Developing environmental innovations:
A study of cooperation and greening supply chains

by

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A thesis submitted to the
Faculty of Engineering and Industrial Sciences,
Swinburne University of Technology, Melbourne,
in fulfilment of the thesis requirement for the degree of
Doctor of Philosophy

2014
Abstract

Over the past few decades there has been increasing pressure on firms to reduce their negative impact on the natural environment. The way they may contribute to resolve this issue is through developing new products, processes, and organisational practices—known as environmental innovations—that have less impact on the environment. Nevertheless, anecdotal evidence suggests that many firms struggle to develop environmental innovations in isolation. Environmental innovations are often more complex than conventional innovations as they may require multiple skills to develop and the outcome is yet uncertain. Cooperation with external organisations has been proposed as an effective strategy to overcome some of these difficulties. One area that has interested researchers is that of developing environmental innovations with supply chain partners, known as green supply chain management (GSCM). The activities of supply chain members are closely related; a failure of one supplier to comply with environmental standards and regulations can affect downstream buyers and the whole supply chain; and more importantly trust created amongst buyers and suppliers can help in further co-investments in environmental innovations.

This research investigates the way firms interact with their suppliers over the challenge of developing environmental innovations. Current knowledge in this area is still scant, but evolving; however, several fundamental questions remain: Is cooperation with external partners including supply chain members important for developing environmental innovations? What criteria do firms use to select their suppliers? To what extent do firms select and evaluate suppliers based on environmental criteria? How do firms cooperate with their suppliers on environmental innovations? What areas have more potential for cooperation? What motivates supply chain members to implement GSCM? And what are the barriers to GSCM? Answering these questions will contribute to knowledge about critical factors in greening supply chains.

This research uses the resource-based view, institutional theory, and other existing green supply chain and environmental innovation research to construct a framework for data collection and analysis. A mixed-method approach using secondary survey data and information gathered from interviews from multiple case studies is used. The study is conducted in two phases. In the first phase, the relationship between cooperation and environmental innovation is examined using Business Longitudinal Database (published by Australian Bureau of Statistics), which contains the data for 2,732 businesses for the year
2007. This is analysed using descriptive and logistic regression statistics. The results showed a positive correlation between environmental innovation and cooperation. This finding is in line with the resource-based view that states that by linking to other organisations, firms can obtain resources that facilitate the development of environmental innovations. It also strengthens the institutional theory that suggests that cooperation helps to enhance legitimacy of firms and reduce the pressure of various stakeholders. Although knowledge of a positive link between cooperation and environmental innovation is useful, it still does not provide rich and in-depth explanation about the realities of environmental cooperation. The second phase therefore investigates the way firms interact with their suppliers on environmental issues.

The second phase focuses on interviewing senior supply chain, procurement and general managers of a sample of manufacturing firms including 13 buyer and 11 supplier firms. The aim is to analyse and understand the way these firms interact with each other over environmental issues. The findings revealed a gap between a growing theoretical awareness of GSCM and the reality that was a low implementation of GSCM. Buyers mainly focused on quality, cost, and delivery time. Environmental criteria deemed desirable in some cases, but were not decisive factors. Cooperation between buyers and suppliers for environmental innovations was at a minimal level. There were a few cases where buyers had cooperated with their suppliers, mainly on packaging and waste minimisation initiatives. If there was a motivation to implement GSCM it mainly reflected cost-saving opportunities for both buyers and suppliers.

In a further examination of the findings and the literature on the underlying reasons for the low implementation of GSCM, two primary and two secondary factors were uncovered. The primary factors reflect the notions of senior managers that implementing GSCM practices is costly and that resources of suppliers are inadequate to the task. The secondary factors relate to the external environment of firms. These include a lack of motivating policies and low customer and consumer demand. The main conclusion to be drawn from this research is that, to drive environmental innovations along the supply chains, there should be more focus on changing the internal factors.

There are several notable contributions from this research. Firstly, from a theoretical perspective, this research uses the resource-based view, institutional theory, and existing literature on environmental innovation and green supply chain management to analyse and discuss the complex and multi-facet concept of ‘cooperation for reducing environmental
impacts’. A framework is constructed from the key elements that emerge from these theories and the relevant literature enabling conduction of further empirical study. Secondly, from a practical perspective, the results obtained from both quantitative and qualitative phases have significant implications for business managers. They may use these results to examine their green supply chain practices against those found in this research. By integrating the views of participants from both buyers and suppliers, this research shows that successful implementation of green supply chain management requires close cooperation between buyers and suppliers. Although some incremental changes may occur if buyers enforce suppliers to adopt green practices, systemic innovations are more likely to be developed if buyers engage their suppliers. Achieving such outcomes, although not easy, requires the adoption of a long-term view by business managers.
Dedication

I would like to dedicate this thesis to:

- My beloved wife, Farzaneh
- My compassionate parents
- And my kind siblings
Acknowledgment

I would like to acknowledge my supervisory team, Dr Peter Higgins, Professor Michael Clements, Dr Amir Abdekhodaei for their continual support and guidance. I am grateful to Dr Higgins, my principal supervisor, for reviewing my work and providing me with constructive comments. I would also like to thank Professor Clements, my associate supervisor, for spending many hours of his valuable time to discuss each step of this research. I would like to thank Dr Higgins and Professor Clements for supporting me financially and intellectually to attend conferences and present my work to the academic community. I would also like to sincerely thank Dr Abdekhodaei for reviewing my final draft and providing me with helpful comments.

I would like to offer my deepest gratitude to Dr Jay Hays who provided me with invaluable comments, especially about research methods. My meetings with Dr Hays and Professor Clements were amongst the most productive times of all my research period.

I wish to thank my friend and colleague Dr Hadi Sohrabi who reviewed the first and final drafts of my thesis and provided me with useful and constructive comments. My discussions with him helped me to realize some of the opportunities for improving the thesis.

I would like to express my especial thanks to Dr Sylvia Mackie, Academic Language and Learning Adviser at Swinburne, for providing assistance in reviewing and editing some chapters. I believe she is a great asset for Swinburne University.

I deeply appreciate the contribution of all firms and their participants who devoted their valuable times and answered all my questions. This research would have not been done without their inputs.

I would like to thank people that I had useful discussions with, especially at the early stages of my research when there were many questions to ask, Dr. Ambika Zutshi from Deakin University, Dr Bruce Whan from Swinburne University, Adjunct Professor Alan Pears from RMIT University, Scott McKenry from National Centre for Sustainability, Jo Brownlee from Sustainability Victoria, Vivine filling from AiGroup, and Wayne Jencke from Swinburne University.

I am grateful to people who provided me with industry contacts, Tracey Nelson, Industry-Based Learning (IBL) Coordinator, Caroline Clarke, Director of SCM Services, Ray Littlefield, Director of Operations Transformation Institute for Lean Systems, Matt
Drum, Dr Clint Steele, Senior lecturer at Swinburne University of Technology, and Jan Fitzgerald, Sustainability Programme Manager at Coles.

I acknowledge the assistance of Bradley Marlow in helping me to transcribe the interview recordings. I must also thank all my colleagues and friends, Dr Gayan Rathnaweera, Dr Shigeaki Kinoshita, Ben Ekman, Martin Vcelka, Dr Mahdi Miri, Dr Tanweer Chudhory, Dr Azman Yahaya, Binh Tran, Saeed Yousefdoost, Dr Hossein Jafari, Hamed Haghighi, whom I had great time with during this PhD journey.

I would like to thank my family, my parents for their love, support, and encouragement throughout my studies. Leaving the best to last, I would like to thank my lovely wife for her patience, sacrifice, encouragement, and friendship. She has stood by me at good and bad times.
Declaration

I hereby declare that the thesis entitled “Developing environmental innovations: A study of cooperation and greening supply chains” submitted in fulfilment of the requirements for the Degree of Doctor of Philosophy in the Faculty of Engineering and Industrial Sciences of Swinburne University of Technology:

- Contains no material which has been accepted for the award to the candidate of any other degree or diploma, except where due reference is made in the text of the examinable outcome.

- To the best of this candidate’s knowledge contains no material previously published or written by another person except where due reference is made in the text of the examinable outcome.

- Where the work is based on joint research or publications, discloses the relative contributions of the respective workers or authors.

Mohammad Yarahmadi

November, 2014

Melbourne, Australia.
List of publications


Definitions

**Environmental innovation (EI):** A new product, process or technology developed and/or adopted by a firm to reduce environmental impacts.

**Green supply chain management (GSCM):** The inclusion of environmental concerns into the management of supply chains.

**Green supply chain practices (GSCPs):** A set of practices that firms use to green their supply chains and is comprised of green compliance-oriented practices and green cooperative-oriented practices.

**Green compliance-oriented practices:** A set of practices that firms use to select and monitor suppliers according to environmental criteria.

**Green cooperative-oriented practices:** A set of practices that firms use to jointly develop environmental innovations with their supply chain partners.

**Environmental initiatives:** All activities of firms to address environmental challenges (e.g., implementing green supply chain practices and/or developing and adopting environmental innovations)
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1. Chapter One: Introduction

“We do not inherit the Earth from our ancestors; we borrow it from our children.”

*Amber Sprunt*
Chapter 1: Introduction

1.1. Background and context

Significant improvements have been made in the overall quality of life over the past few decades owing to the investment of firms in advanced technologies and new products and practices (Matus, 2010). However, many of these innovations, while beneficial, contribute to many of the current environmental issues such as global warming and resource scarcity (Porter and van der Linde, 1995; OECD, 2009). This has created a demand for firms to revise their traditional practices and minimise their negative impacts on the environment (Azzone and Noci, 1998; Bansal and Roth, 2000; Conceição et al., 2006). The way firms address such concerns is through adoption and development of environmental innovations (Cleff and Rennings, 1999; Rennings, 2000; Biondi et al., 2002; Frondel et al., 2008; Carrillo-Hermosilla et al., 2009; OECD, 2009; Potts, 2010). Environmental innovations represent a separate sub-group of conventional innovations with a focus on reducing or avoiding harm to the environment (Rennings, 2000; OECD, 2009; Carrillo-Hermosilla et al., 2010).

There has been a growing realisation amongst researchers that environmental innovations, especially more systemic changes, require the involvement of more than one organisation (Collins et al., 2007; Horbach, 2008; Vachon and Klassen, 2008; Mazzanti and Zoboli, 2009; De Marchi, 2010b; Posch, 2010). According to the resource-based view (RBV), cooperation could provide the opportunity of sharing resources that may not easily be found within a single firm. This could be especially important for environmental innovations that require multiple skills (Geffen and Rothenberg, 2000; Biondi et al., 2002; Gavronski et al., 2011). According to institutional theory, firms are under pressure from their stakeholders to improve their environmental performance (Delmas and Toffel, 2004; Ervin et al., 2012). This theory suggests that cooperation could help firms to reduce this pressure and enhance the legitimacy of their activities (Dacin et al., 2007; Lin and Darnall, 2010).

Cooperation with supply chain partners to develop environmental innovations has gained more interest in recent years (Vachon and Klassen, 2006; De Marchi, 2010a; Gavronski et al., 2011; Zhu et al., 2012). This area of research known as Green Supply Chain Management (GSCM), originates from supply chain management (SCM) (Sarkis, 2003; Srivastava, 2007). It extends the SCM definition—the management of a network of interconnected organisations involved in the provision of product and services to end customers (Harland, 1996, p.S64)—to the inclusion of environmental concerns throughout
the supply chain. GSCM suggests that cooperation among firms along a supply chain could lead to more systematic changes. Given the established relationship and trust between buyers and suppliers, co-investment in environmental innovations is easier. GSCM also suggests that firms have to be accountable for the environmental performance of their suppliers and therefore should monitor the environmental performance of their supply chains (Bowen et al., 2001; Hall, 2001; Rao, 2002; Preuss, 2005; Vachon and Klassen, 2008; Azevedo et al., 2011).

As a proactive environmental management practice, GSCM enables companies to reduce costs and increase earnings in coordination with their supply chain partners. This is achieved through improving the efficiency of processes and better utilising material and parts. GSCM could lead to better competitive advantage when members of a chain cooperate with one another to develop new products and processes. These innovations increase customer satisfaction and drive sales. Unique capabilities could also emerge from close interaction between supply chain partners. GSCM is also a powerful risk assessment practice. It helps firms to avoid the reputational risk that is involved with the activities of downstream customers and upstream suppliers. GSCM could also enhance the public image as firms that implement GSCM practices show more responsibility for their activities (Rao and Holt, 2005; Vachon and Klassen, 2008; Schliephake et al., 2009; Zhu et al., 2012).

1.2. Problem statement and research objective

Despite the growing importance of environmental innovations in the context of supply chain management, this area of research has received limited attention. There is still little knowledge—especially in studies that have focused on Australian firms—about the way buyers and suppliers interact with each other to develop environmental innovations. The areas that buyers and suppliers may be interested in for cooperation are still unclear. Furthermore, the evidence for environmental innovations found in the literature indicates that a majority of these innovations are developed internally and not in cooperation with supply chain partners. Possible motivations for supply chain members to co-invest in environmental innovations and potential barriers are yet to be explored. The aim of this research is to address these gaps by studying and exploring the way firms interact with their suppliers in the challenge of developing environmental innovations.
1.3. Research questions

To satisfy the objective of this research two main questions are addressed. The first question is designed to test the validity of an assumption made by many researchers. This assumption, which is a prerequisite to the main research topic, states that cooperation with external partners, especially supply chain partners, positively impacts the ability of firms to develop environmental innovations. Despite anecdotal evidence in support of this hypothesis, empirical evidence is scarce. Thus, the first research question is:

Q1: Is there a meaningful relationship between cooperation with external partners and the ability of firms to adopt or develop environmental innovations?

The second research question seeks to comprehend the perception by business decision makers through exploration of their green supply chain practices, motivations, and barriers. Thus, the second research question is:

Q2: How do firms interact with their supply chain partners on environmental issues?

- Q2a: How do buyer organisations select and monitor their suppliers? To what extent are environmental considerations amongst the selection and assessment requirements of suppliers?

- Q2b: To what extent do firms cooperate with their suppliers for further development and adoption of environmental innovations?

- Q2c: What motivates firms to adopt and develop environmental innovations and invest in GSCM?

- Q2d: What factors hinder firms from adopting and developing environmental innovations and investing in GSCM?

Although these two questions investigate environmental innovation from slightly different angles, complement each other. In pointing out the importance of cooperation for environmental innovation, they are convergent. The first research question has a broader aim. It seeks to examine the link between cooperation for all types of external partners and environmental innovation. The second research question, however, has a narrower focus; it investigates the role and contribution of supply chain partners.
1. 4. Methodology

This research adopts a mixed-method approach using secondary survey data and information gathered from interviews from multiple case studies. The aim is to give both depth and breadth of insight into the research topic, thereby generating greater confidence in conclusions. The research is conducted in two phases as follows.

The first phase is a quantitative analysis using survey data. This phase is explanatory in nature and corresponds to the first research question. The aim is to investigate the relationship between cooperation and environmental innovation. A survey-based secondary database, the Business Longitudinal Database (BLD) published by the Australian Bureau of Statistics (ABS), is used. The BLD contains the data for 2,732 businesses for the year 2007—this was the latest data available at the time of the analysis. The survey data is analysed using descriptive and logistic regression statistics.

The second phase is a qualitative analysis using multiple case-studies. This phase has an exploratory and descriptive nature and corresponds to the second research question. The aim here is to enhance understanding of green supply chain management. This phase is the major portion of the research. The qualitative method provides the opportunity to look in-depth into the way buyer and supplier firms interact over environmental issues and to uncover the underlying reasons for a low implementation rate of green supply chain practices. This phase allows the development of practical and theoretical understanding, as well as the generation of new concepts. The cases were all from the manufacturing industry and consisted of 13 buyer and 11 supplier firms. A total of 28 semi-structured interviews with the senior managers of the participating firms were conducted, each lasting from one to two hours.

1. 5. Contribution of this research

This study builds upon the resource-based view, institutional theory, and existing literature on green supply chains and environmental innovation to analyse and discuss the greening process in the context of supply chains. It provides empirical evidence on the positive relationship that exist between cooperation and environmental innovation. This research constructs a framework of green supply chain practices, differentiating between compliance-oriented practices and cooperative-oriented practices, and illustrates examples of such practices within the sample studied. This framework would be useful for practitioners seeking to develop environmental innovations in cooperation with their supply chains. Most studies that have looked at environmental innovation in the supply
chains have analysed the issue from the buyers’ perspective. Despite the power of large buyers to initiate the greening process, successful implementation of green initiatives depends on suppliers (Forman and Jørgensen, 2004). This research, therefore, makes a significant contribution by integrating the views of participants from both buyers and suppliers.

One main contribution of this research is that it highlights the factors that lead to a passive environmental supply chain strategy by firms. It demonstrates the importance of internal organisational factors (e.g., the perspective of managers and culture as well as the sufficiency of resource) over the external factors (regulations and consumer expectations). The resolution framework proposed in the final chapter shows that fundamental environmental changes (i.e., more novel and/or more complex and systemic environmental innovations) could be achieved, if firms engaged their suppliers in the greening process. Another contribution of this research is that it adds to the current body of knowledge of Australian firms, especially in manufacturing. While some studies in other countries have investigated environmental innovation in the context of supply chains (Vachon, 2007; De Marchi, 2010a; Zhu et al., 2012), such studies are scarce in Australia. These findings could guide Australian practitioners in green supply chain decisions.
1.6. Research process

Following and refining the research steps suggested by Bloomberg and Volpe (2008), Creswell (2003), Patton (2002), and Yin (2011), seven major steps, as shown in the table, were taken in this research (Table 1.1).

Table 1.1: Research process

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<tr>
<th>Major step</th>
<th>Activities</th>
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<td>Collating information</td>
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### Chapter 1: Introduction

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1. 7. Outline of the thesis

The thesis is structured as follows:

**Chapter One:** This chapter provides an overview of the entire research study. It outlines the context and background of the study as well as defining the research problem and associated objectives and describing the methodology.

**Chapter two:** This chapter reviews the literature on environmental innovation and uses the resource-based view to explain the importance of cooperation for the adoption and development of environmental innovations. The focus of the chapter then turns to a discussion of interaction with supply chain partners, who are amongst the most important external partners. The concept of green supply chain management (GSCM) is defined and explained from the perspectives of different researchers. The current research on green supply chain management is reviewed, to develop a framework of green supply chain practices. Moreover, this section reviews and discusses motivating and impeding factors encountered in addressing environmental challenges within firms and across their supply chains. This chapter ends with the development of a conceptual framework, which is used for further data collection and analysis.

**Chapter three:** This chapter outlines the research method and strategy used to collect the data. The chapter begins with a discussion of the choice of mixed-method strategy and is followed by a detailed discussion of quantitative and qualitative methods. The quantitative section provides details of the data source, the reliability and validity of the source, and method for data analysis. The qualitative section discusses the exploratory qualitative method based on multiple case-studies. The importance of the manufacturing setting, from which the data is collected, is described. How companies were selected to participate in the interviews, how the interviews were conducted, and how the transcripts of the interviews were prepared are also detailed. The chapter also outlines the four steps used to analyse the data. The ethical considerations and the ethics approval process are described. A discussion of the issue of trustworthiness of the research concludes the chapter.

**Chapter four:** This chapter presents the findings of the quantitative phase. It first explains the set of measurement variables including the dependent variable (environmental innovation), the main predictor (business cooperation), and the control variables (R&D expenditure, export, size, government grants and subsidies, and industry division). After
this, the results of descriptive and logistic regression analysis are presented, followed by a discussion of the findings.

**Chapter five:** This chapter presents the key findings obtained from 16 in-depth interviews with senior managers of 13 buyer firms. Narratives from responses by participants are provided, which allow portraying multiple participant perspectives and capturing some of the richness and complexity of green supply chain management. The emphasis throughout is to maintain objectivity by letting the participants speak for themselves.

**Chapter six:** This chapter presents the key findings obtained from 12 in-depth interviews with general managers of 11 supplier firms. A similar approach to that used in reporting the findings of buyer participants is used for this chapter.

**Chapter seven:** This chapter presents a discussion of the findings of qualitative interviews. The discussion is based on a cross-case analysis, interpretation, and synthesis of the findings. The purpose of this chapter is to provide interpretative insights into these findings. While the findings of buyers and suppliers tell the “story of the research” from the participants’ perspective, this chapter is an attempt to reconstruct a more holistic understanding. The analysis depicts a more integrated picture, and what emerges is a layered synthesis. It shows the primary and secondary factors that contribute to the passive environmental supply chain strategies of firms. These factors are discussed in detail.

**Chapter eight:** This chapter presents the conclusion of the findings of quantitative and qualitative analysis. It also offers recommendations to business and policy decision makers, which leads to the development of a resolution framework. Furthermore, directions to build on the findings of this research are outlined for future research. This chapter culminates by outlining the limitations of the research.
2. Chapter Two: Literature Review

“Perfection is immutable. But for things imperfect, change is the way to perfect them.”

Owen Feltham
2. 1. Introduction

This chapter provides a critical overview of current and past studies. This review is consisted of two parts. In the first part, a review of environmental innovation is conducted. Environmental innovation is the constant unit of analysis throughout the entire study. In the first phase (the quantitative analysis), it is the dependent variable of regression analysis and in the second phase (the qualitative study), it is the focus of questions asked of the participants. The review provides an understanding of the concept of environmental innovation and shows the characteristics that differentiate this type of innovation from conventional innovations. Importantly, realization and implementation of environmental innovation may be easier by firms moving beyond their borders to cooperate with their external partners. The importance of cooperation is discussed in detail from the perspective of resource-based view (RBV); a theory that is widely expressed in the literature on strategic management.

In the second part, the focus becomes narrower by reviewing the literature on the way firms interact with an important select group of external partners: their supply chain partners. This field is known as green supply chain management (GSCM) and has been a focus of scholars and practitioners in recent years. The concept of GSCM is defined and explained through the perspectives of different researchers. A framework of green supply chain practices (GSCPs) is developed and explained in detail. Furthermore, an inclusive review and discussion is provided in regards to the motivating and impeding factors that address environmental challenges. This chapter ends with the development of a conceptual framework, which is used for further data collection and data analysis.

Figure 2.1 provides a visual representation of the main streams of the literature that focus on the green supply chain management. It includes three types of researchers: those researchers with an innovation background, who have realized the importance of environmental innovation as a means to address the environmental challenges and have found out that cooperation with external partners including supply chain partners is a major determining factor; those researchers with an environmental background, who have found cooperation a solution to overcome the technical difficulties of environmental projects; and those researchers who study in the supply chain domain and have realized how ignoring the environmental agenda could impact the reputation of the whole supply chain and how investing on joint environmental projects could enhance the performance
of the entire supply chain. Due to the multi-disciplinary nature of the research topic, the review that follows has references to studies within these three streams of the literature.

Figure 2.1: Literature map
2. 2. Environmental innovation

2. 2. 1. Understanding environmental innovation

The contribution of industrial and business units to sustainable development is being recognized through environmental innovation (Rennings, 2000; Brío and Junquera, 2003; Rainey, 2006; Lehmann-Waffenschmidt, 2007; Masurel, 2007; Frondel et al., 2008; Carrillo-Hermosilla et al., 2010; Garnaut, 2011). A widely accepted definition of environmental innovation, also known as sustainable innovation, green innovation, and eco-innovation, is given by OECD (2009, p.40):

“The creation of new, or significantly improved, products (goods and services), processes, marketing methods, organisational structures and institutional arrangements which, with or without intent, lead to environmental improvements compared to relevant alternatives”.

