your company rate <u>ROI's priority</u> in making a decision of Green Logistics projects?	Very important Not important 5 4 3 2 1 ☐☐☐☐☐
Q7. Over what period does your company <u>expect</u> to achieve ROI from a Green Logistics project?	a. 1 year or less b. 1-2 years c. 2-3 years d. 3-4 years e. 5 years or more f. Do not expect a return on investment
Q8. What are the <u>barriers</u> of achieving ROI in your company's perspectives?	a. Initial cost for setting up the systems b. Continuous cost maintaining greenness c. Certificate cost d. Training cost c. Lack of experience staff d. Other..
Q9. Would a green logistics initiative create <u>competitiveness</u> for your organization? ☐ Yes ☐ No	**If yes, what is the most important <u>advantage</u> for your organization?** a. Brand image b. Reduce expense/cost c. Improve process's efficiency d. Sales increase e. Improve customer service's level f. Other..

Q10. Is there a long-term plan for investing in green logistics in place or being put in place for your organisation? ☐ Yes ☐ No	If yes, what categories? a. Product packaging redesign b. Recycling programs c. Transport routing and scheduling optimisation d. Transport mode optimisation e. Waste reduction f. Levering technologies such as GPS and RFID g. Responding to customer needs and marked forces h. Supply chain partners requests i. Other...
Q11. Would the use of information technology improve the anticipated return on investment for investing in green logistics for the organisation?	☐ Yes ☐ No
Q12. What does your company consider are the main barriers to investing in green logistics?	a. Ineffective transportation b. Ineffective information systems c. Lack of supply chain integration with supply chain partners d. Other...

13. How important does your company rate green issues as a business priority?	Very important Not important
	
	  5 4 3 2 1
	  ☐ ☐ ☐ ☐ ☐

Appendix B: Survey Cover Sheet

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The Manager
{Company}
{Address}

{Suburb}

Dear Sir / Madam,

Please find enclosed a questionnaire investigating **Australian transport perspectives on Green Logistics, Focussing on Return of Investment (ROI).**

This research study is being conducted within the School of Computing and Information Systems at the University of Tasmania.

- Logistics organisations perceptions of Green Logistics
- Return on Investment (ROI) of Green Logistics of logistics organisations

The questionnaire will take approximately 10 minutes to complete. Your response will be treated as **strictly confidential**, and all results will be pooled for group analysis.

Thank you for your participation in this study.

Regards

Malcolm Bertoni

Appendix C: Information Sheet

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PARTICIPANT INFORMATION SHEET (PROFORMA)
SOCIAL SCIENCE/ HUMANITITES
RESEARCH

Australian transport perspectives on Green Logistics, Focussing on Return of Investment (ROI)

Invitation

You are invited to participate in a research study into Green Logistics.

The study is being conducted by Miss Matchima Nimpao who is completing the research for her Master Degree under the supervision of **Malcolm Bertoni.**

This survey explores economic issues in the Australian transport sector. It is directed at organisations that operate transport logistics, either directly or indirectly. **The questionnaire is attached with this sheet.** The first three questions are screen questions and the other questions ask the participants about their perspectives on Green Logistics. The questionnaire should take no more than 10 minutes to complete. A self-addressed envelope is provided to return the completed survey.

1. 'What is the purpose of this study?'

The purpose is to investigate the Australians Logistics companies' perspective on Green Logistics in term of Return of Investment from Green Logistics projects.

2. 'Why have I been invited to participate in this study?'

You are eligible to participate in this study because your organisation operates within the transport logistics sector.

4. 'What does this study involve?'

This research is collecting data regarding practices of logistics organisations in the Australian transport logistics sector.

As such, this survey explores economic issues in the Australian transport logistics sector. It is intended for organisations that operate transport logistics, either directly or indirectly.

It is important that you understand that your involvement is this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you if you decide not to participate. If you decide to discontinue participation at any time, you may do so without providing an explanation. All information will be treated in a confidential manner, and your name will not be used in any publication arising out of the research. All of the research will be kept in a locked cabinet in the office of **Malcolm Bertoni** and will be securely destroyed five years after publication of the data.

5. Are there any possible benefits from participation in this study?
It is possible that you will notice some research publications from the program after a certain period of time. This may lead to further studies and research into green logistics. It may also result in more surveys into other logistics sectors. We will be interested to see if you experience any other benefits from the findings of this particular research.

If we are able to take the findings of this small study and link them with a wider study, the result may be valuable information for others and it may lead to an enhanced understanding of the Australian logistics sector regarding economic issues.

6. Are there any possible risks from participation in this study?
There are no specific risks anticipated with participation in this study.

7. What if I have questions about this research?
If you would like to discuss any aspect of this study please feel free to contact Malcolm Bertoni on ph 03 6226-6210. Either of us would be happy to discuss any aspect of the research with you. Once we have analysed the information we will be mailing / emailing you a summary of our findings if you so require. You are welcome to contact us at that time to discuss any issue relating to the research study. This study has been approved by the Tasmanian Social Science Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study should contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. You will need to quote H11971.

Thank you for taking the time to consider this study.
By completing and returning the survey, your consent is implied.
All information provided by the participants in the survey will be anonymous.
This information sheet is for you to keep.