A close examination of the OECD definition and other definitions in the literature uncovers two points. Firstly, in many aspects, environmental innovation represents a separate sub-group of general innovation and the terminology used to describe it, is consistent with the main stream innovation. Secondly, it is the effect rather than the intention that determines an innovation as environmental (Arundel et al., 2007; OECD, 2009). Kemp and Pearson (2007) group those firms that intentionally develop or adopt environmental innovations as “strategic eco-innovators” and “strategic eco-adopters”.

These firms actively search for environmental solutions. Kemp and Pearson, however, classify firms that unintentionally develop innovations that benefit the environment as “Passive eco-innovators”. For this group, the argument is that although their primary intention is not necessarily environmental improvement—it could be some other business goals such as reducing the cost or improving the quality—they are still creating positive impact on the environment (Halila, 2007). Based on the notion that the effect is superior to intention, Kemp and Pearson (2007, p.7) argue that “Anything is an eco-innovative solution as long as it is more environmentally benign than “the relevant alternative”.

Some researchers, who have disparate interpretations, exclude unintentional innovations from their definitions. Table 2.1 on page 16 shows such differences in definition and interpretation of environmental innovation. The view that focuses on intention has been criticised lately. Discerning environmental motivation from other motivations is becoming more difficult as firms move from end-of-pipe innovations to more systemic and integrated technologies and product solutions. It is also less complicated
to measure effect rather than motivation. Moreover, establishing the link between the dedicated environmental activities of firms and the environmental performance of industry is difficult (Carrillo-Hermosilla et al., 2010).
Table 2.1: Environmental innovation definitions

| Effect on the environment is emphasised, but the intention is not mentioned or considered irrelevant | An innovation that improves environmental performance, in line with the idea that the reduction in environmental impacts (whether intentional or not) is the main distinguishing feature of eco-innovation (Carrillo-Hermosilla et al., 2010, p.1075).

Innovation that results in a reduction of environmental impact, no matter whether or not that effect is intended (OECD, 2009, p.15).

In a broad sense, environmental innovations can be defined as innovations that consist of new or modified processes, practices, systems and products which benefit the environment and so contribute to environmental sustainability (Oltra and Saint Jean, 2009, p.567).

Any innovative product or technology that has less harmful environmental effects than the available alternatives (Kivimaa, 2007, p.93).

The production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives (Kemp and Pearson, 2007).

| Both the effect on the environment and the intention to reduce the impact on the environment are emphasised. | Product and process innovation, including the development of new technologies, that focuses on energy saving, pollution prevention, waste recycling, and eco-efficient design (Leenders and Chandra, 2012, p.4).

Any form of innovation aimed at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment or achieving a more efficient and responsible use of natural resources (Lee, K-H and Kim, 2011, p.529).

A new product, process or technology developed and/or adopted by a firm to reduce environmental impacts (Hall, 2001, p.107). |
Chapter 2: Literature review

Is reducing the impact on the environment the sole factor that differentiates environmental innovation from conventional innovation? A deeper examination of literature provides a negative answer. The literature shows the following four important characteristics that separate environmental innovation from the main stream innovation works. These characteristic are:

1. The scope of environmental innovation goes beyond simple product or process innovations and may include a change in social norms, cultural values, or structures.
2. The private benefits of environmental innovations may be less than social benefits—a phenomenon known as the double externality problem.
3. Environmental regulations play an important role in driving firms to invest in environmental innovations.
4. Developing environmental innovations is more complex than conventional innovations and requires a closer cooperation with external partners of a firm.

Environmental innovation has a broader scope than conventional innovation. It includes not only technological changes, but also changes in social norms, cultural values, and institutional structures—non-technological changes (Rennings, 2000; Falk and Ryan, 2007; OECD, 2009). Technological changes in the form of product or process innovations are mainly addressed in engineering disciplines, whereas non-technological changes are more common in management and policy literature (Carrillo-Hermosilla et al., 2009). The OECD report categorizes the non-technological innovations into informal and formal institutions. Informal institutional environmental innovation refers to changes in behaviour, knowledge and values of individual within a society. Rennings (2000) gives the example of shifting from personal car use to the riding of a bicycle, to illustrate how social change may take place due to people becoming more aware of the environmental issues. Some other examples of social changes cited by the OECD are the formation of volunteer groups that help clean the environment and the increasing interest by the public in consuming organic foods. Formal institutional environmental innovation is concerned with redefining roles and relationships to address environmental issues. Cooperation between various stakeholders such as government authorities, scientists, firms and NGOs, to encourage sustainable transport is an example of formal institutional change (Rennings, 2000). The emergence of eco-industrial parks, in which firms group cooperatively to utilize each other’s by-products and to share resources, is another example of institutional change.
In general, institutional innovations are more likely to drive systemic improvements than technological changes, which tend to be mainly incremental in nature (Hellström, 2007; OECD, 2009).

There is a lack of motivation for firms to invest in environmental innovations, because the private returns of these innovations are less than the social returns. There are two market failures (known as double externalities in the literature) that create a gap between the private and social returns. The first market failure occurs in the developmental phase, where environmental innovations create positive knowledge spill overs (a positive externality) that can be easily obtained by other firms and the rest of society because they can take advantage of the innovation by adopting or improving it. While the knowledge created may be beneficial to the whole society, the firm financing the environmental innovation has to incur the predominant costs: a cheap outcome for reproducers at the expense of the pioneers. This externality, however, is not specific only to environmental innovations and is common for all types of innovations. The next market failure occurs during the phase of development and adoption. This failure distinguishes environmental innovations from other innovations. Adoption of environmental innovations leads to reduced impact on the natural environment (the second positive externality). While this is also desirable for the whole society, it may not necessarily be valued by the market; consequently, it does not easily translate into benefits for the firm financing the environmental innovation. These two market failures together could potentially discourage firms to invest in environmental innovations (Cleff and Rennings, 1999; Rennings, 2000; Carrillo-Hermosilla et al., 2009; Horbach et al., 2012).

The growing role of environmental regulations as a driver is another feature that distinguishes environmental innovations from conventional innovations (Porter and van der Linde, 1995; Rennings, 2000). In the conventional innovation model, either demand-pull or technology-push factors, or both together, are sufficient to trigger the development of innovations. Demand-pull factors include market expectations and consumer preferences, whereas technology-push factors include research and development activities and expenditure (Kivimaa, 2007). For environmental innovations, however, because of the problem of double externality a third factor, government intervention, has been proposed. Rennings (2000) calls this the “regulatory push/pull” effect. By raising the cost of pollution through penalties, employing subsidies, and facilitating technological development, governments can reduce the gap between private and social returns, thereby making development of environmental innovations more feasible (Rennings, 2000; Mazzanti and
Zoboli, 2005; Carrión-Flores and Innes, 2010; Johnstone et al., 2010; van den Bergh et al., 2011).

As development of environmental innovations is more complex than conventional innovations, firms must cooperate more closely with their external partners. The skills and knowledge required for developing environmental innovations are more diverse and complex, which may not readily be found within a single firm. This increases the risk in their development. Nevertheless, cooperative networks could reduce this risk by providing the resources required (De Marchi, 2012). Information about environmental innovations may not be readily available for many firms due to the novelty of these innovations. External partners could facilitate the flow of such information. Many, more radical, technological environmental innovations are so expensive that it may not be feasible for a single firm to incur all the costs. Partnerships could help to share the investments and make these innovations viable (Carrillo-Hermosilla et al., 2009). Some changes in products, processes or practices for reducing the impact on the environment may affect downstream customers or upstream suppliers. This demands a closer cooperation with supply chain partners in devising solutions. A good example of the great importance of cooperation for environmental innovation can be observed in closed-loop manufacturing systems, in which the output of one unit becomes the input for the other and vice versa (OECD, 2009). Despite the increasing importance of cooperation as a major determinant of environmental innovation, the literature on this topic is scant. In the section 2.3. The importance of cooperation for environmental innovation a detailed discussion of cooperation is elucidated through a resource-based lens, which is supplemented with some limited empirical evidence from the literature.

2. 2. 2. A typology for environmental innovation

Most typologies in the literature use conventional innovation models to explain different types of environmental innovations. This section reviews some of these typologies and concludes with a discussion of the typology proposed by Trifilova et al. (2012), which better suits the purpose of this research.

The classification proposed by Rennings (2000), which was introduced in the preceding discussion (Section 2.2.1. Understanding the environmental innovation), has been widely used by some scholars (Arundel et al., 2007). His framework distinguishes between technological, organisational, social, and institutional environmental innovations. Technological innovation includes new products or processes, such as compact phosphate-
free detergents or energy-efficient washing machines. Arundel et al. (2007) identified six categories of technological environmental innovations, with minimum overlaps as follows:

**Clean products**: Products that have least environmental impacts through their lifecycle.

**Cleaner production**: Process innovations in the production system aiming to diminish the amount of pollutants and waste material generated during the production.

**Pollution control**: Technology to prevent the direct release of environmentally hazardous emissions into air, surface water and soil.

**Recycling**: Re-use of materials recovered from waste streams to minimize waste generation.

**Waste management**: A formal system for handling, treatment and disposal of all wastes.

**Clean-up**: Remediation technologies such as air purifiers, land farming and bioremediation, which uses plant species to remove toxic materials from contaminated soil.

Organizational innovation refers to changes in organizational structure, plans, routines, and orientations (Arundel et al., 2007). Examples include implementation of environmental management systems (EMS) such as ISO 14001 or the European Eco-Management and Audit Scheme (EMAS), using tools such as life-cycle assessment (LCA), and through the conduction of environmental trainings programmes.

As explained earlier, social and institutional environmental innovations concern broad changes in life style and restructuring of formal institutions—for instance, through improved laws and standards—and improvements to decision-making process by applying new methods of scientific assessment and public participation. For radical innovations, a need for social change becomes much more apparent. However, because of complexity in analysing societal environmental innovations, most studies have focused on the technological aspects of environmental innovations (Carrillo-Hermosilla et al., 2009).

In considering the mechanism for reducing environmental effects, Ekins (2010) identified three types of environmental innovations. First is end-of-pipe technology, characterised by eliminating pollution after it is produced. Criticism is levelled at the need to dispose of the removed waste (van den Bergh et al., 2011). Second is product innovation, which refers to developing or (re)designing products that contain less harmful
substances, use less energy, and produce less waste. Third is process-integrated technology (Clean technology), which refers to changes in processes and production methods that lead to less pollution, resource and/or energy use. Despite the potential advantages of clean technologies (Porter and van der Linde, 1995), they are rarely adopted by manufacturing firms, as they require significant changes to current production processes and product features, compared to the incremental changes of end-of-pipe technologies (Klassen and Vachon, 2003).

OECD (2009) based its typology on three dimensions of environmental innovation namely, target, mechanism and impact (See Figure 2.2 on page 22). Target refers to the focus of environmental innovation. Five types of targets are identified: product, process, marketing methods, organizational, and institutional innovations. Mechanism refers to the methods by which companies innovate. The mechanisms are categorized under four main captions:

- **Modification**: Small amendments in products and production processes
- **Redesign**: major changes in existing products, processes, organisational structures, etc.
- **Alternatives**: The substitution of existing products with new products that have the same functionality
- **Creation**: The design and introduction of entirely new products, processes, procedures, and organisational and institutional settings

**Impact**: The resulting effects of environmental innovation on the natural environment, which depends on the combination of environmental target and mechanism.
Institutions
Organizations and Marketing methods
Processes and Products

Primarily non-technological change

Higher potential environmental benefits ...

... but more difficult to coordinate

Primarily technological change

Carillo-Hermosilla et al. (2010) define three groups of environmental innovations—component change, sub-system change, and system change—that are based on the extent of change and the degree of impact on the environment (See Figure 2.3 on page 23). Component change refers to incremental improvements to current systems that help to reduce negative impacts. It includes mainly innovations that are similar to Ekins’ (2010) end-of-pipe technologies. Component changes have been applied widely across industries, because they are relatively cheap and quick to implement. Nonetheless, they only offer a partial solution. Sub-system change refers to a concept known as eco-efficiency. An eco-efficient system produces more goods and services while consuming fewer resources, by optimising existing systems where feasible, and replacing some sub-systems with more efficient alternatives. Sub-system changes are considered practical and preventive solutions, and as such, firms have become increasingly interested in their development and adoption. System change refers to fundamental alteration in the system, its sub-systems and components. This approach questions the current production systems and products, and in seeking more effective solutions (eco-effectiveness), it may go beyond these industrial concerns to questions of lifestyle. Potentially, they can return higher benefits in the
medium and long terms. Closed-loop systems (discussed in the preceding section) are an example of innovation through system change.

Figure 2.3: A typology of environmental innovation according to the radical or incremental nature of produced technological change and the level of impacts to the system. Source: (Carrillo-Hermosilla et al., 2010)

In their maturity model, Trifilova et al. (2012) distinguish different types of environmental innovations: passive/cosmetic, improvement innovation, opportunity-driven innovation, system level innovation (See Table 2.2 on page 24). They introduced the “passive/cosmetic” dichotomy, in which there is either no active pursuit of environmental innovation, or, at most, there is only cosmetic publicity of “green credentials”, without any attempt to perform any activity that benefits the environment. “Improvement innovation” is concerned with improving existing products and processes and is often triggered by an external force such as environmental regulations. “Opportunity-driven innovation” refers to creation of new products and processes and is mainly driven by a desire of firms to move beyond compliance, to gain competitive advantage.1 “System level innovation” refers to creation of new business models. Its

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1 The motivations to address environmental challenges are discussed in detail in section 2.5.1.
delivery entails major redesigns of products, processes and services and engagement with external organisations (Weber and Hemmelskamp, 2005).

The typology of the maturity model is used in this research because it draws on an evolutionary aspect of innovation that is more compatible with the reality. Also its simplicity makes it more comprehensible.

Table 2.2: The typology of environmental innovation. Source: (Trifilova et al., 2012)

<table>
<thead>
<tr>
<th>Level</th>
<th>Characteristics</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-Passive/cosmetic</td>
<td>No activity, or ‘cosmetic’ public relations based statements of intent</td>
<td>n/a</td>
</tr>
<tr>
<td>1-Improvement innovation</td>
<td>‘Do what we do but better’ innovation, taking waste out, reducing footprint of existing processes, efficiency enhancing.</td>
<td>Compliance with externally imposed regulation Commitment to frameworks like FSC, Greening of existing processes, products and inter-organizational value chains</td>
</tr>
<tr>
<td>2-Opportunity-driven innovation</td>
<td>Creation of new products, processes, services which open up innovation space</td>
<td>New technologies – solar, etc. New process routes and architectures – e.g. low energy bioprocessing instead of thermal cracking</td>
</tr>
<tr>
<td>3-System level innovation</td>
<td>Creation of new business models at system level involving reframing of the way value is created and often extending across multiple organizations</td>
<td>Interface Flor re-inventing itself as an integrated ‘green’ company</td>
</tr>
</tbody>
</table>

Trifilova et al. (2012) propose that innovations at most firms are at level 1, with movement towards level 2, which they support with some empirical evidence. They also observed a growing trend towards system-level innovations, though small at present.

Firms may be able to develop or adopt level 1 and 2 innovations by themselves. But they would find it challenging to undertake more systemic changes without assistance from external organisations that include government agencies, competitors, NGOs, universities,
and research centres. More importantly, assistance from supply chain partners may facilitate the process in a way that is pivotal for success. A discussion of the imperative of cooperation for environmental innovations is presented in the next section.

2.3 The importance of cooperation for environmental innovation

While some incremental employment of environmental innovations are achievable by a single firm, most environmental improvements, especially radical ones, require multi-party cooperation. This has attracted researchers to study the interaction of firms with their external partners on environmental issues (Wheeler et al., 2005; Horbach, 2008). In the following paragraphs, the importance of cooperation is discussed through a resource-based view of the firm—a perspective, originating in strategic management, that has been widely used to explain the motivation of firms in forming cooperative ties. This is followed by a review of empirical evidence.

2.3.1 Resource-based view (RBV)

The resource-based view asserts that firms could gain competitive advantage if they own resources and capabilities that are valuable, non-substitutable, rare and not imitable by their competitors (Barney, 1991; Hart, 1995). According to Barney (1991, p.101), the resources of a firm include “all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness”. Das and Teng (2000) classified resources into property-based and knowledge-based. Property-based resources refer to legal properties possessed by firms, including financial capital, physical assets, and human resources, while knowledge-based resources are a firm’s intangible knowledge and skills. Unlike property-based resources, knowledge-based resources are hard to imitate due to knowledge and information barriers (Das and Teng, 2000; Bakar and Ahmad, 2010). Drawing on the resource-based view, partnerships can benefit firms in several ways.

Firstly, partners may access heterogeneous resources (property-based) that do not exist within a single firm (Barney, 1991; Mesquita and Lazzarini, 2008), but are essential for environmental innovations (Brio and Junquera, 2003; Carrillo-Hermosilla et al., 2010; Gavronski et al., 2011). By pooling resources, firms can considerably reduce the cost of environmental innovations. Biondi et al. (2002) give the example from the ceramic-tile industry, where firms within the same geographic area share expensive equipment for recycling broken tiles. Environmentally innovative solutions in areas such as waste
minimisation, energy efficiency, material and packaging optimisation have shown to be efficient in reducing operating costs for participants and have led to higher performance levels (Geffen and Rothenberg, 2000; Rao and Holt, 2005; Vachon and Klassen, 2008).

Secondly, partnership advances corporate learning through a reciprocal flow of knowledge and information, in that the risks and learning of environmental innovations are shared (Lin and Darnall, 2010). Firms with greater knowledge and understanding of the environment are more likely to identify market opportunities and establish technological innovations, which can then be shared among their partners. Continual interaction among partners engenders a capability for continuous environmental innovation that leads to sustained competitive advantage (Sharma and Vredenburg, 1998). Carter and Rogers (2008) expand this view to the resources of a supply chain. The knowledge that is transferred among members of the supply chain is more technical, less transparent, takes longer time, and therefore is more difficult to be replicated.

Thirdly, partnerships could also enable firms to move towards entirely new clean technologies or reformed business models where sustainable practices replace old and environmentally unfriendly ones (Moore and Manring, 2009). They play an important role at every stage of the development of these technological innovations. Partners provide appropriate information in the early stages when critical decisions have to be made. For radical innovations such as clean technologies, firms need to have a structured R&D (Biondi et al., 2002). Therefore, they must to rely on their partners. Examples observed, include competitor firms sharing advanced technological resources, such as experimental plants, and laboratories to test and develop environmental innovations. Given the complexity of some new technologies, the implementation phase requires substantial support from various experts (Biondi et al., 2002).

2.3.2. Empirical evidence

Using a discrete-choice model to analyse the data extracted from the Mannheim innovation panel (MIP) database, Horbach (2008) maintains the position that cooperative activities aid the development of environmental innovation. Moreover, he claims that cooperative arrangements are more important for environmental innovation than general innovation. However, this study fails to mention the influence of different types of partners. The definition for the indicator he uses for the realization of environmental innovation is also so broad that it biases the results. The survey question includes innovations that led to improvements to either environment or health conditions. Similarly,
based on a dataset of Spanish manufacturing firms, De Marchi (2010b) indicates that cooperative arrangements have a stronger impact on environmental innovations compared to other innovations.

In an attempt to find determinants of environmental innovations among manufacturing firms in Italy, Mazzanti and Zoboli (2005) showed that networking arrangements—that they called “horizontal economies of scale”—have greater relevance for environmental innovations than structural characteristics. Although their results do not clearly distinguish between various partners, they state that research institutes and other firms are the main partners. Their involvements are mainly in energy and emission related innovations.

Based on data from the Community Innovation Survey in Portugal, Conceição et al. (2006) show that belonging to an economic group is positively related to the introduction of innovations due to environmental concerns. They note that joining a group has the advantage of being aware of environmental issues. Although their findings confirm the strong relationship between cooperative arrangements and environmental innovation, the variable used for cooperation is so broad that it is impossible to distinguish between different types of partners.

While cooperation with partners can be a great advantage, firms need to be careful, as it does not always work well and for certain contexts it is inappropriate (Nieto and Santamaría, 2007). Fadeeva (2005), for instance, shows that cooperation frequently falls short of expectations. Achievement of satisfactory results depends on a number of factors that might well be ignored by engaged parties. He argues that partnerships could be of value when dependencies imposed by collaborator are balanced by the advantages provided by the information and control acquired. He then lists the issues that may lead to inefficiency of cooperative arrangements: vague or differently interpreted goals, unclear targets, lack of credible commitment, neglect of critical partners, lack of monitoring, inability to adjust strategy, lack of trust, missing information links, insufficient use of resources, lack of incentives and sanctions. By entering into cooperative arrangements firms also have to give up complete control, learn to negotiate and compromise (Edwards and Edwards, 1997).
2. 4. Interaction with supply chain partners

2. 4. 1. Green supply chain management

There is growing research interest in the interaction among supply chain actors regarding environmental issues and in the development of environmental innovations (Bowen et al., 2001; Linton et al., 2007; Srivastava, 2007; Vachon and Klassen, 2008; Vachon and Mao, 2008; De Marchi, 2010a; Testa and Iraldo, 2010; Sarkis et al., 2011; Hassini et al., 2012). Green supply chain management (GSCM) is the term used for this emerging area of research, with origins from the literature in both environment management and supply chain management. A wide variety of definitions and terms have been used in the literature referring to the consideration of environmental concerns in supply chain management (See Table 2.3).

These definitions vary, based on their focus area ranging from green purchasing (Green, Ken et al., 1998; Carter et al., 2000; Min and Galle, 2001; Zsidisin and Siferd, 2001; Hamner, 2006) to a broader definition that integrates the supply chain, flowing from supplier, to manufacturer, to customer, and on to reverse logistics (Sarkis, 2003; Zhu et al., 2005; Vachon, 2007; Sarkis et al., 2011). There is, however, common agreement that important consideration be given to environmental issues in the supply chain. Some authors (Hassini et al., 2012) include social considerations in their frameworks, and refer to the concept as “sustainable supply chain”. The definition presented by Azevedo et al. (2011, p.850), which is adopted for this research, describes GSCM as “an organizational philosophy that helps organizations and their partners to achieve corporate profit and market-share objectives by reducing environmental risk and impacts while improving ecological efficiency”

GSCM challenges the customary view that focuses on a firm’s internal efforts to reduce the impact on the natural environment (Srivastava, 2007; Sarkis et al., 2011). It expands the focus outside the borders of a firm, examining inter-firm dynamics of supply chain members (De Marchi, 2010a). Some studies suggest that greening supply chains not only create an opportunity for cost savings, but also enhances the financial performance and competitiveness of the firms (Carter et al., 2000; Rao and Holt, 2005). The GSCM literature submits that the introduction of environmental concerns within the business activities of firms requires them to interact with supply chain partners—suppliers in particular—as partners affect how environmental innovations are introduced and the overall reduction in pollution levels. Hall (2001), for example, introduced his sphere of influence model
Chapter 2: Literature review

showing the extent of buyers’ influence on their upstream and downstream supply chains. In his depiction, he first highlights a black area around the buyer firm that denotes the legal responsibility of the buyer, which does not concern the suppliers’ environmental issues and is easily managed. The next area, called the sphere-of-influence, is where the activities of customers and suppliers are influenced or controlled by the buyer firm. The last area, called the sphere of concern, is where the buyer may have a concern over the environmental issues of its upstream and downstream supply chain members, but does not necessarily have control over these issues. Hall (2001) found that there is a positive relationship between the pressure that firms are exposed and their environmental supply chain initiatives. In particular, he found that large firms are under significant pressures with regards to the environmental impact of their suppliers. Similarly, some other scholars point out the power advantage of buyers in greening supply chains and creating a multiplier effect (Preuss, 2005).

Table 2.3: Green supply chain definitions

<table>
<thead>
<tr>
<th>Description</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td>The extent to which supply management incorporates environmental, social, and economic value into the selection, evaluation and management of its supply base</td>
<td>Giunipero et al., 2012, p.260</td>
</tr>
<tr>
<td>The management of supply chain operations, resources, information, and funds in order to maximize the supply chain profitability while at the same time minimizing the environmental impacts and maximizing the social well-being</td>
<td>Hassini et al., 2012, p.70</td>
</tr>
<tr>
<td>Integrating environmental concerns into the inter-organizational practices of SCM including reverse logistics.</td>
<td>Sarkis et al., 2011, p.3</td>
</tr>
<tr>
<td>The complex of mechanisms implemented at the corporate and plant level to assess or improve the environmental performance of a supplier base</td>
<td>Gavrinski et al., 2011, p.4</td>
</tr>
<tr>
<td>Cooperative supply-chain environmental management (CSCEM) occurs between focal firms, companies that sell either directly to them or to a supplier further up the chain or with downstream firms that focal firms supply. In such activities the focal firm and its supplier(s) work together to reduce the firms’ collective effects on the natural environment through any of the elements of the total product lifecycle (physical system) from the creation of inputs to the final disposal, decontamination or recycling/reuse of outputs. Such activities may include actions as diverse as joint research and development on materials reduction/toxicity, common sourcing, coordinated training activities and inter-organizational product design teams.</td>
<td>Sharfman et al., 2009, p.2</td>
</tr>
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</table>
The management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements (Seuring and Müller, 2008, p.1700).

Integrating environmental thinking into supply-chain, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life”. (Srivastava, 2007, pp.54-55).

The control exerted over all immediate and eventual environmental effects of products and processes associated with converting raw materials into final products (Beamon, 2005, p.221)

We define environmental supply management practice in a product chain as attempts to:

- Address environmental problems in a product chain
- Convert the understanding of problems and their management into changed practices in the individual companies in the product chain and/or the product chain as a whole (Forman and Jørgensen, 2004, p.45)

The set of supply chain management policies held, actions taken, and relationships formed in response to concerns related to the natural environment with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm’s goods and services (Zsidisin and Siferd, 2001, p.69).

Environmental management has been expanded to include not just standard contract language stipulating that a supplier complies with all applicable environmental laws, regulations and other government requirements, but in some cases expectations that suppliers participate actively in pursuing the goal of sustainability. All the different approaches to this broader definition of environmental management can collectively be called Supply Chain Environmental Management (SCEM) (Green Business Network, 2001, p.10).

Environmental supply-chain innovation is when a supplier, under the advice, coercion or direction of a customer firm, adopts an environmental innovation (Hall, 2001, p.107).

Environmental supply chain management consists of the purchasing function’s involvement in activities that include reduction, recycling, reuse and the substitution of materials (Narasimhan, 1998, p.6).

Green supply refers to the way in which innovations in supply chain management and industrial purchasing may be considered in the context of the environment (Green, Ken et al., 1996, p.188).
2.4.2. The state of GSCM in Australia

Research on the green supply chain for Australian businesses is limited and has shortcomings (Sheu and Talley, 2011). Simpson et al. (2007) conducted a survey and collected data of first and second-tier component manufacturers in the automotive industry. They found that environmental requirements enforced by buyers may induce suppliers to commit to environmental improvements at a strategic level. Despite the insights offered, their study is limited in several ways. They did not investigate the cooperative practices associated with innovation. Furthermore, the scope of their research is limited only to the automotive industry and the small sample size used in their study limits the generalizability of their findings.

Hasan (2013) used five case studies to examine the relationship between implementing green supply-chain practices and operational and environmental performance in Australian companies. He found that most companies were certified through an environmental management system such as ISO 14001 and that they were engaged with their key suppliers in developing long-term relationships. Furthermore, this study found that most companies undertook recycling or either improvement in packaging or recycling with their suppliers. In terms of operational and environmental benefits, he found that these firms had been able to reduce their pollution levels, improve their energy efficiency, and use fewer resources. By doing so, they could reduce costs, increase sales, gain more make share, and make more profits. While offering valuable insights, his research lacks a strong research methodology. The data were collected mainly from reports and documents published by the companies, which could be considerably biased towards showing a good, but unrealistic image of the companies studied. According to Deegan and Rankin (1996), Australian annual reports—similar to many reports elsewhere in the world—do not provide an accurate representation of corporate environmental image, because firms are deliberately selective in choosing which information to include.

Keating et al. (2008), in their study of the green supply chain practices of Westpac Banking Corporation, identified the factors that impeded and motivated Westpac in pursuing a green supply chain strategy. Their study concludes with a seven-step guideline of best practices of GSCM; what they called the sustainable supply chain model (SSCM). Unfortunately, by addressing a single company they are unable to generalise their findings. They also failed to provide comprehensive knowledge of the underlying reasons associated with the challenges that Westpac face in greening its supply chains.
2. 4. 3. Green supply chain practices (GSCPs)

The greening process usually starts with large buyer corporations and moves to upstream suppliers and, to a lesser extent, to downstream customers (Remmen and Holgaard, 2004; Vachon, 2007). The process of greening a supply chain requires firms to use a set of practices known as Green Supply Chain Practices (GSCPs) (Vachon and Klassen, 2006; Gavronski et al., 2011). Both buyers and suppliers are involved in implementing these practices, with the aim to eliminate or reduce environmental impacts (Azevedo et al., 2011; Gavronski et al., 2011).

A chronological review of the literature indicates a number of different frameworks for green supply chain practices. Based on a review of the literature and from researching five major UK firms, Lamming and Hampson (1996) identified five practices: vendor questionnaires, use of environmental management systems, life-cycle assessment, product stewardship, cooperation and relationships. Using an exploratory factor analysis, Zsidisin and Hendrick (1998) determined four practices including, hazardous materials, investment recovery, product design, and supply chain relationships.

Through conducting an exploratory analysis, three green supply chain practices were recognized by Bowen et al. (2001) namely, product-based green supply, greening the supply process, and advanced green supply. Product-based practices refer to joint works by buyers and suppliers focusing on packaging and waste minimisation (e.g., recycling initiatives that require co-operation with a supplier, cooperation with a supplier to eliminate packaging, efforts with suppliers to reduce waste). Greening supply processes revolve around activities that incorporate environmental criteria in selection and assessment of suppliers (e.g., building environmental criteria into the vendor assessment system, use of a scoring system to rank suppliers on their environmental performance, use of an environmental supplier questionnaire, use of environmental criteria in the selection of strategic suppliers, supplier environmental awards, requiring suppliers to have an environmental management system). Advanced green supply, includes more proactive approaches such as the use of environmental criteria in risk-sharing, evaluation of buyer performance and joint clean technology programs with suppliers.

Forman and Jorgensen (2004) conducted a case-study analysis in the Danish textile sector. They proposed a typology of three environmental supply-chain practices. First is the wake strategy: a reactive strategy that does not set requirements on suppliers, but instead, buyers follow in the ‘wake’ of other companies that have already put in place these
requirements. Second is the **asymmetrical partnership**, which is a more proactive practice, based on the long-term relationships between buyers and suppliers. The balance of power is significantly in favour of buyers and they control suppliers for their compliance through a set of requirements. Third is the **symmetrical partnership**, which is characterized by long-term relationships between buyers and suppliers that is based on joint work and mutual partnership.

Rao and Holt (2005) propose three main green supply chain practices: inbound logistic, production or the internal supply chain, and outbound logistics. The inbound function refers to green purchasing strategies adopted by organisations in response to the increasing global concerns of environmental sustainability. The production function is concerned with the internal organisational activities in relation to the environment such as leaner production, design for environment, remanufacturing and lean production. The outbound function refers to all activities after production, such as green marketing, environment-friendly packaging, environment-friendly distribution, and reverse logistics.

Hamner (2006) proposes a typology that takes into account the buyer effort in relation to impact on supplier behaviour. The 11 practices recognised in this paper, begin with lowest effort and lowest impact on the buyer and move to highest effort and highest impact. These practices include: product content requirements; product content requirements; product content labelling or disclosure; supplier questionnaires; supplier environmental management systems; supplier compliance auditing; supplier environmental management system auditing; buyers set their own compliance standards; product stewardship; education and cooperation; industrial ecology.

Zhu et al. (2008) advanced five practices: namely, internal environmental management (IEM), green purchasing (GP), cooperation with customers on environmental initiatives (CC), eco-design (ECO) and investment recovery (IR). The authors presented measurement scale of 21 items for assessing the different aspects of these five main factors. Hsu and Hu (2008) studied the Taiwanese electronic industry and identified four major green supply chain practices: namely, supplier management, product recycling, organisation involvement, and life cycle management.

A shortfall with most classifications described above is the lack of a theoretical underpinning for conceptualising green supply chain practices. Consequently, this thesis refines and applies the framework recommended by Vachon and Klassen (2006), which has a theoretical foundation adopted from strategic management. Their conceptual framework,
while simple, makes a clear distinction between two sets of green supply chain practices. In the first group are practices that require minimal involvement of supply chain partners. These practices—called “compliance-oriented practices” in this study—are often imposed by buyers on suppliers to meet sets of environmental criteria, requirements or standards (Vachon and Klassen, 2006; Gavronski et al., 2011). Suppliers are then monitored for their compliance. Where they are non-compliant, corrective action may be required or the buyer may terminate the contract with the supplier, depending on the severity of the violation.

The second group of green supply chain practices, labelled “cooperative-oriented practices”, goes beyond compliance. They focus on cooperative activities between buyers and suppliers (Vachon and Klassen, 2006; De Marchi, 2010a). Their main advantage is that buyers help suppliers build up their capabilities sufficiently for them to self-manage their own environmental issues. This approach takes into account continuous improvement as a core philosophy (Ciliberti et al., 2008).

2. 4. 3. 1. Green compliance-oriented practices

To define and conceptualise green supply chain practices, Vachon and Klassen (2006) adopted—in the absence of a clear framework for green supply chain practices—the internalisation/externalisation framework from strategic management literature. Externalisation occurs when firms decide to employ a market-based mechanism for their activities, whereas internalisation incorporates those activities that are within the existing business hierarchy.

Corresponding to the externalisation aspect of the framework, Vachon and Klassen (2006) propose, in relation to the environmental issues in supply chains, the adoption of practices oriented towards compliance and monitoring. To control and monitor the environmental activities of their suppliers, buyers exercise either a market-based mechanism or an arm’s length approach (Min and Galle, 2001). Often these practices do not require buyers to commit substantial resources to environmental initiatives outside their operations (Vachon and Klassen, 2008; Gavronski et al., 2011).

Compliance-oriented practices can be classified into two sets of activities. The first set concerns selecting suppliers (Choi and Hartley, 1996; Bala et al., 2008). Supplier selection includes those practices that buyers impose to ensure they source from environmentally friendly suppliers (Rao and Holt, 2005). For example, buyers may include (Noci, 1997) environmental considerations that are stated specifically in the selection criteria for tenders and contracts. Purchasing criteria may cover the management of hazardous air emissions,
water and wastewater, solid waste, and energy efficiency, or, they may cover environmentally-friendly packaging of products. Suppliers may be required to comply with environmental regulations (e.g., labelling of hazardous material and industry environmental standards) or acquire an environmental management system (e.g., ISO14001). Buyers may demand disclosure of environmental attributes through product labelling and the restriction in usage of environmentally undesirable substances, or, they may ask suppliers to commit to waste reduction goals (Bowen et al., 2001; Rao and Holt, 2005; Delmas and Montiel, 2009). The extent to which these practices are exercised depends on the structure of a firm and the size and importance of purchasing function, as well as the geographic location of suppliers (Zsidisin and Siferd, 2001; Rao and Holt, 2005). Large buyer firms can often influence the environmental activities of their suppliers through their purchasing power (Green, Ken et al., 1998; Günther and Scheibe, 2006). Buyers may be more concerned about their distant suppliers located in developing countries and therefore use their purchasing power to ask these suppliers to accredit to environmental management systems (Rao and Holt, 2005). Recently, researchers have begun proposing decision models that incorporate environmental criteria in supplier selection (Handfield et al., 2002; Giannis T. Tsoulfas, 2008; Kannan et al., 2009; Gnoni et al., 2011).

The second set of compliance-oriented practices concerns ongoing assessment of suppliers (Delmas and Montiel, 2009) and the monitoring of environmental performance of the contracted suppliers (Carr and Pearson, 1999). The purpose is to gain knowledge of their strengths and weaknesses (Gavronski et al., 2011). Buyers, by themselves or through a third-party organisation, audit suppliers for their compliance with a set of environmental criteria stated in the standard or developed by the buyer firm (Humphreys et al., 2003; Zhu and Sarkis, 2004). In their site visits, auditors examine the documents and procedures, and interview the supplier's employee to assess the overall the compliance of the supplier firm with the specified requirements stated in the standard or developed by the buyer firm. Audits and monitoring practices ensure that suppliers constantly check and improve their environmental performance (Gavronski et al., 2011). The second set include activities such as requesting suppliers to fill out environmental questionnaires, on-site periodic evaluations by either an internal team or a third-party (Hines, 2001; Zsidisin and Siferd, 2001), mandatory reporting by suppliers of the results of environmental audits, and public disclosure of environmental records (Noci, 2000). Supplier questionnaires have become common since quality management systems such as ISO 9001 have become customary. However, they have been predominantly used to assess conventional performance
measures (e.g., quality and delivery). When firms aim to evaluate their suppliers on their environmental activities, these questionnaires may be supplemented by an environmental section that asks questions concerning, for instance, the supplier firm having a certified environmental management system and whether they engage in activities for reducing environmental impact (Noci, 1997).

Monitoring demands may extend along the supply chain, with second-tier suppliers evaluating the environmental performance of their own suppliers (De Marchi, 2010a). It has to be noted that buyers may not necessarily enforce compliance and monitoring-oriented practices on all suppliers to the same degree. The extent of investigation of a supplier depends on its criticality to the buyer. Having an environmental management system such as ISO 14001 seems to satisfy many buyers, though they often audit their strategic and critical suppliers and may simply send questionnaire to the majority of non-critical suppliers (Kovács, 2008).

Compliance-oriented practices have a positive relationship with the ability of suppliers to adopt and develop environmental innovations (Klassen and Vachon, 2003). Green et al. (1998) argue that the pressure exerted along the supply chains will eventually influence R&D departments within firms, thereby translating supply-chain practices into environmental improvements to products and processes. Lee and Kim (2011) observed a strong relationship between compliance-oriented practices and environmental product innovations in Korean semiconductor companies.

2.4.3.2 Green cooperative-oriented practices

Cooperative-oriented practices correspond to the internalisation aspect of the internalisation/externalisation framework (Vachon and Klassen, 2006). Going beyond compliance, these practices focus on cooperative activities between buyers and suppliers (Sinding, 2000; Sharfman et al., 2009). Joint efforts by buyers and suppliers in devising and developing environmental solutions characterise them (Simpson, DF and Power, 2005; Vachon, 2007). In contrast to compliance practices, these practices are long-term investments in which firms are involved directly in devoting particular resources towards addressing environmental issues across the supply chain (Hines, 2001). Therefore, it often takes a longer time for both buyers and suppliers to reap the benefits (Bowen et al., 2001). Drawing on a resource-based view for cooperative-oriented practices, Gold et al. (2010) highlights the importance of inter-firm resources and capabilities that arise from cooperation between supply chain partners. Being “socially complex, causally ambiguous
and historically grown”, they are not readily imitated, which may be competitively advantageous.

Cooperative practices include activities such as providing design specification to suppliers (Handfield et al., 2005), which include environmental requirements, working with product designers to reduce and eliminate product environmental impacts, conducting joint planning to anticipate and resolve environmental-related problems, helping suppliers to obtain an environmental management certificate (e.g., ISO14001), establishing terms and agreements for the environmental partnership, providing environmental training or workshops for suppliers (e.g., awareness training or skill-based training), sharing environmental information, and providing technical assistance (Hines, 2001; Zsidisin and Siferd, 2001; Klassen and Vachon, 2003).

The findings of some empirical studies reveal a positive link between supply chain cooperation and adoption of environmental innovations (Remmen and Holgaard, 2004; Vachon, 2007; De Marchi, 2010a). The extent of changes introduced through cooperation with supply chain partners is often fundamental and systemic (Noci, 1997; Vachon, 2007). From an analysis of three case studies of US assembly plants, Geffen and Rothenberg (2000) argue that cooperation with suppliers—supported by appropriate incentive systems—help the adoption and development of innovative environmental technologies whilst sustaining production quality and cost. They note that a closer relationship enables suppliers to gain knowledge about the production processes of customers and as a result, they find solutions that better serve customer needs (Lamming and Hampson, 1996; Hines, 2001). Trust created through such partnership engenders suppliers to express their innovative ideas (Sharfman et al., 2009; Gold et al., 2010) and to engage in green supply chain activities (Hoejmose et al., 2012). Trust is a valuable inter-organisational resource that facilitates commitment and a common vision of participants. It is particularly important for environmentally innovative initiatives that are less certain and more difficult to manage (Gold et al., 2010).

By comparing two automobile plants, the study by Geffen and Rothenberg (2000) further shows the importance of cooperative practices and engaging suppliers in early stages of development. Both manufacturers used similar technology (waterborne paint) to reduce environmental emissions. In one case, the strong relationship with the suppliers led to intended targets. The other application failed, as the manufacturer neither sought the expertise of its supply-chain partners nor encouraged them to take the initiative in adapting
to changes in the painting process. Increased emissions and frustrations in successfully implementing the new technology were the consequence.

The findings of a survey of 124 companies in Taiwan showed that engaging with suppliers on environmental issues leads to environmental product, process and managerial innovations, which in turn enhances competitive advantage. The authors contend that buyers’ direct involvement in guiding and helping suppliers to improve their environmental performance is a win-win situation that benefits both parties (Chiou et al., 2011). Similar results were found in another research, in which it was found that greening suppliers enhances internal environmental performance of high profile firms, leading to increased competitive advantage and economic performance (Rao, 2002). In a survey of Canadian and United States package printing industry, Vachon (2007) examined the relationship between GSCPs and environmental innovations and found that cooperative practices lead to the introduction of pollution prevention technologies, although the effects of joint environmental planning and cooperation with major suppliers were stronger than with customers.

De Marchi (2010a) studied two furniture manufacturers (IKEA and Valcucine) and their suppliers in Italy. The two firms found to be leader in introducing environmental innovations to the market and an effective strategy to overcome the complexity aspect of environmental innovations was cooperation with suppliers. Given that environmental innovations require not only improved features of the products, but also improved environmental performance, suppliers’ knowledge and competence helped them to meet the demands of the Italian kitchen SMEs. It was observed that these two firms only cooperate with their strategic suppliers—those who contribute to advancing the competitive advantage of these firms. The form and intensity of cooperation varied between IKEA and Valcucine. IKEA gave the design specification to its suppliers and expected them to manufacture accordingly, whereas Valcucine was more engaged with its suppliers right from the beginning of product development.

Compliance-oriented and cooperative-oriented practices can be implemented concurrently, as they are not mutually exclusive (Vachon and Klassen, 2006). Nevertheless, firms may reduce the transaction costs associated with compliance and monitoring practices by building stronger relationships with their supply chain partners. Once a reasonable degree of trust is created, the act of monitoring suppliers may no longer be necessary (Zsidisin and Siferd, 2001).
2. 5. Motivations and barriers to develop environmental innovations and invest in GSCM

Questions raised by researchers concerned with organisations and the natural environment are: What trigger firms to address environmental concerns? What hinders them from doing so? With the recent increase in interest in the environmental behaviour of supply chain actors, these questions have become the subject of investigation in green supply chains. To obtain a better insight of the motivators and barriers in adopting environmental initiatives, a review of environmental management literature in general (Bansal and Roth, 2000) and environmental innovation and green supply chain management literature (Bowen et al., 2001; Diabat and Govindan, 2011) in particular is conducted. The review, however, shows an almost consistent set of factors across these three streams of environmental management literature.

2. 5. 1. Motivations

Various motivations were found in the literature. Those that have received more attention from researchers can be selected and grouped under three categories: (a) Economic motivations; (b) Institutional pressure; (c) Ethical values. These are reviewed in this section (See Table 2.4 on page 40). These motivations are not independent; being related, it is rare to find firms undertaking environmental initiatives solely based on one motivation (Hines, 2001).

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2 - Environmental initiative is used here referring to all activities of firms to address environmental challenges (e.g., implementing green supply chain practices and developing environmental innovations) (Preuss, 2005).
<table>
<thead>
<tr>
<th>Motivation</th>
<th>Type</th>
<th>Reference</th>
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<tbody>
<tr>
<td>Economic</td>
<td>Reduction of costs and increase in earnings</td>
<td>(Porter and van der Linde, 1995; Green, Ken et al., 1996; Carter and Dresner, 2001; Hines, 2001; Trowbridge, 2001; Masurel, 2007; Carter and Rogers, 2008; Tate et al., 2011)</td>
</tr>
<tr>
<td></td>
<td>The opportunity to increase the gap with competitors and become the market leader</td>
<td>(Porter and van der Linde, 1995; Sharma and Vredenburg, 1998; Rao and Holt, 2005; Vachon and Klassen, 2006; Walker et al., 2008)</td>
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<td></td>
<td>Compliance with environmental regulations</td>
<td>(Green, Ken et al., 1996; Henriques and Sadorsky, 1996; Bowen et al., 2001; Hall, 2001; Min and Galle, 2001; Zhu et al., 2005; Masurel, 2007; Cheng-Wen, 2008; Seuring and Müller, 2008; Walker et al., 2008; Belin et al., 2009; Holt and Ghobadian, 2009; Diabat and Govindan, 2011; Tate et al., 2011)</td>
</tr>
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<td></td>
<td>Pressure by customers/consumers</td>
<td>(Henriques and Sadorsky, 1996; Carter and Dresner, 2001; Hall, 2001; Hines, 2001; Zhu et al., 2005; Bonini et al., 2008; Seuring and Müller, 2008; Walker et al., 2008; Delmas and Montiel, 2009)</td>
</tr>
<tr>
<td></td>
<td>Pressure from non-economic stakeholders (e.g., NGOs, media, and competitors)</td>
<td>(Noci, 1997; Sharma and Vredenburg, 1998; Hall, 2001; Delmas and Toffel, 2004; Walker et al., 2008; Testa and Iraldo, 2010)</td>
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<tr>
<td>Ethical values</td>
<td>Doing what is right for the environment and the whole society</td>
<td>(Bansal and Roth, 2000; González-Benito and González-Benito, 2005; Hendry and Vesilind, 2005; Marshall et al., 2005; Sharifman et al., 2009; Ditlev-Simonsen and Midttun, 2011; Gavronski et al., 2011; Leenders and Chandra, 2012; Zhu et al., 2012)</td>
</tr>
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</table>
2.5.1.1. Economic motivations

Most studies that have examined the motivations of firms in adopting environmental initiatives have found the economic motivations to be at high-priority (Green, Kenneth et al., 1994; Bansal and Roth, 2000; Marshall et al., 2005; Zhu et al., 2005; Belin et al., 2009; Ahmed and Kamruzzaman, 2010; Babiak and Trendafilova, 2011). Economic motivations stem from the desire of firms to maximise their profits, which depends highly on the ability of firms to improve their productivity (Zhu and Sarkis, 2004). Productivity could be achieved either by entering into new markets and offering valuable and innovative products that warrant a premium price or by reducing the costs and offering lower price products than competitors. (Porter and van der Linde, 1995; Bansal and Roth, 2000).

Porter and van der Linde (1995) argue that through more efficient usage of resources, firms would be able to reduce the costs and create competitive advantage (Bansal and Roth, 2000; Carter and Rogers, 2008). Potential economic advantages include:

1. Products of better-quality
2. Products with safer features
3. Products that have higher resale or scrap value
4. Products that have lower costs of disposal by users
5. Products with lower costs due to the elimination of costly material (Hines, 2001)
6. Removal of packaging waste (Hart, 1995; Carter and Rogers, 2008)
7. Products with a simpler design
8. Greater resource productivity such as increased process yields
9. Reduced stoppage (maybe from more careful monitoring and maintenance) (Trowbridge, 2001)
10. Reduced labour costs
12. Shorter lead times
13. Materials savings due to substitution, reuse or recycling of production inputs

15. Lower energy consumption during the production process

(Porter and van der Linde, 1995; Belin et al., 2009)

16. Reduced material storage and handling costs

17. Conversion of waste into valuable forms

(Shrivastava, 1995)

18. Reduced fines for environmental incidents (Zhu and Sarkis, 2004)

19. Safer workplace conditions (Hines, 2001; Masurel, 2007)

Findings from some empirical research provide further insights. Bansal and Roth (2000), for example, found that firms motivated by cost-saving opportunities (what they call competitiveness), are more interested in environmental practices that secure the highest return irrespective of the environmental outcome. Their finding shows that firms motivated by economic reasons, often realise environmental benefits after the decision to implement an idea is made. Carter and Dresner (2001) observed that cost-saving is the main motivation for both successful and unsuccessful environmental initiatives. However, they noticed that firms that experience a successful implementation of environmental projects consider cost from a broad life-cycle perspective compared to unsuccessful projects that are initiated with a narrow and short-term perspective. Álvarez Gil et al. (2001) found a positive relationship between adopting green practices and short-term financial performance. Walker et al. (2008) observed that attaining competitive advantage was a major motivator for some participants in their study, who had implemented green supply-chain management. The competitive advantage came from a better corporate profile that could increase the sales, or, faster access to environmental information of suppliers for tenders. Tate et al. (2011) explained the adoption of environmental initiatives by suppliers through transaction cost and institutional theories. According to transaction cost theory, if suppliers can minimize their information seeking, bargaining and enforcement costs, there is a higher possibility that they adopt environmental practices.

Cost-saving opportunities are like double edge swords. While cost-savings may be a major driver for adopting environmental practices, they may also become an obstacle. When adopting green practices requires fewer changes to the current processes, procedures
or products of a firm, it is more likely to induce firms to invest. (Testa and Iraldo, 2010). Business owners tend, for example, to compare the costs of a new clean technology (fixed plus variable costs) to the cost of running an existing technology (variable cost). Nevertheless, there is a tendency to remain with the old technologies, because the initial costs have already been amortised (Carrillo-Hermosilla et al., 2009).

2.5.1.2. Institutional pressure

The environmental activities of a firm are likely to be driven by external pressures too. Walker et al. (2008) found that external pressures are even more influential than internal motives. Institutional theory has been widely used to explain this type of motivation (Delmas and Toffel, 2004; Ervin et al., 2012; Zhu et al., 2013). Institutional theory posits three forms of isomorphic drivers for organisational change: coercive, normative, and mimetic (DiMaggio and Powell, 1983). These three isomorphic drivers create a common set of values, norms and rules to produce similar practices and structures (Tate et al., 2011). Delmas and Toffel (2004) note that firms adopt different strategies in response to institutional pressures. Some may choose to comply with existing regulations and industrial practices and others go beyond compliance and adopt environmentally innovative practice to obtain competitive advantage and to look legitimate (Ashforth and Gibbs, 1990; Oliver, 1991; Dacin et al., 2007). The term “legitimation” is defined as “a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed systems of norms, values, beliefs and definitions” (Suchman, 1995, p.574). Given that environmental concerns are becoming an integral part of legitimised organisations, being able to response to green demands of external stakeholders is considered a step forward towards legitimisation. This suggests that organisations will adopt green practices to enhance their legitimacy. Legitimate organisations are more persistent, predictable, meaningful and trustworthy as Suchman (1995) describes. Legitimacy is an invaluable resource that aids stakeholders’ support and continuation of a business (Ashforth and Gibbs, 1990). If firms do not operate within the limits of what a society may consider suitable, then their ability to carry on operating may be affected undesirably. Governments may penalise firms for their environmental breaches. Consumers may decide not to purchase the products of non-compliant businesses. Interest groups may run campaigns. Business customers may avoid purchasing their products (Zhu et al., 2013). In the following paragraphs the relevance of the three main stakeholders, including government, consumers and non-economic stakeholders, in driving environmental activities of firms are discussed.
Compliance with environmental regulation

Government agencies are found to be a major source of coercive pressure. Through threats, legal sanctions, or pressure to conform, governments can induce firms to follow certain behaviour (Oliver, 1991; Delmas and Toffel, 2004). With increased concerns over the environmental issues, coercive pressure by governments has increased: thus, it has become a key driver of environmental initiatives (Green, Ken et al., 1996; Zhu et al., 2005; Masurel, 2007; Cheng-Wen, 2008; Belin et al., 2009; Tate et al., 2011). Governmental pressure is likely to be stronger for larger organisations, as they are constantly monitored by government agencies on their conformance with environmental metrics (Min and Galle, 2001).

Cooperation between product designers and suppliers, in reducing and eliminating environmental impacts of products, was found to be influenced by environmental regulations by government (Diabat and Govindan, 2011). In a survey of 527 USA firms, State and Federal regulations were found to be positively related to the implementation of green supply chain practices (Min and Galle, 2001). Likewise, based on data collected through a survey of 149 firms in the UK, Holt and Ghobadian (2009) reported that legislation is perceived to be the most influential motivator of environmental activities of firms.

Some empirical evidence suggests that inducement for environmental adaptation extends beyond current environmental regulation to the threat of future regulation (Hill, 1997; Bowen et al., 2001; Kivimaa, 2007). An OECD survey conducted with more than 4,200 companies in seven industrialized countries showed a positive and significant relationship between the perceived severity of environmental regulations and environmental innovation (Lanoie, 2011). In “the state of environmentally preferable or green purchasing in Australia” report published in 2009 (Netbalance Foundation, 2009), it was found that the “threat of regulation” is a major driver of decisions to adopt green purchasing practices. This report shows the participants were concerned about Carbon Pollution Reduction Scheme (CPRS)\(^3\) and, also, broader carbon reduction commitments made by the Australian Government. Khanna and Anton (2002) found that the threats of liabilities, as well as the extent of industry regulation, have a significant positive relationship

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\(^3\)- The Carbon Pollution Reduction Scheme Bill 2009 legislation was first introduced to the Australian Parliament in early May 2009. The Senate voted against the CPRS legislation in August 2009 and again in December 2009, after it had been reintroduced in Oct. 2009
with the ability of firms to improve their environmental performance. Such concerns arise from the high cost of non-compliance and subsequent negative publicity (Min and Galle, 2001).

There is, however, evidence that government has not been able to drive environmental initiatives (Zhu and Geng, 2010). Some scholars even criticise government intervention (Palmer, 1995; Hilliard, 2004; Mohr and Saha, 2008). Palmer et al. (1995) argue that the coercive pressure exerted by government makes firms less competitive due to the cost burden. Some feasible explanations for these contradictions are provided by the advocates of environmental regulations (Porter and van der Linde, 1995; Rennings, 2000). For instance, in the case of environmental initiatives, such as environmental innovations, advocates point to the double-externality problem of environmental innovations, which makes their adoption and diffusion less probable than conventional innovations. Thus, this group deems that governmental involvement is essential for driving environmental innovation (Horbach, 2008). Porter and van der Linde (1995) argue that while intervention by government is necessary, it is the form of environmental regulation that creates this controversy. They contend that the conventional form of environmental regulation that focuses on command-and-control mechanisms induces firms to adopt reactive strategies, which may not necessarily result in lower costs and better environmental performance. They support more proactive environmental policies that encourage innovation and focus on outcomes.

Porter and van der Linde (1995) argue that many firms lack the sufficient experience to deal creatively with environmental issues. Therefore, proactive environmental policies could steer their innovation in a direction in which they can find solutions that compensate for the cost of compliance, while they become sources of competitive advantage. The critics, however, argue that in practice there may not be many environmental innovations that compensate for the cost of compliance, although they may sound possible in theory. Porter and van der Linde strongly disagree with this notion by arguing that all negative environmental impacts of firms—in the form of pollution, material waste, energy loss, and defective products—indicate inefficient utilisation of resources, which may be due to flaws in design or production processes. Thus, those who resist investing in environmental initiatives, overestimate the hidden costs they are paying for the resource inefficiency. Furthermore, Porter and van der Linde claim that estimates of high cost of compliance are unrealistic producing a gap between the actual cost and the predicted cost. They argue that these costs tend to be biased and generally exaggerated, because they are self-reported by
industries who oppose such governmental policies. Furthermore, such reports assume only the status quo, because they overlook the benefits produced from environmental initiatives. Another aspect to consider is the time between the introduction of stricter policies and the innovation outcome. Ambec et al. (2011) argue that critics, often overlooking this period, measure the effectiveness of environmental regulations immediately after implementation.

**Customer/Consumer pressure**

Pressure from customers and consumers is another form of institutional pressure that motivates firms to adopt and implement environmental initiatives (Hall, 2001; Testa and Iraldo, 2010). Greater public demand for environmentally-friendly products could strongly motivate firms to adopt green practices. Firms are very sensitive to the way consumers perceive them, because of the effect on economic performance (Henriques and Sadorsky, 1996). Influence may be direct or indirect. Consumers may act directly by not buying products from firms that they perceive as damaging. Or, they may act indirectly through environmental interest groups or exhorting governmental agencies to act (Etzion, 2007). Consequently, many firms adopt environmental initiatives that enhance their public image. An improved image not only safeguards them from criticism by consumers, but it may also become a source of competitive advantage (Seuring and Müller, 2008). When consumer awareness of environmental issues is high, firms can take advantage of it. They can differentiate themselves by offering environmentally sounder products and gain more market share (Walker et al., 2008; Delmas and Montiel, 2009).

The extent and form of consumer pressure is related directly to a firm’s position in the supply chain. Khanna and Anton (2002), in relating market pressure stated that “Firms that produce the final goods and are in closer contact with consumers are likely to feel” such pressure (Khanna and Anton, 2002; Carrillo-Hermosilla et al., 2009). Moving through the supply chain to producers of intermediate products, and then to suppliers of raw materials, the consumer pressure may decline, although business customers (buyers) are becoming more careful about the environmental activities of their suppliers. Suppliers with poor environmental performance may lose reputation among buyers. With regards to the form of customer demands, Carter and Dresner (2001) found a positive link between unreasonable customer demands and unsuccessful environmental initiatives. Conversely, customer requests that had a long-term perspective were associated with successful projects.
Empirical evidence supports the importance of influence from customers and consumers. In an empirical study of Canadian firms, respondents marked customer pressure second to government regulations (Henriques and Sadorsky, 1996). Serving key customers was found to be a major motive for firms attempting to implement pollution prevention programs (Florida, 1996). Khanna and Anton (2002) found that firms that encountered more consumer pressures adopted more comprehensive environmental management systems. In a survey of consumers in various countries—including USA, Germany, France, Brazil, Canada, China, India, and UK—eighty-seven per cent of consumers raised concerns about the environmental and social impact of the products they purchase (Bonini et al., 2008).

**Pressure by non-economic stakeholders**

A survey of seven OECD countries—including Canada, France, Germany, Hungary, Japan, Norway and the United States—found that imitating industry partners and competitors induced firms to implement green supply chain practices. Those who follow other firms, decide to adopt innovative practices after they are tested and their effectiveness is confirmed by the early adopters (Testa and Iraldo, 2010).

Environmental advocacy groups put pressure on firms to green their activities and encourage their suppliers in doing so. They try to bring the environmental inefficiencies of firms to the attention of the public, something that may be hidden from regulators or consumers (Cheung, 2007). Nevertheless, the influence of environmental advocacy groups may be limited due to their resource and technical capability shortage and their dependence on donors and members, which means that they have to initiate campaigns that reflect what their donors consider relevant or topical. Campaign targets are therefore not necessarily the most important environmental issues. A lack of technical resources also limits environmental advocacy groups on what should be addressed. Technically complex, obscure and/or low-profile industries may not receive much attention, even though their environmental impacts may be greater than higher-profile firms or provocative issues (Hall, 2001).
2.5.1.3. Ethical values

Ethical values may contribute to the willingness of firms to adopt or develop environmental initiatives (Bansal and Roth, 2000; González-Benito and González-Benito, 2005; Marshall et al., 2005; Ditlev-Simonsen and Midttun, 2011). A unique characteristic that distinguishes this motivation from previous ones is the superiority of ecological and social values over the financial measures (González-Benito and González-Benito, 2005). A close examination of other motivations indicates that even when firms comply with regulation or attempt to satisfy their stakeholders, their decisions are dominated by financial gains. If they breach a law, they will be penalised (lose money); if they transcend customer expectation, they will receive more projects (earn more money). That is, the benefits to the environment are simply a by-product of economically-oriented decisions. On the contrary, the financial benefits of some environmental initiatives may be either none or low. However, some firms may still act on them, because they consider protecting the planet—thereby making it a better place for the future generations—as part of their business responsibility (Bansal and Roth, 2000).

Hendry and Vesilind (2005) explain the making of decisions based on moral values (right thing to do) through a normative model. They claim that most corporate decisions are driven by financial and legal concerns, which may not necessarily be intended to protect the environment. On the contrary, the decision frame of ethical organisations is guided by the “triple bottom line”, in which they attempt to balance the financial, social, and environmental impacts of their activities. Drawing on the work of developmental constructivists, they present their normative view, using the characteristics of moral actions at an individual level, to explain the corporate moral decision making process.

Moral development entails four components: being morally aware, making moral judgment, prioritising moral values, and pursuing moral decisions. The awareness means the actor realises that the act is moral that not only affects the actor, it may have side-effects for others as well. Moral judgement refers to the actor’s judgemental ability to assess options for the best possible outcome, considering how it will affect others. Motivation is deemed essential for an actor to prioritize moral values above other values (e.g., wealth or power). An actor must have a strong character to pursue moral decisions. In stage one and two, an actor is more inclined to strive for pleasure and avoid pain (pre-conventional level). In stage three, the actor considers the effect of her actions on others. In stage four, the actor becomes more considerate about the wider community and reflects on the consequences of her decision on them (conventional level). There is, however, another
stage where people assess their acts based on the universal moral principles, “that is, the principles by which reasonable people would agree should bind the actions of all people who find themselves in similar situations” (post-conventional level) (Hendry and Vesilind, 2005, p.257). Compliance with environmental laws to avoid fines and penalties is similar to avoiding the punishment in the moral development model—pre-conventional level. Making profit to satisfy shareholders, employees, and other business partners matches the conventional level. Integrating moral environmental principles (doing the right thing) into the business practices is similar to the post-conventional level in the moral development model. Hendry and Vesilind argue that this third level is most desirable. Business decision makers should not only consider the effect of their decisions internally (for example on shareholders, business partners, employees, and the like.), but should also look at the bigger picture and think about the broader society and even future generations.

Firms motivated by ethical values are often cited as being influenced by the positive attitude of top management. In other words, firms tend to be more environmentally innovative when managers have positive environmental concerns towards the natural environment and perceive environmental issues as opportunities (Florida, 1996; Bansal and Roth, 2000; González-Benito and González-Benito, 2005; Marshall et al., 2005; Eiadat et al., 2008; Routroy, 2009). By avoiding environmental problems, managers show their competence in managing their organisations. By investing in environmentally friendly initiatives, they demonstrate awareness of public demands (Sharma, 2000; Eiadat et al., 2008). Without top management support, environmental innovation projects may not lead to predicted outcomes, because compared to normal operations or strategic issues, these innovations need a higher degree of managerial attention and commitment.

Although not many, there is empirical evidence in support of ethical value motivation. In their study of 14 US and European companies, Sharfman et al. (2009, p.5) found (what they call) value-driven motivations in all firms they interviewed. One participant in their study puts it this way:

“We needed to put in a capturing and destruction device for the solvents that were being emitted. . . . We talk to the CEO, and we give our mechanical presentation, we give the permitting presentation, and I kind of sum it all up and I sit down. The CEO looks at me and goes, ‘what should we do?’ . . . And I said, ‘Well, two things. One is we probably will need it with the Clean Air Act
in 1995’. But I said, ‘I live down-wind and I think it’s the right thing to do’.
And he said, ‘Okay,’ and signed it that day.” (p.5)

Bansal and Roth (2000) found that genuine concern for the environment, regardless of the financial gain, motivated some firms to engage in some environmental activities, such as producing less profitable green products, helping environmental activists and community groups, using recyclable office work material and recycling the waste. A survey of Spanish firms found that ethical motivations triggered some firms to pursue ISO14001 certification. These firms were on the opinion that their activities lead to competitive advantage (González-Benito and González-Benito, 2005). The findings of a survey distributed among 123 wineries, in USA, Canada, South Africa, Australia and New Zealand, show that in developing environmental innovations, internal motivations (e.g., ethical motivations, economic benefits, the attitude of managers towards environmental initiatives) are more important than external motivations (e.g., regulatory pressures, market competition, consumer demand) (Leenders and Chandra, 2012).
2.5.2. Barriers

Despite the advantages of environmental initiatives, they are not easily adopted or diffused. While some firms may be interested in adopting and developing environmental innovations either on their own or by encouraging their supply chain partners (either by enforcing them or cooperating with them), others take a less proactive approach and show little interest. Many factors contribute to the unwillingness of firms to develop environmental innovations and engage in cooperative environmental activities with their supply chains. A review of the literature on environmental management, environmental innovation and green supply chain management indicates two broad categories of barriers: external and internal (Biondi et al., 2002; Hillary, 2004; Shi et al., 2008; Thun and Müller, 2010; Murillo-Luna et al., 2011)—See Table 2.5 on page 52.

External barriers include: lack of support and enabling policies; low pressure from influential stakeholders. Internal barriers refer to the lack of management commitment and a compliance-oriented culture of the firm, as well as the absence of resources, including capital and human and financial resources. The degree of difficulty of the internal and external barriers, however, is not identical. Some researchers (Murillo-Luna et al., 2011; Muduli et al., 2012; Walker and Jones, 2012) have found internal barriers to be the main issue and others (Dahlmann et al., 2008; Shi et al., 2008; Massoud et al., 2010; Papagiannakis and Lioukas, 2012) have pointed out the external barriers as the main obstacles standing in the way of firms to form a greener economy. The literature on these barriers is reviewed in more detail in the following section.
Table 2.5: Barriers to address environmental challenges

<table>
<thead>
<tr>
<th>Source</th>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>External</td>
<td>Lack of appropriate regulation and enabling policies (Dahllmann et al., 2008; Shi et al., 2008; Massoud et al., 2010; Murillo-Luna et al., 2011; Muduli et al., 2012)</td>
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<td></td>
<td>Low pressure from customers and consumers (Orsato, 2006; Dahllmann et al., 2008; Ageron et al., 2012; Muduli et al., 2012)</td>
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<td></td>
<td>Consumer desire for lower prices (Dearing, 2000; Orsato, 2006)</td>
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<td></td>
<td>Difficulties in sourcing from overseas suppliers (Thun and Müller, 2010; Giunipero et al., 2012; Walker and Jones, 2012)</td>
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<tr>
<td>Internal</td>
<td>Lack of management commitment and poor managerial abilities (Min and Galle, 2001; Biondi et al., 2002; Ervin et al., 2012; Giunipero et al., 2012; Walker and Jones, 2012)</td>
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<td></td>
<td>Tendency to focus on short-term investments (Dearing, 2000; Bowen et al., 2001; Giunipero et al., 2012)</td>
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<td></td>
<td>Lack of an environmentally-oriented culture (Azzone and Noci, 1998; Biondi et al., 2002; Thun and Müller, 2010)</td>
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<td>Resources</td>
<td>Low technological capability (Dearing, 2000; Carrillo-Hermosilla et al., 2009)</td>
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<tr>
<td></td>
<td>Limited access to information regarding environmental issues (Tilley, 1999; Biondi et al., 2002; Côté et al., 2008; Young, 2010; Ageron et al., 2012; Walker and Jones, 2012)</td>
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<tr>
<td>Human</td>
<td>Lack of in-house technical skills and appropriate expertise (Tilley, 1999; Biondi et al., 2002; Condon, 2004; Hillary, 2004; Zhu and Geng, 2010)</td>
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<td>---------------</td>
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<tr>
<td>Financial</td>
<td>Lack of financial resources to adopt environmental initiatives (Tilley, 1999; Biondi et al., 2002; Masurel, 2007; Côté et al., 2008; Shi et al., 2008; Testa and Iraldo, 2010; Young, 2010; Ervin et al., 2012; Giunipero et al., 2012; Walker and Jones, 2012)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The cost of acquiring environmental management systems such as ISO 14001 (Hillary, 2004; Zutshi and Sohal, 2004; Nawrocka et al., 2009)</td>
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</table>
2.5.2.1. External barriers

External barriers refer to the factors outside the boundaries of firms, which are not directly controllable (Murillo-Luna et al., 2011). This mainly includes the lack of pressure exerted by stakeholders such as government, NGOs, customers, suppliers, competitors, and consumers and other social and economic actors (Dahlmann et al., 2008). It also covers government policies that are inconsistent, frequently changing (Muduli et al., 2012), lacking guidance and incentives (Shi et al., 2008; Massoud et al., 2010), very loose (Shi et al., 2008), or not sufficiently persuasive in encouraging firms to take on environmental activities.

Murillo-Luna et al. (2011), in conducting a survey, collected data from 250 Spanish firms on the barriers to environmental adaptation. They extracted the following five dimensions that encapsulated external barriers: scarcity of information and lack of clarity on environmental legislation; rigidity of legislation and bureaucratic complexity; limited development of the environmental supply sector; high cost of environmental services/technologies; difficulties derived from competitive pressure.

Massoud et al. (2010), in their study of Lebanese firms, concluded that lack of government support and inadequate environmental regulations are the two uppermost barriers to the adoption of environmental management systems. Likewise, Dahlmann et al. (2008) found lack of clarity in environmental regulations to be the most salient barrier to proactive adoption of environmental practices by UK firms in their study. They surmised that plausible reasons for this claim could be attributable to complaints by survey participants, especially from small firms, concerning the time and effort required by firms to manage environmental impacts mandated by environmental legislation. Some firms also asserted that in some situations, government requirements even impedes environmental improvements, or sometimes, environmental legislation conflicts with other regulatory requirements, such as those concerning health and safety in the food industry (Massoud et al., 2010).

Lack of consumer interest in purchasing environmentally friendly products can also be a major external impediment (Dahlmann et al., 2008). Despite initial interest by many consumers in purchasing environmentally friendly products, generally, they are not willing to pay a premium price for them (Dearing, 2000; Orsato, 2006). Dahlmann et al. (2008) reported low consumer demand as a main barrier in their study. A majority of participants mentioned that there was little or no influence from their environmental activities in
decisions made by purchasers. Instead, price and quality were the main determinants. The authors suggest that this may be attributed to the perception of consumers that reducing environmental impact may affect maintaining high product quality. Based on data collected from 178 French companies, Ageron et al. (2012) deduced that few companies perceive that environmental improvements create value for consumers and enhance their performance.

For some large buyer-organisations that source their supplies from overseas, difficulty arises in implementing green supply chain practices, because of differences in environmental regulations across countries (Thun and Müller, 2010). Supplying materials and components from a country with loose environmental regulations may require tighter examination than from a country having strict environmental laws and standards (Giunipero et al., 2012). Furthermore, language and cultural barriers can inhibit an effective communication with overseas suppliers (Walker and Jones, 2012).

2.5.2.2. Internal barriers

Internal barriers refer to factors within the boundaries of a firm that the firm has control over them (Murillo-Luna et al., 2011). The lack of management commitment and the absence of resources have been cited as repeated obstacles to the uptake of environmental initiatives. It is noteworthy that small size firms, more than large firms, have been found to struggle with these types of impediments (Min and Galle, 2001; Walker and Jones, 2012).

Management and culture

Committed top management and company values, Bansal and Roth (2000) claim as “instrumental in encouraging firms to evaluate their role in the society” (Bansal and Roth, 2000; Papagiannakis and Lioukas, 2012). Managers provide strategic direction for their firms. Their interpretation of environmental challenges can affect their decision to invest further in environmental initiatives. If they perceive the environmental concerns as opportunities they may encourage their employees and provide support for further research and development of green practices (Sharma, 2000; Ervin et al., 2012). However, if they show little or no interest in improving the environmental performance of the firm and its supply chains, it will be unlikely to perceive any success (Giunipero et al., 2012; Walker and Jones, 2012). In the absence of positive attitudes towards the environment, managers tend to shift their resources towards activities that only and directly contribute to their profit margin such as process or product innovation, marketing or customer satisfaction.
(Condon, 2004). Hoejmose et al. (2012) found that in greening supply chains, support from top management is more important for business to business (B2B) markets than for business to consumer (B2C) markets.

An issue with a majority of managers, who are uninterested in environmental practices, is their focus on short-term goals (Dearing, 2000) that are often directed towards one to five year returns of investment. Consequently, they don’t seek a business case for environmental initiatives that pay off in a longer term (Bowen et al., 2001; Giunipero et al., 2012). Another reason that managers become reluctant concerns fundamental changes (e.g., technological innovations) that are not compatible with existing systems. Muduli et al. (2012) found that the lack of managers’ knowledge of environmental issues inhibits their realisation of many cost-saving opportunities, such as advanced technological development, recycling, reuse, and energy efficiency programmes. Massoud et al. (2010) note that insufficient knowledge by managers causes scepticism about the benefits derived from environmental initiatives.

The lack of an environmentally-oriented culture constitutes another major internal barrier (Azzone and Noci, 1998; Thun and Müller, 2010). A conflict may arise between “safeguarders” and “reformist” upon the introduction of environmental changes. Environmental initiatives may confront employees’ ignorance or inadequate appreciation of necessary acts to achieve successful outcomes (Thun and Müller, 2010). Azzone and Noci (1998), Thun and Muller (2010), and Muduli et al. (2012) contend that top management support and encouragement for learning could change such culture. Biondi et al. (2002) claim that the cultural lag within European firms is mainly derived from a command-and-control approach in environmental regulations (the external factors). These types of regulations put little or no pressure on firms to go beyond legal compliance and therefore create a reactive attitude within firms and along their supply chains.

**Resources**

A frequently cited constraint in the literature is the lack of resources—including human, capital and financial resources—required for developing environmental innovations. In regards to human resources and skills, technical environmental initiatives depend upon highly skilled employees (Carrillo-Hermosilla et al., 2009). This, in particular, has been found to be a serious issue for small and medium sized enterprises (SMEs) (Tilley, 1999; Condon, 2004; Hillary, 2004; Young, 2010). Small size firms face difficulty in assigning staff to environmental issues. Even if they are willing to adopt green practices, they may have to
recruit new employees or retrain current staff, which may be a considerable burden for many SMEs (Condon, 2004).

Lack of capital and information is found to be a major issue for many firms and, especially, for small firms (Collins et al., 2007; Ageron et al., 2012). SMEs suffer from their lack of awareness and knowledge of environmental issues (Lee, K-H, 2009). Evidence has also shown that insufficient information on the real costs and potential benefits of environmental initiatives is a key obstacle (Condon, 2004). This is mainly because SMEs do not operate within the main flows of information on environmental issues (Biondi et al., 2002).

Cost of environmental initiatives and the financial resources required is cited as a recurrent obstacle in the literature (Condon, 2004; Masurel, 2007; Carrillo-Hermosilla et al., 2009; Giunipero et al., 2012; Walker and Jones, 2012). Ageron et al. (2012) note that managers are concerned about the amount they have to invest and the return of investment (ROI). Some scholars argue that addressing environmental challenges are costly and add to the expenses of firms. Management consultants, Walley and Whitehead (1994) contend that paybacks expected from environmental innovations are unrealistic (Walley and Whitehead, 1994). According to Porter and van der Linde (1995), and also other scholars cited by Carter and Rodgers (Carter and Rodgers, 2008), commentaries that focus too much on short-term benefits are myopic, as they ignore long-term achievements and viability.

Carrillo-Hermosilla et al. (2009) compared the initial cost of adopting low-emissions technologies with similar technologies and concluded that the relatively higher prices of clean technologies combined with the complexity associated with these technologies hinder their adoption (Shi et al., 2008). Using an example from the textile sector, Biondi et al. (2002) state that SMEs struggle to obtain the best available technologies because of their high costs. They claim that for most industrial sectors, application of clean technologies is still experimental. Most firms are waiting for early adopters to verify benefits of such technologies through field tests. Condon (2004) notes that under the financial difficulty firms may only look for generic solutions with lower costs. For many firms, and, especially, small firms, priority is given to activities that generate revenue. Environmental initiatives receive attention, if they contribute to core functions and meet legal compliance and financial benefit (Biondi et al., 2002; Côté et al., 2008; Young, 2010). Côté et al. (2008) assert that persuasion of managers relies on the use of appropriate language and arguments that address environmental initiatives in terms of core functions and benefits.
To identify barriers of green supply chain implementation, Giunipero et al. (2012) conducted a multi-stage analysis of responses from executives. Their discussions and interviews with forty procurement and supply chain managers indicated that the two major barriers for greening supply chains are the high cost of environmental initiatives for buyers and suppliers and economic recession. The authors contend that, despite the value of environmental and social initiatives, the reality is that firms become motivated if the economic uncertainty of environmental initiatives is reduced. Having found similar results in their study, Testa and Iraldo (2010) argue that adopting GSCPs requires the “catalyst” firm, the firm that leads the GSCM projects, to bear the costs of the buyer-supplier relationship and operational costs for the environmental innovations, which act as a barrier.

Another difficulty, especially for small suppliers, is the cost and effort involved in acquiring environmental management systems such as ISO 14001 (Hillary, 2004). These management systems are increasingly being requested by many buyer organisations (Nawrocka et al., 2009). These costs include things such as new equipment, software, auditors fees, surveillance audit fees, and employees training costs (Zutshi and Sohal, 2004).

While most cited motivation and barriers in the literature were discussed, other attributes of the firm such as the size (Hillary, 2004; Murillo-Luna et al., 2011), position in the supply chain (Khanna and Anton, 2002; González-Benito and González-Benito, 2006; Hoejmose et al., 2012), scope of operation: regional, national, or international (Holt and Ghobadian, 2009), the sector that a firm belongs to (Post and Altma, 1994), and the economic performance of a country (Carrillo-Hermosilla et al., 2009) may also affect the ability of firms to address environmental challenges.

As Lee and Kim (2011) point out, some firms may take a reactive approach in addressing environmental challenges, while others are more proactive. The reactive firms, perceiving environmental demands as a burden, may only attempt to comply with legislation. They are less likely to encourage their supply chains to instigate any environmental activity. On the other hand, proactive firms try to benefit from the environmental gaps, by joining with their supply chain partners to develop environmental innovations.
2. 6. The conceptual framework and research questions

The broad objective of this research is to study and explore how companies deal with the challenge of developing environmental innovations in interaction with external organisations, especially supply chain partners. The review of the literature provided insight and context to the main issues and the areas that require further research. The key issues that guide this research are presented in a conceptual framework (See Figure 2.4) and are explained below. This conceptual framework lays down the boundaries of the research and helps to organise thoughts, make better decision about the choice of methodology, and facilitates the report of findings as well as analysis and interpretation of data (Miles and Huberman, 1994; Yin, 2003; Bloomberg and Volpe, 2008).

![Figure 2.4: The conceptual framework](image)

Developing and adopting environmental innovations has been recognised as a way that companies could deal with the challenge of green movement and becoming more sustainable businesses. There are, however, some characteristics that differentiate between environmental and conventional innovations (See section 2. 2. 1. Understanding the environmental innovation). A lack of understanding of these differences could add to the complexities associated with their adoption and development. As firms begin to invest in environmental innovations, they may go through a step-wise process, whereby they start with the lower level innovations and when they become more mature they approach more radical and systemic changes (See section 2. 2. 2. A typology for environmental...
innovation). Nevertheless, as firms become more involved, they may realise that they do not possess all resources needed to develop more fundamental and systemic improvements. The review of the literature points out that many firms are currently held at this stage. Those firms at the early stages struggle with justifying the feasibility of environmental initiatives and the resources required. Firms with some experience find it hard to undertake more fundamental changes as the risk is high and expected outcome is not assured. These challenges have triggered scholars and practitioner to look for practical solutions. A solution that has been proposed for this complex problem is for firms to interact with external organisations such as government agencies, NGOs, competitors, universities, research centres, and supply chain partners. This provides them with the opportunity to complement the resources they require and share the risks (See section 2.3, The importance of cooperation for environmental innovation). Despite the theoretical benefits of cooperation with external organisations, the empirical evidence is scarce. More studies with empirical data could shed light on the hypothetical relationship between cooperation and environmental innovations. To the best of the researcher’s knowledge and an analysis of the current literature, a study that examines this link has not been conducted for Australian businesses. Therefore, this gap sets the first research question:

Q1: Is there a meaningful relationship between cooperation with external partners and the ability of firms to adopt or develop environmental innovations?

Based on the literature review and to provide direction for data collection, analysis and interpretation of the findings, the following hypothesis is proposed:

**Hypothesis:** Firms that cooperate with their external partners on research and development are more likely to adopt or develop environmental innovations

Knowledge about the sign and magnitude of the relationship between cooperation and environmental innovation is important. Nevertheless, by itself, this relationship is insufficient for ascertaining in-depth knowledge about the complexities involved in interaction with external organisations over environmental solutions. With the objective of determining this deep knowledge within a specified research timeline, the focus of the research was narrowed to a detailed study of the interaction of firms with their supply
chain partners (green supply chain management). Restricting the study to supply chain partners is posited on the growing evidence that their interaction has the greatest impact on the formation of a greener economy. In addition, buyers and suppliers within a chain already have formed contractual relationships that make it easier for them to develop further cooperation for environmental purposes (See section 2.4.1. Green supply chain management for a detailed discussion of the GSCM concept). The greening process usually begins with buyers and then continues to upstream suppliers. Buyers use a set of practices called green supply chain practices (GSCPs) to do this (See section 2.4.2. Green supply chain practices (GSCPs)). There has been some research on identifying and classifying these practices. However, this evidence is limited and regional (for example, Europe and United States). In particular, there is little evidence in current literature on systematic studies of green supply chains in Australia. Those that exist have methodological shortcomings, and, the majority fail to provide detailed information about why many firms are still reluctant to engage with their supply chain partners (See 1.2. Problem statement and research objective for a detailed analysis of some of these studies). These gaps in the literature set the second research question:

Q2: How do firms interact with their supply chain partners on environmental issues?

Q2a: How do buyer organisations select and monitor their suppliers? To what extent are environmental considerations amongst the selection and assessment requirements of suppliers?

Q2b: To what extent firms cooperate with their suppliers for further development and adoption of environmental innovations?

Q2c: What motivates firms to adopt and develop environmental innovations and address environmental concerns along their supply chains?

Q2d: What factors hinder firms to adopt and develop environmental innovations and address environmental concerns along their supply chains?

The discussion of the literature provided a theoretical context in which this study took place. The following chapter outlines the methodology and research design used in the research, including the two sequential phases to answer the two research questions.
3. Chapter Three: Methodology

“Science, my boy, is made up of mistakes, but they are mistakes which it is useful to make, because they lead little by little to the truth.”

Jules Verne
3. 1. Introduction

In this chapter, the methodology to answer the research questions is discussed. The chapter is structured as follows. “The rationale for a mix method approach” section describes the different data analysis approaches and explains the reason a mixed method approach consisting of quantitative and qualitative methods is selected for this study. The study is conducted in two separate phases. “The phase one: quantitative method based on survey data” section explains the quantitative method to answer the first research question. The analysis is based on the data drawn from a secondary survey called Business Longitudinal Database (BLD) published by Australian Bureau of Statistics (ABS). The data is collected from 2,732 businesses across different industries in Australia and is analysed in this research using logistic regression. “The phase two: qualitative method based on multiple case studies” section explains the qualitative method—the main focus of this research—to answer the second research question. It provides a rationale for the decision to adopt a multiple case study approach. The research setting of manufacturing from which the data is collected is also described. This section provides a detailed explanation of the process of case selection. In total, 13 buyer organisations and 11 supplier organisations agreed to participate in this study. The different data collection methods used is described. Semi-structured interviews with senior managers of the participating firms were the main source of data. The four steps used to analyse collected data are outlined in detail. These steps consisted of data exploration, coding, reporting the findings, and interpreting the findings. The ethical considerations and the ethic approval process are described. This section also provides detail explanation about the issue of research trustworthiness and explains how this has been dealt with in this research. This chapter concludes by providing a summary of the main points discussed.
3.2. The rationale for a mix method approach

There are three types of empirical research methods: quantitative, qualitative, and mixed methods (Creswell, 2003; Saunders et al., 2007). Quantitative research methods collect predominantly numerical data and analyse data using statistical methods. Qualitative research methods collect mainly qualitative data drawn from interviews, observations, and documentary evidence and analyse data with qualitative data analysis methods. The purpose of quantitative analysis is to examine a relationship or test a hypothesis—a deductive reasoning, whereas the qualitative analysis is an attempt to build arguments based on the qualitative data (mainly interviews) and to provide explanations that fit the data—an inductive reasoning (Creswell, 2003). The mixed method uses both quantitative and qualitative methods, either sequentially or simultaneously, to answer the research questions. A challenge for researchers is to decide which research approach is most suitable for their research; a single quantitative or qualitative method, or mixed methods.

Saunders et al. (2007) contend that the decision should be based on the following criteria:

a) The research questions and the research objective;

b) The extent of current knowledge about the research topic;

c) The researcher’s time and available resources;

d) The researcher’s philosophical underpinnings

Considering these four criteria, and following other environmental management researchers, such as De Marchi (2010a), this research adopts a sequential mixed-method approach by combining survey with multiple case-studies. With regards to the first criteria, two main research questions are advanced. The first question seeks to examine the relationship between cooperation with external partners and environmental innovation. The second question, however, seeks to understand and explore the way buyers and suppliers interact with each other over developing environmental innovations and addressing environmental issues. While these two questions aim to provide insight about the main theme of this research, which is cooperation for environmental innovation, they require different methods of investigation. The first question tests the hypothesis that is derived from the literature stating cooperation with external partners increases the likelihood of developing environmental innovations by firms. Quantitative analysis is more appropriate than qualitative analysis for testing such hypothesis because it enables the
researcher to determine which variables to be entered into the model. Furthermore, the
great number of responses, which represent the views of the population being studied,
increases the validity of findings. The second research question, however, can be better
answered by employing a qualitative method. Rather than accepting pre-determined
explanations for a complex concept such as GSCM, the researcher studies the reality of
GSCM issues by exploring the views of participants who deal with this subject. This allows
the development of practical and theoretical understanding, as well as generating new
concepts suggested by many qualitative scholars (Patton, 2002; Creswell, 2003; Bloomberg
and Volpe, 2008; Yin, 2011). A combination of both quantitative and qualitative methods
increases the validity of findings and generates greater confidence in conclusions; it gives
both depth and breadth of insight into the research topic (Miles and Huberman, 1994).

For the second criteria of Saunders et al., there are a few quantitative studies conducted
in other countries to test the hypothetical relationship between cooperation and
environmental innovation, but not any in Australia—to the best of the researcher’s
knowledge. Thus, a quantitative analysis of Australian data is an appropriate method to
validate other researcher’s findings. The complexities associated with interacting with
supply chain members in developing environmental innovations is an insufficiently
researched area. Although there has been increased interest among researchers in studying
GSCM, it is still in its early stages. An exploratory qualitative research, therefore, is a
suitable method for providing more insight about this particular type of environmental
coop eration.

With regards to the third criteria, this research was conducted over a four years period,
which allowed sufficient time to employ a mixed-method approach, although it required
more resources than a single-method approach. A shorter time could have limited this
choice. Finally, the researcher’s previous experience in using quantitative method and the
interest to learn and practice the qualitative method contributed in making a decision to
choose a mixed-method approach.

The research was conducted in two phases. The first phase is quantitative analysis using
survey data. This phase is comparatively a small portion of the entire study. The second
phase is qualitative analysis using multiple case-studies and constitutes the main portion of
the entire study. In the following sections these two phases are explained.
3. 3. Phase one: quantitative method based on survey data

This section describes the method used to answer the first research question: that is whether or not there is a meaningful relationship between cooperation with external partners and environmental innovation. A survey was deemed the most appropriate method to answer this question. Using a pre-designed questionnaire, a survey produces numeric results that represent the opinions of a population being studied. It allows to collect a large amount of data in an economical way; the standardized questions also allow for an easy comparison (Creswell, 2003; Saunders et al., 2007). The following section details the data source for the survey and the method for data analysis.

3. 3. 1. Data source

A decision was made to use a secondary data source, instead of conducting a separate survey. A survey-based secondary data, called Business Longitudinal Database (BLD), published by Australian Bureau of Statistics (ABS) is used. BLD is collected from Australian businesses every year and is released every two or three years. At the time of this phase of the research, the latest data available were for the periods of 2006-07 in a de-identified form called Confidentialised Unit Record File (CURF). The main objectives of BLD are to provide information about activities or factors that are relevant to business performance, and to help academics and practitioners to know the business characteristics that are associated with these activities or factors.

Although the data for BLD are collected for other business purposes, it was useful in answering this research questions. As suggested by Saunders et al. (2007), the advantages of using BLD, included saving in time and money, as the data have already been collected and no cost needed to be paid for its use—the access is granted to researchers for free through Swinburne. Furthermore, there was more time to spend on analysing and interpreting results as the steps for preparing questionnaires, disseminating and collecting them were skipped. Comparative analysis and longitudinal studies are also possible as the new data are published every few years. Given that BLD is available to other researchers, findings are more open to public scrutiny.

businesses (see Figure 3.1). Each panel is directly surveyed once a year for a period of five years (ABS, 2009).

![Figure 3.1: BLD structure: Panel one and Panel two- Source: (ABS, 2009)](image)

The data for BLD, consisted of 407 data items most of which require respondents to either answer yes or no, come from two main sources: administrative data and the ABS Business Characteristics Survey (BCS). Administrative data are obtained from other governmental agencies (Australian Taxation Office (ATO) and the Australian Customs and Border Protection Service (ACBPS)). BSC is an annual ABS survey that is conducted via a questionnaire. The reference period for the data included in the BCS is the Australian financial year, which ends 30th June (ABS, 2009).

In total, 31 data items were selected from the BLD to use in this study (See chapter 4, Table 4.1 for a complete list of data items). These data items were used as proxies for environmental innovation as the dependent variable, business cooperation as the main predictor, and a set of control variables consisted of research and development (R&D), size, grants and subsidies, export, and industry division.

While offering valuable benefits, like other secondary data sources, using BLD had some limitations. The data items were not specifically designed to collect information for environmental innovation limiting the ability to investigate different aspects of it. In
addition, the applicability of the data may be affected by the period of its collection not coinciding with the application of the other instruments.

### 3.3.2. Reliability and validity

Reliability is concerned with the extent to which data collection and data analysis methods produce consistent results, and, whether the research is replicable in similar situations or not. Validity refers to the extent to which the results measure what was anticipated (Saunders et al., 2007; Bloomberg and Volpe, 2008). Saunders et al. (2007) contend that with secondary data, reliability and validity depend on the source and the method by which the data were collected. They suggest that data sources that are published by large organisations or governments are likely to be reliable and valid. However, Saunders et al. (2007) suggest detailed review of the methodology applied on the secondary data, if accessible. The review includes looking at the previous records of responsible body or people that collect the data; the context in which the data is collected; the data collection process (sampling strategy and response rate).

For the BLD used in this research, a detailed examination was conducted before the data were used. ABS publications, widely used by researchers for different purposes, are considered reliable sources. ABS uses experts to collect and compile the data. The method of data collection, sampling procedure and the setting from which the data were collected are fully explained in the Technical Manual (ABS, 2009) that accompanies the data source. In terms of the validity of the results, careful attention was paid to select those data items that match that which needed.

### 3.3.3. Data analysis

The survey data were analysed using descriptive and regression statistics.

#### 3.3.3.1. Descriptive analysis

Descriptive analysis is a simple and effective way to describe the basic features of the data in the study. The simplest way to present the data is through tables, showing the frequency distribution of data items (Saunders et al., 2007). In this study, tables summarised how participants from different industry sectors responded to survey questions. The 12 industry sectors from which the data were obtained are as follows:

A = Agriculture, Forestry and Fishing

B = Mining
C = Manufacturing
E = Construction
F = Wholesale Trade
G = Retail Trade
H = Accommodation, Cafes and Restaurants
I = Transport and Storage
J = Communication Services
L = Property and Business Services
P = Cultural and Recreational Services
Q = Personal and Other Services

Bar charts or histograms provide visual representation of data. The height of the bar represents the frequency of occurrence for a particular variable. Bar chart is used in this study to show how survey respondents answered the question of motivation for innovation.

3.3.2 Logistic regression

Logistic regression is used to analyse the data because the dependent variable, environmental innovation, in the data set was dichotomous (yes, no). Logistic regression allows assessment of how well the set of independent variables predicts or explains the categorical dependent variable (Kleinbaum and Klein, 2007). The objective of logistic regression is same as the objective of multiple linear regression: construction of a model to describe the relationship between a response variable and a set of independent variables. It indicates the adequacy of the model, by assessing goodness of fit. It is also possible to know the relative importance of each predictor variable (Hosmer and Lemeshow, 2000; Tabachnick and Fidell, 2007). In contrast to linear regression, which uses least squares, logistic regression relies on maximum likelihood procedures to obtain the coefficient estimates (Hosmer and Lemeshow, 2000; Tabachnick and Fidell, 2007). The results of this analysis are presented in two parts: descriptive statistics and logistic regression results. The results and the discussion of phase one analysis are presented in chapter 4.
3.4. Phase two: qualitative method based on multiple case studies

This phase describes the method used to answer the second research question: how do firms interact with their supply chain partners to develop environmental innovations and address environmental issues? From the various qualitative methods (See Appendix A), a case study most suited this investigation. Case study research is richly descriptive, because it is grounded in deep and varied sources of information. It employs quotations by key participants, anecdotes, prose composed from interviews, and other literary techniques to create mental images that bring to life the complexity of the many variables inherent in the phenomenon being studied (Hancock and Algozzine, 2006). According to Yin (2003, p.p.13). “A case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident.”

Case study is a useful tool for the preliminary, exploratory stage of a research for presenting proposed theory that can be tested empirically by means of quantitative methods such as surveys or experiments (Perry, 1998). Case studies—common in studying organisational and inter-organisational research—have been recently used in studying green supply chain and environmental management (Bowen et al., 2001; Preuss, 2001; Forman and Jørgensen, 2004; De Marchi, 2010a; Azevedo et al., 2011).

Rowley (2002) suggests three criteria to be considered for a research problem, before choosing a case study approach (See Table 3.1).

<table>
<thead>
<tr>
<th>Factors</th>
<th>scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>The types of questions to be answered</td>
<td>How and why</td>
</tr>
<tr>
<td>The extent of control over behavioural events</td>
<td>No or little control</td>
</tr>
<tr>
<td>The degree of focus on contemporary as opposed to historical events</td>
<td>Contemporary phenomenon</td>
</tr>
</tbody>
</table>

This research fits well with Yin’s definition and Rowley’s criteria because it seeks to explore and better understand how firms interact with their supply chain partners over environmental issues. The concept of greening supply chains is relatively new to many businesses. The factors associated with a business decision to initiate the greening process are various and complicated. Therefore, a case study provides the opportunity to scrutinize
the opinion of business decision makers about these factors and collect a lot richer and
deeper information than would be able via other research methods. According to Yin
(2003), there are three types of case study designs: explanatory, where cases are used to
provide data collection and testing on cause and effect relationships; exploratory, where
cases are used to define the questions, and form a hypothesis for a subsequent study; and
descriptive, where cases are used to provide a complete description of a phenomenon
within its context. In this thesis case study is used for both exploratory and descriptive
purposes.

A frequently raised question is how many cases should be included in a case study. Is
one case sufficient? Single case studies are useful when they represent rare and extreme
events or are critical to meet all the conditions of the theory (Yin, 2003). Nevertheless,
Perry (1998) suggests that postgraduate researchers should use several case studies. In line
with similar studies in the environmental innovation and GSCM fields (Pagell, 2009; De
Marchi, 2010a), this thesis used multiple case studies consisting of 13 buyer and 11 supplier
cases to answer the second research question.

Because case studies rely on analytical generalization, studying multiple cases offer a
greater opportunity for theory building. Hence, findings are more compelling and robust
(Miles and Huberman, 1994; Yin, 2003). While each individual case can reveal a discovery,
replication across cases may lead to a theoretical breakthrough. Multiple cases are
equivalent to multiple experiments. The more cases investigated to establish or refute a
theory, the more robust are the research outcomes (Rowley, 2002). According to Miles and
Huberman (1994, pp.186-87):

At a deeper level, the aim is to see processes and outcomes across many cases,
to understand how they are qualified by local conditions, and thus to develop
more sophisticated descriptions and more powerful explanations.

Caveat, however, should be considered with a large number of cases as the likelihood to
get rich data may decreases. Thus, it is advised to deal with the issue of number of cases
conceptually, meaning to end further data collection when researchers feel they have
reached a saturation point, in which further data do not add any new insight (Miles and
Huberman, 1994; Bloomberg and Volpe, 2008; Yin, 2011).
3. 4. 1. The research setting

The setting for this study was manufacturing in Victoria, Australia. The decision to study manufacturing was made because manufacturing has both significant economic and environmental impacts. Several other studies in environmental management have also focused on manufacturing (Hill, 1997; Williamson et al., 2006; Simpson, D et al., 2007; Vachon, 2007). Manufacturing sector provides a rich ground for the purpose of this research.

Australia’s manufacturing sector is diverse. Australian manufacturers range from those producing commodity products such as some foods and beverages, and other simply transformed manufactures, to high precision, high value-added products, including automotive and aerospace components, machine tools, medical devices, electronics, scientific instruments, advanced materials and pharmaceuticals. Australia’s manufacturing sector has grown progressively over the last decade, although at a slower rate than other sectors of the economy. This is partly because economic recessions affect manufacturing much more than the rest of the economy (AiGroup, 2012).

The economic contribution by manufacturing is 14.3% of all industries, the second largest contributor after wholesale trade (15.5%) (ABS, 2012). In 2006-07, Australia exported $85.4b of manufactured goods, which was 51% of the value of all goods exported. Manufacturing was followed by mining (37%) with agriculture, forestry and fishing (5%) the next highest. Manufacturing industry produces eight per cent of the country’s Gross Domestic Production (GDP), although indirectly it contributes more because of its link with other sectors. Manufacturing contributes to 25 per cent of Australia’s research and development (AiGroup, 2012). The industry employs almost one million people, about 10% of the Australian working population, of which 87% are full time workers (Hasan, M. and Chung, 2011; AiGroup, 2012). Manufacturing sector with over 16000 businesses is the second largest contributor to the Victorian economy after wholesale trade. It accounts for 16.5 per cent of sales and service income. Victoria accounts for 28% of sales and service income for all Australian manufacturing, (ABS, 2008). With a share of 32.7 per cent, Victoria accounts for the largest share of manufacturing employees in Australia (AiGroup, 2012).

The environmental impact of manufacturing is significant. The energy consumption of manufacturing industries grew worldwide by 61% from 1971 to 2004 and accounts for nearly a third of global energy usage. Manufacturing industries are also responsible for 36%
of global carbon dioxide (CO₂) emissions (OECD, 2009). Manufacturing in Australia is also a major contributor of greenhouse gas emissions (27.7% total emissions of Australian industry), ranking second to the agriculture industry (Garnaut, 2008). According to Garnaut, the manufacturing industry’s total emissions were about 130 million tonne of CO₂ equivalent (Mt CO₂-e) in 2006.

3.4.2. Case selection

In contrast to quantitative methods, which use either probability sampling or convenience sampling, case studies rely on purposeful sampling (Miles and Huberman, 1994; Maxwell, 1996). This is a strategy in which particular settings, persons, or events are selected on purpose because the phenomenon under the study is more likely to occur in these settings. Purposeful sampling enables the researcher to select cases that will best enable answering the research questions and to meet the research objectives. This study employed a purposeful sampling procedure. It was decided to examine multiple cases in manufacturing industry with a cross-section of different types of manufacturing firms. The existing literature provides evidence of using this approach (Hill, 1997; Bowen et al., 2001; Klassen and Vachon, 2003; Pagell, 2009). This approach allowed to capture a variety of managerial perceptions and interpretations of green supply chain practices and environmental innovations as it is becoming important for all industry sectors, and not only one single sector. It also improved the generalizability of findings. Nevertheless, by nature the findings are limited in the sense that industry specific contingencies are not directly controlled.

Considering the aim of the research in exploring the way buyers and suppliers interact over environmental issues, it was important to approach firms that have already proven to be environmentally aware and have shown some evidence of internal environmental improvements. The firms selected were large or medium size⁴ buyer firms who were able to influence their suppliers. They were manufacturers that were either selling their products to retailers or distributing their products directly to the market. A list of 37 potential firms was produced through discussion with academic and industry experts. An invitation letter was sent to these firms, of which 13 agreed to participate. Overall, 16 managers

⁴ - According to the definition of ABS (2010), the three categories of businesses are:

- Small size: businesses employing 5 or more people, but less than 20 people
- Medium size: businesses employing 20 or more people, but less than 200 people
- Large size: businesses employing 200 or more people
participated in the study. A summary of the buyers and participants is provided in Table 3.2. To de-identify buyers and their participants, BUi and BPi codes are used respectively.

<table>
<thead>
<tr>
<th>Firm code</th>
<th>Manufacturing sector</th>
<th>No. of employees</th>
<th>The manager(s) interviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU1</td>
<td>Pulp, Paper and Converted Paper Product</td>
<td>&gt; 4000</td>
<td>BP1: Procurement Manager</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
<td>BP2: Environmental Manager</td>
</tr>
<tr>
<td>BU2</td>
<td>Transport Equipment Manufacturing</td>
<td>&gt; 200</td>
<td>BP3: Sustainability Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BP4: Procurement Manager</td>
</tr>
<tr>
<td>BU3</td>
<td>Textile, Leather, Clothing and Footwear</td>
<td>&gt; 3000</td>
<td>BP5: Procurement Manager</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
<td>BP6: Operations Manager</td>
</tr>
<tr>
<td>BU4</td>
<td>Textile, Leather, Clothing and Footwear</td>
<td>&gt; 3000</td>
<td>BP7: Supply Chain Manager</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BU5</td>
<td>Machinery and Equipment Manufacturing</td>
<td>&gt; 500</td>
<td>BP8: Quality and Sustainability Manager</td>
</tr>
<tr>
<td>BU6</td>
<td>Machinery and Equipment Manufacturing</td>
<td>&gt; 5000</td>
<td>BP9: Procurement Manager</td>
</tr>
<tr>
<td>BU7</td>
<td>Transport Equipment Manufacturing</td>
<td>&gt; 6000</td>
<td>BP10: Procurement Manager</td>
</tr>
<tr>
<td>BU8</td>
<td>Food Product Manufacturing</td>
<td>&gt; 2000</td>
<td>BP11: Procurement Manager</td>
</tr>
<tr>
<td>BU9</td>
<td>Petroleum and Coal Product Manufacturing</td>
<td>&gt; 250</td>
<td>BP12: Procurement Manager</td>
</tr>
<tr>
<td>BU10</td>
<td>Transport Equipment Manufacturing</td>
<td>&gt; 500</td>
<td>BP13: Procurement Manager</td>
</tr>
<tr>
<td>BU11</td>
<td>Fabricated Metal Product Manufacturing</td>
<td>&gt; 2000</td>
<td>BP14: Procurement Manager</td>
</tr>
<tr>
<td>BU12</td>
<td>Basic Chemical and Chemical Product</td>
<td>&gt; 5000</td>
<td>BP15: Procurement Manager</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BU13</td>
<td>Pulp, Paper and Converted Paper Product</td>
<td>&gt; 2000</td>
<td>BP16: Supply Chain Manager</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The green supply chain process is a complex topic and studying the opinion of buyer participants would only provide one-sided insight. Therefore, to increase the validity of
research and complement the buyers’ findings, interviews were conducted with a group of supplier firms (tier one suppliers). The process of selecting suppliers included requesting buyer participants to provide a list of the potential suppliers that could contribute to better understanding of the research problem. Then following criteria were considered for the selection of suppliers:

1- The supplier operates within Australia and NOT overseas and interacts with the buyer on a regular basis

2- Preferably, the supplier has experience in working with the buyer on environmental issues

Although an attempt was made initially to include a direct supplier for each buyer, such access was not readily secured. Only two firms within the sample were direct suppliers of two interviewed buyers (BU10-SU9 and BU2-SU5). The main reasons for not being able to interview direct suppliers of all buyer firms included: buyer organisations not willing to share the contact details of their suppliers, suppliers not willing to be interviewed, or suppliers being overseas. To overcome this issue, where possible, another supplier with almost the same characteristics of the potential direct suppliers was identified and contacted. Similar to buyer firms, an invitation letter was sent to suppliers, of which 11 agreed to participate. Overall, 12 managers participated in the study. A summary of the suppliers and participants is provided in Table 3.3. To de-identify suppliers and their participants, SUi and SPi codes are used respectively.
Table 3.3: Demographic of suppliers

<table>
<thead>
<tr>
<th>Firm code</th>
<th>Manufacturing sector</th>
<th>No. of employees</th>
<th>The manager(s) interviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>SU1</td>
<td>Textile, Leather, Clothing and Footwear Manufacturing</td>
<td>&lt; 200</td>
<td>SP1: General Manager</td>
</tr>
<tr>
<td>SU2</td>
<td>Food Product Manufacturing</td>
<td>&lt; 200</td>
<td>SP2: General Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SP3: Sustainable System Coordinator</td>
</tr>
<tr>
<td>SU3</td>
<td>Machinery and Equipment Manufacturing</td>
<td>&lt; 50</td>
<td>SP4: General Manager</td>
</tr>
<tr>
<td>SU4</td>
<td>Polymer Product and Rubber Product Manufacturing</td>
<td>&lt; 80</td>
<td>SP5: General Manager</td>
</tr>
<tr>
<td>SU5</td>
<td>Transport Equipment Manufacturing</td>
<td>&lt; 20</td>
<td>SP6: General Manager</td>
</tr>
<tr>
<td>SU6</td>
<td>Machinery and Equipment Manufacturing</td>
<td>&lt; 30</td>
<td>SP7: General Manager</td>
</tr>
<tr>
<td>SU7</td>
<td>Transport Equipment Manufacturing</td>
<td>&lt; 100</td>
<td>SP8: General Manager</td>
</tr>
<tr>
<td>SU8</td>
<td>Polymer Product and Rubber Product Manufacturing</td>
<td>&lt; 90</td>
<td>SP9: Operations Manager</td>
</tr>
<tr>
<td>SU9</td>
<td>Transport Equipment Manufacturing</td>
<td>&lt; 30</td>
<td>SP10: General Manager</td>
</tr>
<tr>
<td>SU10</td>
<td>Printing</td>
<td>&lt; 70</td>
<td>SP11: General Manager</td>
</tr>
<tr>
<td>SU11</td>
<td>Food Product Manufacturing</td>
<td>&lt; 50</td>
<td>SP12: General Manager</td>
</tr>
</tbody>
</table>

3.4.3. Data collection methods

The use of multiple methods is important in gaining an in-depth understanding of the phenomenon under study. This strategy adds rigour, breath, and depth to the study and provides corroborative evidence for the data (Bloomberg and Volpe, 2008; Yin, 2011). Thus, this study employed various data collection methods as follows.

3.4.3.1. Interviews

The semi-structured interviews were the primary method of data collection in this research. This method has a number of advantages. It allows the researcher to gain an understanding of the issue at hand from the participant’s perspective, as it is the participant who has experienced the phenomena being studied (Miles and Huberman, 1994). It
provides the opportunity to clarify any misunderstanding the participant may have about the interview questions. The open-ended questions allow the participants to elaborate on their responses and provide richer and more in-depth information and give the researcher the chance to probe for additional information. Furthermore, interviews provide a more relaxed atmosphere; participants may feel more comfortable having a conversation with the researcher about the research topic as opposed to filling out a survey (Boyce and Neale, 2006). Another benefit of interviews is that by engaging the participant, it leaves it open for the participant to suggest other sources of information or other people to consider for further investigation. Yin (2003), calling a respondent that assists in this manner an “informant”, places emphasis on the role of them in advancing a case-study research.

Despite the advantages of interviews, there are some limitations associated with this method. Interviewing people requires special skills. Because of the diversity of participants in terms of their attitudes, positions, and willingness to answer questions, the researcher has to be flexible and ready to accommodate different situations. It is also possible that the researcher unconsciously guides participants to give answers expected by him. Moreover, participants may give answers that deliberately or undeliberate do not match with the reality. Sometimes, people may not simply recall events that happened in the past. As the researcher was not a novice interviewer, such effects were minimised.

3.4.3.1.1. Interview participants

One critical step in designing the case study research is to decide who participates in the interviews. It is advised to interview persons who have knowledge related to the topic of study and might hold different views. Most importantly, care should be given to avoid biasing the study—or any appearance of bias—by choosing only those sources that corroborate the researcher’s preconceptions (Yin, 2011).

Interviews in buyer firms were held with senior manager with responsibilities related to procurement, supply chain or the environment. Given all supplier firms were small and medium size firms, interviews were held with the General Managers of these firms. There were 28 interviews in total consisting of 16 interviews with buyer participants and 12 interviews with supplier participants.

3.4.3.1.2. Interview protocol

The main choice for qualitative studies concerns protocols. A protocol can help to remind the researcher about the original topic and questions. A protocol should indicate a broad set of behaviours that researcher is to undertake, rather than any tightly scripted
interaction between researcher and any source of evidence, such as a field participant. A protocol serves as a “mental framework” that guides the researcher through the study (Yin, 2011, p.p. 103). Yin points out several features of a protocol: containing adequate questions that are central to the research topic for guiding one or more lines of inquiry; being only a mental framework that keeps neutrality of the researcher during data collection phase; having questions that help the researcher to strive for converging and triangulating evidence.

In order for interviewing to be useful for this purpose, the researcher needs to ask about specific events and actions, rather than posing questions that elicit only generalizations or abstract opinions. The interview questions are what the researcher asks people in order to gain that understanding. Proper interview questions are judged by whether they provide the data that will contribute to answering research questions. The development of good interview questions requires creativity and insight, rather than a mechanical translation of the research questions into an interview guide; it depends fundamentally on how the interview questions actually work in practice (Yin, 2011).

The interview protocol for this study was based on the conceptual framework developed in the previous chapter. This protocol is presented in Appendix B. The protocol contains an introduction (including informed consent), a set of questions, and closing comments. The questions for buyers are slightly different from those of suppliers. All questions were asked from the perspective of the responding interviewee to ensure that the participant do not have to speculate about the practices of another organisation. The questions were mainly exploratory aiming at investigating, for example, the priorities of firms in working with their supply chain partners; whether or not environmental considerations are amongst them and why they have these priorities. Some questions were explanatory and investigated the green supply chain practices that firms had in place and asking about environmental innovations developed by the firms.

3. 4. 3. 1. 3. Pilot study

In preparing for the data collection, researchers may run a small scale version of the major study to identify the issues and rectify them. This pilot case is like a laboratory where researchers test, review and revise their procedures, questions and hypotheses. In explaining the benefit of pilot studies, Maxwell (1996) states that pilot studies produce an understanding of the concepts and theories from actors’ point of view, which may be also achieved by prior research. Although a pilot study does not guarantee success in the main
study, it significantly increases the likelihood. The pilot study in this research was conducted after the conceptual framework was developed and before the actual data collection starts. Pilot cases were chosen based on the criteria of convenience, access, and geographic proximity, as is suggested by Yin (2003). The purpose here was to find shortcomings in the framework and interview questions and rectify them. Furthermore, this stage helped the researcher to become familiar with the manufacturing setting, the participants’ feedback on the research topic and questions, and the time needed to obtain satisfactory information.

The pilot study included three interviews with procurement and environmental managers of three large manufacturing firms, two interviews with General Managers of two supplier firms, and two interviews with industry experts. These pilot interviews carried out from September 2011 to November 2011. The preliminary themes that emerged from the pilot interviews revolved around the barriers in implementing environmental initiatives. From the pilot study, a series of open-ended questions was developed, which enabled the researcher the flexibility to allow new directions to emerge during the interviews. Changes were made to some interview questions to improve the wording and the order.

3.4.3.1.4. Interview process

Interviews were conducted in two stages: first buyer participants were all interviewed and then interviews with supplier participants were conducted. Interviews were conducted between February and June 2012. The procedure to approach and conduct the interviews with both buyer and supplier participants was almost the same. Individual emails were sent to prospective participants describing the purpose of the research, the time required, the confidentiality of their responses and inviting their participation (see Appendix C). Some requests were received for additional information, which mainly included requesting a copy of interview questions—predominantly by supplier participants—or re-confirming the confidentiality of their responses—predominantly by buyer participants.

Once the approval was received a convenient time and date was confirmed for the interviews. The interviews were held in the firms’ premises, except two interviews with buyer participants that were conducted by telephone due to their distance from Melbourne. Before the interviews commence, participants were requested to review and sign university consent forms required for participation in this research (see Appendix D). The interviews lasted between one to two hours depending on the availability and time pressure on the participants. All interviews were recorded on a digital recorder and the audio files were
transferred to the researcher’s computer for easy access. Patton (2002) provides some
guidelines that help in recording better quality audio files. These techniques were used in
conducting the interviews. They include the use of a high quality digital recorder,
interviewing at a place free from interruptions, placing the microphone close to the
participant, speaking clearly and also requesting the participant to speak clearly, not rustling
papers, cups, bottles, and other items near the microphone, transferring the audio files to
the computer as soon as practical and labelling the audio files appropriately. On the
completion of each interview, the recording was transcribed and saved on the researcher’s
computer. In addition to interview recording, field notes were taken to record impressions,
context and so on. The field notes were edited and checked for accuracy right after
returning from the interviews.

3. 4. 3. 2. Documents

It is important to systematically look for any relevant documents during the course of
data collection. Documents are useful sources in case study research because they can
confirm or boost evidence from other sources (Yin, 2003). Reviewing organisational
documents before the interviews helps to obtain some general knowledge about the firm
and perhaps the participants. It can also aid to keep the flow of the interview without
interrupting the participant to ask questions such as spelling a name or a title. Furthermore,
these documents provide more accurate demographic information (e.g., number of
employees, sector, turn over, etc.) than what is stated by the participant. Examples of
organisational documents that were reviewed for this research included annual
environmental and financial reports, sustainability reports, environmental policies, supplier
evaluation questionnaires, and internal newsletters. The researcher is aware that most of the
documents have been generated for specific purposes and perhaps a specific audience and
therefore careful attention was paid in interpreting them and they were used only as
supplementary evidence.

Another useful source of information is non-organisational documents. These include
things such as newspaper articles and industry reports. Academic resources such as journal
and conference papers, books, and PhD dissertations were also extensively used in this
research. These sources provided the opportunity to compare and contrast the findings
with the existing knowledge.
3. 4. 3. 3. Direct observation

Additional information can be obtained through observational evidence. These can be in the form of formal or informal observations. A good example of formal observations includes attending organisational meetings. Less formal observations, on the other hand, might be made throughout a field visit including those occasions during which other evidence, such as that from interviews is being collected (Yin, 2003). Given that a majority of interviews were held in the participants’ premises, the latter form of observation was relevant and provided the opportunity to acquire additional information. These included things such as the company’s attitude with regards to environmental considerations (for instance, in some firms, there were environmental policies put on the wall, the sustainability reports were on the table, or energy consumption reports were pinned on the public board), and the technological capabilities. This information is difficult to acquire through other data collection methods.

3. 4. 3. 4. Conferences, workshops, and seminars

Attending pertinent environmental and green supply chain conferences, seminars, and workshops provided additional insights. The conferences and seminars provided the opportunity to exchange knowledge with experts who were up to date with the latest developments in the field and helped to become familiar with the best green practices of pioneering firms and hear about the current challenges. Workshops helped the researcher to increase his knowledge of the environmental domain, which in turn helped him to be more prepared during the interviews. Workshops also provided the opportunity to interact with other participants that were mainly employees of various companies and allowed the researcher to obtain some participant’s perspective on the research topic.

3. 4. 4. Methods for data analysis and synthesis

Data analysis is making sense of data that is collected from various sources (Miles and Huberman, 1994; Bloomberg and Volpe, 2008). The data analysis is perhaps one of the most challenging tasks for researchers, especially those who are new to qualitative methods. The main reason is because there is no single right method to analyse qualitative data (Maxwell, 1996). Researchers need to reduce the large volume of data collected from the field, identify the significant patterns within and across cases, and move beyond the data to interpret the findings and perhaps develop a framework or theory (Bloomberg and Volpe, 2008; Yin, 2011). Miles and Huberman (1994) refer to data analysis as the process of data reduction, display, conclusion and verification. As the process of data analysis proceeds...
from data collection to conclusion drawing, data is reduced and the interpretation of the
data increases. Throughout the entire process, the researcher has to keep an open mind and
be ready for unexpected (Bloomberg and Volpe, 2008). According to Bloomberg and
Volpe (2008), the analytic process in qualitative research is a combination of inductive and
deductive thinking.

The data analysis procedure in this study consisted of four major steps including, data
exploration, coding, reporting the findings, and interpreting the findings as advised by
Bloomberg and Volpe (2008). These steps, which are almost similar to the steps
recommended by other qualitative authors (Miles and Huberman, 1994; Maxwell, 1996;
Patton, 2002; Yin, 2011), are described in the following sections and graphically in Figure
3.2. It is, however, noteworthy that these steps did not necessarily occur in a linear fashion.
There was an ongoing iteration between the four steps. The iteration continued until the
meaning of data became clear.
Step one

Review and Explore Data
Identify “Big Ideas”

Step two

Re-read and examine data
Code data
Place coded data in categories

Memo/Journal
Data summary tables
Inter-ratter reliability

Revise coding scheme
Codes are added, eliminated, and/or collapsed

Step three

Report findings
Formulate findings statements
Provide participants quotations
Summarize key findings

Chapter 5 and 6

Data
Information

Step four

Interpret findings
Analyse and synthesise findings by linking to experience, insight, and literature

Chapter 7

Knowledge

Figure 3.2: Data analysis process-source (Bloomberg and Volpe, 2008, p.100)
The data analysis process was identical for both buyers and suppliers up to step three. Nevertheless, the interpretation (step four) was based on the collective findings of both buyers and suppliers.

Qualitative software packages are becoming more popular amongst qualitative researchers. They eliminate traditional ways of photocopying, filing cards, sorting or colour pen coding. Amongst the various qualitative software packages, NVivo version 9 was used due to its availability and ease of use. NVivo provided the flexibility that is required to manipulate a large amount of data. Nevertheless, the capabilities of qualitative software are still much less than quantitative software. In using NVivo, the researcher was fully in charge of all the steps. As described by Yin (2011) the researcher cannot call upon pre-set formulas as in quantitative methods. This is mainly due to the nature of qualitative studies that draw the meaning from a large amount of text and require extensive thinking and re-thinking.

3.4.4.1. Step one: Data exploration

The interviews generated a great amount of text; the interview transcripts ranged from 20 to 30 pages each. This data was supplemented with the field notes and the information obtained from documentary evidence. All these data sources were uploaded into NVivo and were labelled for further analysis (See Appendix E for screenshots of the NVivo). The initial step in data analysis was to review and explore the collected data to gain a feel for the storyline. The purpose here was to make sense of what participants had said during the interviews and compare them with what had emerged from other data sources. As recommended by Bloomberg and Volpe (2008) this stage helped to identify the “big ideas”, which provided a preliminary framework for the study’s findings.

3.4.4.2. Step two: Coding

This step was concerned with organising and placing the large amount of data collected into categories or so called “codes”. Bloomberg and Volpe (2008, p.102) define codes as:

> Codes are a type of short-hand; the names or identifiers that you attach to chunks or segment of data that you consider relevant to your study.

The purpose of coding was to start moving from a large pile of raw data to slightly higher conceptual level (Yin, 2011).
There are two main ways to code the data, which depends on the research method and the personal inclination and knowledge of the researcher (Miles and Huberman, 1994; Patton, 2002). The first method is to start with the pre-established conceptual framework and use the elements of the framework as the primary coding scheme. The researcher, however, remains flexible to any new ideas and concepts that emerge from the data and modifies the coding scheme as the coding progresses. The second method is mainly data-driven and heavily relies on the researcher ability to draw the codes from the text. This approach is popular amongst researchers that adopt a grounded theory approach proposed by Glaser and Strauss (1967).

The first coding method was adopted in this study mainly because it allowed the use of existing theories. The conceptual framework developed in previous chapter served as a primary coding scheme. However, as it is expected from any qualitative research, the primary coding scheme was expanded to include the concepts that emerged from the data, but which had not appeared in the literature. Figure 3.3 shows the coding process. The coding was done in two levels. The first level was labelling significant words, phrases or sentences that related to research questions and research topic. In some cases the exact phrase or word was used as the code name. The coding scheme gradually grew with coding each case, which often required going back to previously coded cases to look for evidence of the newly identified codes. The same process was followed for all succeeding cases. This was an iterative process. An example of how the data were coded at this stage is given in Table 3.4, though the entire process was done in NVivo. In the second round, however, an effort was made to identify and group those codes that relate to each other. The objective was to move to a higher conceptual level as recommended by Yin (2011). These higher level codes are referred as themes in this study and are consisted of four main themes:

1- Environmental factors in selection and assessment criteria of suppliers

2- Cooperation between buyers and suppliers on environmental improvements

3- Motivations to develop environmental innovations and engage in green supply chain management

4- Barriers in developing environmental innovations and engaging in green supply chain management
During the coding, for a few cases, there were some inconsistencies between the data sources. To resolve the issue, participants were contacted again either via email or phone.

Memo writing was conducted concurrently to the coding. Yin (2011, p.310) defines memos as:

A set of notes specifically dedicated to a qualitative researcher’s ongoing ideas during the coding of qualitative data. The memos help track the coding process and provide reminders about possible refinements as well as tentative thoughts about the relationships among codes and the potential clustering of codes into categories and themes (cf. personal journal).

Writing memos helps to clarify ideas, refine the codes, and define relationships between the codes and emergent themes. It is a powerful sense-making tool for qualitative researchers (Miles and Huberman, 1994; Yin, 2011). Whenever anything related to and significant about the coding or analysis of the data was found, it was put into writing immediately. Memos were kept as a spate file in NVivo.
Table 3.4: An example of a coding level 1

<table>
<thead>
<tr>
<th>What drives you to adopt environmental initiatives?</th>
<th>Codes (nodes in NVivo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well everything comes down to a cost benefit, the beauty about environmental initiative, is quite often, if you reduce your environmental footprint, you save some money, so that gets a big tick. On the other side, if you reduce your footprint it can cost more, and in that case you do a cost benefit analysis, and if it is too costly it does not get done.</td>
<td>Cost-benefit analysis</td>
</tr>
<tr>
<td>Cost-saving advantage</td>
<td>Cost as a barrier</td>
</tr>
<tr>
<td>It would either have to be where we see increased growth opportunities in order to be seen as that sort of a company, I’m not sure. Or there is some sort of regulation that is imposed view that “you have got to have this environmental focus right down the supply chain”</td>
<td>Market opportunities</td>
</tr>
<tr>
<td>Regulations</td>
<td></td>
</tr>
<tr>
<td>If you put compliance to one side, because that’s not negotiable, the main pressure point comes from customers and supermarkets. The supply chain feeds backwards. “What is the consumer going to be looking for?” and how is that going to work within a supermarket? And how is that going to work for a brand owner and from a marketing perspective and linking back into the customer. And then we have to make a package which fits.</td>
<td>Compliance</td>
</tr>
<tr>
<td>Customer/consumer pressure</td>
<td></td>
</tr>
</tbody>
</table>

One concern with coding qualitative data is the different approaches in coding the data, which may result in different labels and codes (Bloomberg and Volpe, 2008). To ensure the appropriateness and consistency of codes, two colleagues were requested to code a sample of the transcripts and also to review the entire code list. A meeting was then held to discuss the similarities and differences. The discussion helped to revise some of the codes.
3. 4. 4. 3. Step three: Reporting the findings

This step involves telling the story of the research findings. This story as Bloomberg and Volpe (2008) argue should be vivid and interesting while also accurate and credible. The coding process helped to reduce the large amount of data into codes and themes. This, however, needed to be shaped in a form that can be shared and displayed (Miles and Huberman, 1994). The findings were presented in an objective and narrative manner without speculation from the researcher. These included samples of participant quotations. The objective was to provide rich description and illustrate the points made by participants. The findings for buyer and supplier participants are presented in two separate chapters (chapter 5 and 6). Each chapter tells the story of green supply chain process from a different angle.

To effectively communicate the findings, data summary tables were used. These tables were used for recording the number and types of participant responses. The purpose of having tables is for readers to scan the tables easily, deriving the key relationships between the rows and the columns and quickly interpreting the information in a table’s cells (Miles and Huberman, 1994). Data summary tables provide a record of who said what and how many times a particular response occurs. In the absence of such a summery, identification of pervasive themes and findings is either up to the discretion of the researcher or the interpretation of the reader (Bloomberg and Volpe, 2008). Participants (under pseudonyms) were listed down the vertical axis, with the categories (various participant responses) being listed along the horizontal axis. The cells within the tables show how each participant responded to each of the categories. Raw frequencies as well as percentage were noted at the bottom of each column. While the intent was not to quantify the qualitative data, these frequencies and percentages acted as supplements to the narrative.

3. 4. 4. 4. Step four: Interpreting the findings

The purpose of this step is to look at the broader meaning of the data. Yin (2011) calls the coding step “Disassembling” the data and the interpreting step as “Re-assembling” the data. The task here is to take levels 1 (codes) and 2 (themes) to a higher and more holistic conceptual level. Bloomberg and Volpe (2008) name this step synthesis and argue that at this step the researchers have to ask themselves: what do these finding mean? What do the findings tell me about the research topic? What is really happening? Researchers ask these questions and move back and forth between the findings and their own perspectives and understandings to make sense and meaning out of data.
In this study, buyer participants shared their views and concerns with regards to greening supply chains. There were some similarities and differences to the responses of supplier participants. The findings of buyers and suppliers were compared and contrasted with each other as well as with the findings of other studies. Scrutinising the provided deeper meaning, which led to a set of coherent explanations (Miles and Huberman, 1994). These explanations communicate the essence of what data revealed. The interpretation of findings is in the discussion presented in chapter 7. The analysis and synthesis allows for drawings of broader implications of this study. Toward this end, a resolution framework, including recommendations to business and policy decision makers and directions for prospect researchers, was developed. This part is in the conclusion presented in chapter 8.

3.4.5. Ethical considerations

Studies that deal with human subjects—whether qualitative or quantitative—must receive ethics approval from Swinburne Human Research Ethics Committee (HREC). The imperative of ethics approval is to inform participants about the research purpose and protect them from any potential risk or undesired outcome (Miles and Huberman, 1994; Maxwell, 1996; Patton, 2002; Bloomberg and Volpe, 2008; Yin, 2011).

Despite the low level risk of this study, ethics approval was required before proceeding with data collection. Therefore, an ethics application was written in the standard format provided by the University and was handed to HREC. Three main subjects were covered in the application: a) why this research is to be undertaken; b) what is to be studied; and c) how this study is to be conducted. The first draft was reviewed and revised with the principal supervisor. The final version was sent to the HREC. The Committee reviewed the application in four weeks and few minor corrections were asked. The corrections were sent to the committee by email and approval was issued in one week (See Appendix F for the Ethics Approval letter).

The main issue with this type of research, which is concerned with collecting information from people with organisational responsibilities, is the ways in which the information is treated. To ensure the confidentiality of participants and their rights is preserved, the following measures were employed. A consent form was sent to each participant before conducting the interviews informing them that there are no implicit constraints to participate and that the decision is truly voluntary. Participants were asked to sign the consent form under the company permission and return it to the researcher. This research did not need the individual participants’ names or their organisations for the
purpose of reporting findings or any published works. Therefore, their identities were protected using pseudonyms. The real names of the participants were stored in a separate locked storage file, so that there was no way to match the pseudonym codes to the real participants’ names.

3. 4. 6. The research trustworthiness

The key quality control issue in case-study research is the trustworthiness (or validity) of the study and its findings. Maxwell (1996, p.87) defines validity as “the correctness or credibility of a description, conclusion, explanation, interpretation, or other sort of account”. According to Yin (2011, p.p. 78), “a valid study is one that has properly collected and interpreted its data, so that the conclusions accurately reflect and represent the real world (or laboratory) that was studied”.

Trustworthiness in qualitative research is comparable to validity and reliability in quantitative research. Nevertheless, there are significant differences in dealing with trustworthiness issues across quantitative and qualitative studies. Quantitative methods tend to combat the threats of validity, before the data collection is conducted. These include things such as proposing hypotheses in advance, using random sampling, testing the data collection instrument, separating control variables, and using statistical significance tests. Qualitative researchers, on the other hand, deal with the trustworthiness issues while the research is undergoing. The job of the qualitative researcher is to make sure that the research findings reflect the reality of the phenomenon under study. They have to detect the threats and develop ways to limit the impacts throughout the design, implementation and analysis of the research (Maxwell, 1996; Bloomberg and Volpe, 2008).

Lincoln and Guba (1985) discuss how the rigor of qualitative research could be enhanced. They note four factors that are important to the trustworthiness of qualitative research: credibility, dependability, transferability, and confirmability. Credibility refers to the fact that the findings are accurate and plausible and match the perceptions and opinions of the participants. This factor is similar to validity in quantitative analysis. Credibility consists of two validity tests: methodological validity and interpretive validity. Methodological validity is concerned with selecting a rational approach that matches with research purpose, questions and methods. In this research, the use of multiple data sources and recording of interviews and accurate transcription of recordings contributed to the enhanced methodological validity. Maxwell (1996) argues that researchers may unintentionally impose their own framework on what is heard or observed and select data
that fit the researcher’s existing theory. This may occur in different ways. If the researcher
does not listen for the participants’ meanings or asks leading, closed, or short-answer
questions that do not give participants the opportunity to reveal their own perspective. To
avoid these threats in this research, the interviews were conducted in a manner that gave
the participants enough time and flexibility to elaborate on their answers. The questions
were mainly designed to be open-ended, so that rich data can be collected. Interpretive
validity includes determining the validity of data analysis and the following interpretations.
To enhance the interpretive validity of this research various strategies were employed. The
assumptions and limitation were considered before conducting the analysis and the steps
required to interpret the findings were planned. Searching for discrepant evidence and peer
review were also used. Alternative explanations or understandings of the phenomena under
study were considered while analyzing and interpreting the findings. Furthermore, to
ensure that the likelihood of accurate finding is maintained, the research findings were
reviewed in line with the prior published research. Discussion with colleagues and the
supervisory team helped to ensure that the reality of participants was effectively reflected in
the findings.

Dependability refers to whether or not the findings are consistent and dependable with
the data collected. This factor is similar to reliability in quantitative analysis. A research is
consistent when another researcher can follow the steps taken by the research of a study
and achieve consistent results. To enhance the dependability of this research, inter-rater
reliability was established in which two colleagues were asked to code a sample of
interviews and a discussion followed after they prepared their codes. Writing memos was
another way to deal with how well categories and themes covered the data.

Transferability refers to the degree to which the results of qualitative research can be
generalized or transferred to other contexts or settings. Maxwell (1996) distinguishes
between two types of generalisability: external and internal. External generalisability, which
refers to its generalisability beyond that setting or group, is often not an important issue for
qualitative studies. Indeed, the value of a qualitative study may depend on its lack of
external generalisability. The internal generalisability, which refers to the generalisability of
a conclusion within the setting or group studied, is clearly a key issue for qualitative case
studies. The descriptive, interpretive, and theoretical validity of the conclusions all depend
on their internal generalisability to the case as a whole. This is based, not on explicit
sampling of some defined population to which the results can be extended, but on the
development of a theory that can be extended to other cases (Miles and Huberman, 1994;
Yin, 2011). The transferability factor was addressed in this research by presenting representative quotations from the transcripts. Depth, richness, and detailed description provided the basis for a qualitative account’s claim to relevance in some broader context.

Confirmability refers to freedom of bias in the research process. That is, the findings are the result of the research rather than and outcome of the biases and subjectivity of the researcher (Bloomberg and Volpe, 2008). Discussion with academic and industry experts, peer review of coding scheme, and keeping an ongoing record of the researcher’s self-reflection in the format of memos enhanced the confirmability aspect.
“The worthwhile problems are the ones you can really solve or help solve, the ones you can really contribute something to.”

Richard Feynman
4. 1. Introduction

This chapter presents the findings of the first phase, which is a quantitative analysis. The data for this quantitative analysis are drawn from the Business Longitudinal Database (BLD) obtained from Australian Bureau of Statistics (ABS). The BLD contains the record of 2,732 businesses. The aim is to investigate the relationship between cooperation and environmental innovation. The “Measurement variables” section introduces the set of measurement variables, which include the dependent variable (environmental innovation), the main predictor (R&D cooperation), and the control variables (R&D expenditure, export, size, government grants and subsidies, and industry division). The “Results and analysis” section presents the results of descriptive and logistic regression analyses. The “Discussion and conclusion” section provides explanation of the significant and insignificant relationships that were found between the sets of variables. The “Limitations of this phase” section outlines the shortcomings of this phase and provides some recommendations to extend or improve it.
4.2. Measurement variables

The variables used in this study consist of one dependent and six independent variables. A summary of these can be found in Table 4.1.

<table>
<thead>
<tr>
<th>Data Item in BLD CURF</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation = V189_07 OR V194_07 OR V199_07 OR V204_07 OR V223_07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V189_07 INNPROD</td>
<td>The business introduced any new or significantly improved goods or services</td>
<td></td>
</tr>
<tr>
<td>V194_07 INNPROC</td>
<td>The business introduced any new or significantly improved operational processes</td>
<td></td>
</tr>
<tr>
<td>V199_07 INNORGA</td>
<td>The business introduced any new or significantly improved organisational/managerial processes</td>
<td></td>
</tr>
<tr>
<td>V204_07 INNMARK</td>
<td>The business introduced any new or significantly improved marketing methods</td>
<td></td>
</tr>
<tr>
<td>V223_07 INNONGO</td>
<td>The business is still involved in the process of ongoing development or introduction of all types of innovations</td>
<td></td>
</tr>
</tbody>
</table>

**Main reasons for innovation**

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V233_07 MOTINN1</td>
<td>Profit related reasons</td>
<td></td>
</tr>
<tr>
<td>V234_07 MOTINN2</td>
<td>Competition, demand, market-related reasons - Be at the cutting edge of the industry</td>
<td></td>
</tr>
<tr>
<td>V235_07 MOTINN3</td>
<td>Competition, demand, market-related reasons - Increase responsiveness to customer needs</td>
<td></td>
</tr>
<tr>
<td>V236_07 MOTINN4</td>
<td>Competition, demand, market-related reasons - Ensure products are competitively priced</td>
<td></td>
</tr>
<tr>
<td>V237_07 MOTINN5</td>
<td>Competition, demand, market-related reasons - Increase or maintain market share</td>
<td></td>
</tr>
<tr>
<td>V238_07 MOTINN6</td>
<td>Competition, demand, market-related reasons - Establish new markets</td>
<td></td>
</tr>
<tr>
<td>V239_07 MOTINN7</td>
<td>Production and delivery reasons - Increase efficiency of supplying/delivery goods or services</td>
<td></td>
</tr>
<tr>
<td>V240_07 MOTINN8</td>
<td>Production and delivery reasons - Improve quality of goods and services</td>
<td></td>
</tr>
<tr>
<td>V241_07 MOTINN9</td>
<td>Production and delivery reasons - Improve IT capabilities or better utilise IT capacity</td>
<td></td>
</tr>
<tr>
<td>V242_07 MOTINN10</td>
<td>Production and delivery reasons - Increase capacity of production or service provision</td>
<td></td>
</tr>
<tr>
<td>V243_07 ENVINN</td>
<td>Reduce environmental impacts</td>
<td></td>
</tr>
<tr>
<td>V244_07 MOTINN11</td>
<td>Improve safety or working conditions</td>
<td></td>
</tr>
<tr>
<td>V245_07 MOTINN12</td>
<td>In response to government regulations or standards</td>
<td></td>
</tr>
<tr>
<td>V246_07 MOTINN13</td>
<td>Other reasons</td>
<td></td>
</tr>
<tr>
<td>V247_07 MOTINN14</td>
<td>No main reasons</td>
<td></td>
</tr>
</tbody>
</table>

**Cooperation**

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V277_07 COOPERAT</td>
<td>Business collaboration for innovation (No/Yes)</td>
<td></td>
</tr>
<tr>
<td>V278_07 COOPINTE</td>
<td>Other businesses related to the business</td>
<td></td>
</tr>
<tr>
<td>V279_07 COOPCLI</td>
<td>Clients, customers or buyers</td>
<td></td>
</tr>
<tr>
<td>V280_07 COOPSUPP</td>
<td>Suppliers of equipment, materials, components or software</td>
<td></td>
</tr>
<tr>
<td>V281_07 COOPOTHE</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

**Control variables**

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIV93_07 INDUSTRY</td>
<td>Industry division ANZSIC Version 1993</td>
<td></td>
</tr>
<tr>
<td>V006_07 SIZE</td>
<td>Number of persons working for this business</td>
<td></td>
</tr>
<tr>
<td>V114_07 GRANT</td>
<td>Grants</td>
<td></td>
</tr>
<tr>
<td>V115_07 SUBSIDY</td>
<td>Subsidies</td>
<td></td>
</tr>
</tbody>
</table>
### 4.2.1. Dependent variable (Environmental innovation)

The dependent variable in this analysis was “Environmental innovation”. In the survey there was a question that asked about the motivation of firms to innovate; among the possible answers was “reduce environmental impacts”. This was a “Yes” or “No” answer. The discussion that follows explains the choice of using this survey item as a proxy for measuring environmental innovation.

There are two approaches for acquiring environmental innovation data. One is to use existing sources of statistics and the other is to conduct specifically designed surveys. Arundel and Kemp (2009) established four categories for measuring environmental innovation using existing data. The first is input measures where proxies such as environmental research and development (environmental R&D), number of employees working in R&D department, or innovation expenditure are used. The difficulty of these measures is that the data are rarely available and it does not include non-technological aspects. Intermediate output measures (the second group) reflect the number of patents, scientific publications, and citations. These are the most widely employed proxies in environmental innovation studies (Brunnermeier and Cohen, 2003; Wagner, 2007; Carrión-Flores and Innes, 2010; Johnstone et al., 2010). Oltra et al. (2010) argue that patents are a useful means for measuring environmentally motivated product innovations, and, more generally, technologies with environmental benefits. The advantages of patents are: they explicitly provide an indication of inventive output; they can be sorted by technology group; they mix detail and coverage of technologies (Kemp and Arundel, 1998). Nevertheless, patents may not be proper indicators of innovation, as the degree of novelty associated with many patents is not significant.

Trade journals and product information databases, such as the green-car database developed by Yahoo, are other useful, but scarce indicators of environmental innovations. Main drawbacks of these sources of information are that they do not include process innovations that are generated within the firm. Furthermore, preparing a selection of journals that can provide comprehensive coverage of environmental innovations is challenging (Arundel and Kemp, 2009).

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V269_07</td>
<td>RDEXP</td>
<td>Research and Experimental Development</td>
</tr>
<tr>
<td>V036_07</td>
<td>EXPORT</td>
<td>The income from the export of goods and/or services (Yes/No)</td>
</tr>
</tbody>
</table>
Eco-efficiency performance measure, the fourth category, gained a great deal of attention after the concept was defined and explained by the World Business Council for Sustainable Development (WBCSD). The term Eco-efficiency means creating more value, while using fewer resources and impacting less on the environment. The prefix refers to both ecological and economic benefits (WBCSD, 2000). These measures look at changes in resource efficiency and productivity by means of decomposition analysis (Arundel and Kemp, 2009). On the basis of company environmental performance and innovation data that were collected by a survey, the project named Measuring Eco-innovation (MEI), developed and pilot tested a benchmark indicator for environmental innovation. Seven indicators were plotted in a polygon, as shown in Figure 4.1. The bigger the enclosed area of the polygon, the better is the eco-efficiency performance (Arundel and Kemp, 2009).

Despite the insightful information that can be obtained from existing sources, they are not readily available. Therefore, large and small surveys have been developed and used in different countries, in particular, European and OECD countries (Green, Kenneth et al., 1994; Zutshi and Sohal, 2004). Some currently deployed surveys are: PACE, IMPRESS, OECD survey and CIS 2008 Eco-innovation module. The PACE survey looks at Pollution Abatement and Control Expenditures and has been used jointly by OECD countries and by Eurostat since 1996. In most countries, the survey includes only firms that have more than 20 employees. IMPRESS is a European survey covering 1594 establishments in manufacturing and service sectors in five European countries (the UK, Germany, Switzerland, The Netherlands, and Italy). The OECD survey is conducted in seven OECD
countries: Germany, Hungary, Japan, Norway, France, United States, and Canada. The aim is to investigate the link between government environmental policies and environmental management, investments, innovation and performance in private manufacturing firms. CIS 2008 Eco-innovation module is another European questionnaire developed in a group effort between academics and research centres. The module looks at the benefits and drivers of environmental innovations and asks firms if they have any procedures to identify environmental issues and rectify them (Arundel and Kemp, 2009).

National innovation surveys are other useful sources for evaluating environmental innovativeness of firms. They include questions asked about the importance of the effects of the product and process innovations in reducing materials and energy per unit output and reducing environmental impacts or improving health and safety. These surveys are conducted on a regular basis in countries such as Europe, Canada, New Zealand, Korea, Japan, and Australia (Arundel and Kemp, 2009). The main advantage is that they cover many firms that are representative of the actual population. The long list of questions asked, which captures different variables, allows investigating the relationship between these variables and environmental innovation. Nevertheless, the number of questions of relevance to environmental performance of firms is limited, which impedes further analysis of results. Another drawback is that, so far, they have only collected data on reduction in material and energy use and reduced environmental impacts in general. Another disadvantage is that the questions are often so broad in that they not only ask about the environmental impact, but also include the effects on health or safety (Arundel and Kemp, 2009). This biases the analysis as it includes in their statistics non-environmental innovations. Such a bias occurs in a study conducted by De Marchi (2012).

Given the benefits of a large national survey outweighs its limitations, an existing Australian dataset called the Business Longitudinal Database (BLD), published by Australian Bureau of Statistics (ABS), was used (Chapter 3 provides more details about the BLD). The survey is published on a regular basis, which is valuable for future analysis and comparison. It collects data from many firms from all over Australia, thereby being representative of the overall population, the findings may be generalised with high level of confidence. The BLD is based on a survey consisting of more than 200 questions, which allows including more variables in the analysis. In the survey there is a question that asks about the motivation of firms to innovate; among the possible answers is “reduce environmental impacts”. As suggested by Arundel and Kemp (2009), and similar to a study conducted by Conceição et al. (2006), this variable is used as a proxy for environmental
innovation. This question does not have the bias of counting health or safety-related
innovations as the question specifically asks about the environmental impacts.

4. 2. 2. Predictors

4. 2. 2. 1. Cooperation

The main focus of this phase is to test the hypothesis that cooperation with external
partners increases the likelihood of developing environmental innovations. A detailed
discussion was presented in the literature review chapter about the importance and
relevance of cooperation for environmental innovation. A question in the survey that asks
“whether this business had any expenditure on business collaboration for innovation” is
used as a proxy for cooperation. The binary variable COOPERAT obtains value 1 if a firm
collaborates with other businesses on any innovation and 0 otherwise.

4. 2. 2. 2. R&D expenditure

The more an enterprises invest in research and development initiatives, the more likely
it would generate knowledge and build up technological and non-technological capabilities
that are needed for innovation (Horbach, 2008). On the other hand, for firms to be able to
develop environmental innovations, they need in-house expertise and capital, associated
with R&D investment. Expenditure on research and development helps a firm to
accumulate knowledge. This, in turn, enhances its ability to recognize and assimilate new
ideas and convert this knowledge into further innovations (Berchicci, 2009). In an attempt
to identify environmental innovation determinants by using two German panel databases,
Horbach (2008) shows that improvement of a firm’s technological capabilities, which the
author calls “knowledge capital”, by investment on R&D stimulates environmental
innovation. In other words, this finding confirms the belief that “innovation breeds
innovation”. A binary variable RDEXP is used to control for the impact of research and
experimental expenditure on the probability of developing environmental innovation.

4. 2. 2. 3. Export

Attendance of firms in foreign markets is a critical factor in determining firms’
strategies and its significance is expected to grow further as the barriers for international
trades are being removed and markets become increasingly globalised (Martín-Tapia et al.,
2010). Firms enter international markets in order to gain more profit and spread the fixed
costs of innovation over a larger number of units (Pla-Barber and Alegre, 2007). On the
other hand, firms who export to environmentally conscious markets are under severe
pressure to reduce their ecological impacts. Europe, for instance, has tariffs for imported products of polluting industries (The Age, 2010). The binary variable EXPORT obtains value 1 if a firm received income from the export of goods and/or services and 0 otherwise.

4. 2. 2. 4. Size

The link between a firm’s size and propensity to develop environmental innovations has been a subject of debate in the innovation literature and, recently in the environmental innovation literature, although it still remains controversial. There are theoretical explanations suggesting that there is a positive relationship between a firm’s size and environmental innovation. Theoretical approaches used to support this positive link are: the resourced based-view (RBV) and institutional theory. According to the resourced based-view, large companies possess more financial and human resources and higher economies of scale. These characteristics help them acquire new clean technologies and implement reformed green practices. Institutional theory postulates that larger companies are under scrutiny from influential stakeholders to improve their environmental performance (Hart, 1995; Ahuja, 2000; Das and Teng, 2000). Government, society, interest groups, and the public, impose considerable pressures on large firms to rationalize their business and strategic practices and outputs (Marshall et al., 2005; Blind, 2012; Ervin et al., 2012). Environmental protection agencies, for example, determine a variety of procedures that firms are obliged to follow (Delmas and Toffel, 2004). Therefore, the larger the firm is, the greater is the likelihood that it incorporates green concepts into its business strategies and practices. The size of a firm can be measured in various ways. The variable SIZE in this study refers to the number of persons working for a business. This proxy is a common-size indicator in the literature (Conceição et al., 2006; Bakar and Ahmad, 2010).

4. 2. 2. 5. Government grants and subsidies

The role of governments in supporting businesses to promote green practices has been cited by many scholars (Porter and van der Linde, 1995; Frondel et al., 2008). Governments can play roles in two different ways. Firstly, they may set environmental laws and regulations that prevent usage of certain materials or polluting technologies and, instead, stimulate environmentally sound practices and technologies. However, this may not be as effective when governments support firms through incentive programmes such as R&D subsidies and grants. This so called supply-push instrument (Cleff and Rennings, 1999; Horbach, 2008) enables businesses to cover up the high initial cost of investment in
new clean technologies that may not be paid back in the short term (Carrillo-Hermosilla et al., 2009). The two variables GRANT and SUBSIDY are used to control for the effect of government’s support.

4. 2. 6. Industry

The ability to change towards environmentally-friendly practices is not only dependent on the firm’s characteristics; the industry sector that the firm operates in can be an important factor too (Carrillo-Hermosilla et al., 2009). While companies in the chemical industry, for instance, have been under severe pressure for decades to reduce their environmental impacts (Christmann, 2000), firms in other industries, such as the carpet manufacturing, have faced this challenge only recently (Carrillo-Hermosilla et al., 2009). Some industries are more polluting than others; in some sectors the pace of change is too fast (e.g., manufacturing and communication services) whereas in others it is very slow (e.g., mining and agriculture). The variable DIV93 that represents 12 industries in the dataset is used as a proxy for the industry sector.

4. 3. Results and analysis

Given that the dependent variable environmental innovation in the data set was dichotomous (yes, no), the most appropriate technique for analysis was logistic regression. Logistic regression allows assessment of how well the set of predictor variables predicts or explains the categorical dependent variable (Kleinbaum and Klein, 2007). It provides an indication of the adequacy of the model by assessing goodness of fit. It is also possible to know the relative importance of each predictor variable (Hosmer and Lemeshow, 2000; Tabachnick and Fidell, 2007). In contrast to linear regression, which uses least squares, logistic regression relies on maximum likelihood procedures to obtain the coefficient estimates (Hosmer and Lemeshow, 2000; Tabachnick and Fidell, 2007). The results of this analysis are presented in two parts: descriptive statistics, and logistic regression results.

4. 3. 1. Descriptive statistics

Descriptive analysis is a simple and effective way to describe the basic features of the data in the study. It provides a summary of how participants from different industry sectors have responded to survey questions (Saunders et al., 2007). Just about half (49.6%) the firms in the survey came from three sectors: agriculture, forestry and fishing; manufacturing and wholesale trade. The smallest industry divisions were from mining, cultural and recreational services, communication and construction sectors. Over half were
firms with less than five employees, 26% had between five and nineteen employees, and 20% were companies employing more than nineteen employees.

Table 4.2 shows the responses of survey participants to the innovation question. On average almost 70% of survey participants of all industry sectors responded to the question asking whether or not they have introduced any innovation. Overall, 37.7% stated that they have introduced new or significantly improved goods or services, operational processes, organisational/managerial processes, marketing methods, or are still involved in the process of ongoing development or introduction of all types of innovations.

Table 4.2: Descriptive statistics of innovators according to the industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of firms</th>
<th>% Respondents to innovation question within the industry</th>
<th>% Innovators amongst all industry divisions</th>
<th>% Innovators of question respondents within the industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = Agriculture, Forestry and Fishing</td>
<td>622</td>
<td>73%</td>
<td>20%</td>
<td>31%</td>
</tr>
<tr>
<td>B = Mining</td>
<td>120</td>
<td>63%</td>
<td>3%</td>
<td>28%</td>
</tr>
<tr>
<td>C = Manufacturing</td>
<td>449</td>
<td>66%</td>
<td>22%</td>
<td>53%</td>
</tr>
<tr>
<td>E = Construction</td>
<td>142</td>
<td>71%</td>
<td>4%</td>
<td>30%</td>
</tr>
<tr>
<td>F = Wholesale Trade</td>
<td>285</td>
<td>69%</td>
<td>11%</td>
<td>40%</td>
</tr>
<tr>
<td>G = Retail Trade</td>
<td>174</td>
<td>71%</td>
<td>6%</td>
<td>34%</td>
</tr>
<tr>
<td>H = Accommodation, Cafes and Restaurants</td>
<td>183</td>
<td>67%</td>
<td>5%</td>
<td>29%</td>
</tr>
<tr>
<td>I = Transport and Storage</td>
<td>156</td>
<td>71%</td>
<td>6%</td>
<td>38%</td>
</tr>
<tr>
<td>J = Communication Services</td>
<td>139</td>
<td>66%</td>
<td>5%</td>
<td>41%</td>
</tr>
<tr>
<td>L = Property and Business Services</td>
<td>158</td>
<td>70%</td>
<td>5%</td>
<td>33%</td>
</tr>
<tr>
<td>P = Cultural and Recreational Services</td>
<td>141</td>
<td>70%</td>
<td>6%</td>
<td>43%</td>
</tr>
<tr>
<td>Q = Personal and Other Services</td>
<td>163</td>
<td>74%</td>
<td>7%</td>
<td>42%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2732</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The highest respondents belong to the Personal and other services with 74% and the lowest respondents were in the Mining sector with 63%. In regards to the fraction of innovators amongst all industries, Manufacturing, Agriculture, Forestry and Fishing, and Wholesale Trade had the highest percentage of innovators with 22%, 20%, and 11% each respectively. Last column in the Table shows the percentage of innovator within each industry sector. This is from those survey participants who responded to the innovation question. Fifty-three percent of manufacturers indicated that they had introduced innovation, Cultural and Recreational Services innovators accounted for 43%. The least innovators within the industry came from the Mining sector with 28% of respondents indicating that they had at least one innovation during the period.
Table 4.3 shows the descriptive results for the question used as a proxy for environmental innovation (main reason for innovation being to reduce environmental impacts). On average 17% responded to this question with Manufacturing accounting for the highest response rate, 27%, and Agriculture, Forestry and Fishing the lowest response rate, 1%.

Table 4.3: Descriptive statistics of environmental innovators according to the industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of firms</th>
<th>% Respondents to env. innovation question within the industry</th>
<th>% Respondents to env. innovation question within respondents to innovation in industry</th>
<th>% of Environmental innovators of all innovators within industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = Agriculture, Forestry and Fishing</td>
<td>622</td>
<td>1%</td>
<td>2%</td>
<td>1.4%</td>
</tr>
<tr>
<td>B = Mining</td>
<td>120</td>
<td>10%</td>
<td>16%</td>
<td>0.0%</td>
</tr>
<tr>
<td>C = Manufacturing</td>
<td>449</td>
<td>27%</td>
<td>41%</td>
<td>8.2%</td>
</tr>
<tr>
<td>E = Construction</td>
<td>142</td>
<td>14%</td>
<td>20%</td>
<td>20.0%</td>
</tr>
<tr>
<td>F = Wholesale Trade</td>
<td>285</td>
<td>22%</td>
<td>32%</td>
<td>12.8%</td>
</tr>
<tr>
<td>G = Retail Trade</td>
<td>174</td>
<td>16%</td>
<td>22%</td>
<td>4.8%</td>
</tr>
<tr>
<td>H = Accommodation, Cafes and Restaurants</td>
<td>183</td>
<td>15%</td>
<td>23%</td>
<td>8.3%</td>
</tr>
<tr>
<td>I = Transport and Storage</td>
<td>156</td>
<td>19%</td>
<td>27%</td>
<td>11.9%</td>
</tr>
<tr>
<td>J = Communication Services</td>
<td>139</td>
<td>19%</td>
<td>28%</td>
<td>2.6%</td>
</tr>
<tr>
<td>L = Property and Business Services</td>
<td>158</td>
<td>20%</td>
<td>29%</td>
<td>5.4%</td>
</tr>
<tr>
<td>P = Cultural and Recreational Services</td>
<td>141</td>
<td>20%</td>
<td>29%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Q = Personal and Other Services</td>
<td>163</td>
<td>21%</td>
<td>29%</td>
<td>11.8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2732</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On average about 25% of innovators across all industry sectors responded to the environmental innovation question. From these respondents, 20% in the construction, 12.82% in the wholesale trade, 11.90% in the transport and storage, and 11.76% in the personal and other services industry reported reduced environmental impacts (environmental innovation) as the prime motivator. Surprisingly, given the size and propensity of the Australian mining industry, it showed no evidence of innovation that aimed to reduce impact on the environment.
Chapter 4: Quantitative Analysis

Figure 4.2: Main reasons for innovation

The main reason for innovation was ‘profit-related’ (79.4% of firms). ‘Increase responsiveness to customer needs’ was the second most important reason, accounting for 54.1% of responses. Great importance was also given to ‘Increase or maintain market share’ (47.3%), followed by ‘Establish new markets’ (41.8%) and ‘Increase efficiency of supplying/delivery goods or services’ (39.2%).

The least important drivers for innovation, however, were ‘In response to government regulations and standards’, and ‘No main reasons’ with 10.9%, and 3% respectively. ‘Reduced environmental impacts’ received a low percentage (12.1%) of respondents’ motivations (See Figure 4.2).
Firms with more than four employees are more likely to develop environmental innovations. Firms that export show almost similar results as non-exporters. Overall, just above one-fifth of environmental innovators stated that they received financial assistance via subsidies or grants. In contrast, only 12.7% of those with other reasons for innovation received financial support. Amongst environmental innovators, 30% spent on research and development, which was almost twice the level of expenditure as firms with other reasons for innovation. Firms that undertook with business cooperation for innovation accounted for 28.8%, whereas just under half of this proportion was reported by other innovators. Whilst cooperation with other businesses related to the business was nearly equivalent for both groups (26.7% for environmental innovators and 29.3% for other innovators), cooperation with customers, suppliers and others was considerably higher for environmental innovators, 73.3%, 60% and 60%, respectively, compared to 39.7%, 48.3% and 46.6% for other reasons.

Table 4.4: Percentage of the regressors for environmentally driven innovations and other types of innovations

<table>
<thead>
<tr>
<th></th>
<th>Main reason: environmental innovation</th>
<th>Main reason: Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-4</td>
<td>13.5%</td>
<td>26.4%</td>
</tr>
<tr>
<td>5-19</td>
<td>44.2%</td>
<td>36.1%</td>
</tr>
<tr>
<td>20 or more</td>
<td>42.3%</td>
<td>37.5%</td>
</tr>
<tr>
<td>EXPORT</td>
<td>25%</td>
<td>25.7%</td>
</tr>
<tr>
<td>SUBSIDY</td>
<td>5.8%</td>
<td>3%</td>
</tr>
<tr>
<td>GRANTS</td>
<td>15.4%</td>
<td>9.8%</td>
</tr>
<tr>
<td>RDEXP</td>
<td>30%</td>
<td>15.9%</td>
</tr>
<tr>
<td>COOPERATION</td>
<td>28.8%</td>
<td>15.3%</td>
</tr>
<tr>
<td>COOPINTE</td>
<td>26.7%</td>
<td>29.3%</td>
</tr>
<tr>
<td>COOPCLIE</td>
<td>73.3%</td>
<td>39.7%</td>
</tr>
<tr>
<td>COOPSUPP</td>
<td>60%</td>
<td>48.3%</td>
</tr>
<tr>
<td>COOPOTHE</td>
<td>60%</td>
<td>46.6%</td>
</tr>
</tbody>
</table>
4. 3. 2. Logistic regression

To perform logistic regression, the data were filtered to include only innovating firms. This resulted in the 717 cases being reduced to 360 for analysis.

4. 3. 2. 1. Test of collinearity

The coefficients for a regression model cannot be uniquely calculated, when there is a high linear relationship among the predictors. When two variables are near perfect linear combinations of each other, it is called collinearity. The term multicollinearity is used for models with more than two variables (Tabachnick and Fidell, 2007). The multicollinearity was checked for independent variables. Pallant (2002) suggests that the correlation coefficient should be less than 0.7; otherwise, deleting one of the variables or merging the variables with high correlation and forming a new variable should be considered. The correlations between the variables in this study’s model are provided in Table 4.5. The correlation between each of the independent variables is not high (less than 0.2). Therefore, the analysis could continue.

<table>
<thead>
<tr>
<th></th>
<th>SIZE</th>
<th>EXPORT</th>
<th>SUBSIDY</th>
<th>GRANT</th>
<th>RDEXP</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXPORT</td>
<td>0.161**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig</td>
<td>0</td>
<td>.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBSIDY</td>
<td>0.053</td>
<td>-0.063</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig</td>
<td>0.16</td>
<td>0.101</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRANT</td>
<td>0.166**</td>
<td>0.176**</td>
<td>0.136**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sig</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RDEXP</td>
<td>0.04</td>
<td>0.176*</td>
<td>-0.085</td>
<td>0.154*</td>
<td>1</td>
</tr>
<tr>
<td>Sig</td>
<td>0.421</td>
<td>0</td>
<td>0.088</td>
<td>0.002</td>
<td>.</td>
</tr>
<tr>
<td>COOPERAT</td>
<td>-0.037</td>
<td>0.075</td>
<td>-0.013</td>
<td>0.007</td>
<td>0.175**</td>
</tr>
<tr>
<td>Sig</td>
<td>0.426</td>
<td>0.108</td>
<td>0.783</td>
<td>0.877</td>
<td>0</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).
4.3.2.2. Estimation results

Two regression models are run. One with control variables only and the other including control variables and main predictor variable: “COOPERAT”. The aim was to compare the results with and without the main predictor variable. The models are as follow:

Model A) \[\log\left(\frac{\text{Prob}(\text{ENVINN})}{1-\text{Prob}(\text{ENVINN})}\right) = \beta_0 + \beta_1 \ast \text{EXPORT} + \beta_2 \ast \text{RDEXP} + \beta_3 \ast \text{SIZE} + \beta_4 \ast \text{GRANT} + \beta_5 \ast \text{SUBSIDY} + \beta_6 \ast \text{INDUSTRY}\]

Model B) \[\log\left(\frac{\text{Prob}(\text{ENVINN})}{1-\text{Prob}(\text{ENVINN})}\right) = \beta_0 + \beta_1 \ast \text{EXPORT} + \beta_2 \ast \text{RDEXP} + \beta_3 \ast \text{SIZE} + \beta_4 \ast \text{GRANT} + \beta_5 \ast \text{SUBSIDY} + \beta_6 \ast \text{INDUSTRY} + \beta_7 \ast \text{COOPERAT}\]

The results are presented in two tables. Table 4.6 is the regression results for Model A and Table 4.7 shows the estimation results for Model B. Both tables have coefficients, the Exp coefficients (also known as odds ratios), the standard errors, the Wald test statistic with associated degrees of freedom, and p-values. These tables provide information about the sign and contribution of each of the predictor variables.

A forced-entry method is used, in which, all the predictors are entered together. This provides an opportunity to evaluate the contribution made by each predictor over and above that of the other predictors (Tabachnick and Fidell, 2007). The coefficients of the logistic regression model (Values under B column) are determined as maximum likelihood estimators (Hosmer and Lemeshow, 2000). A positive sign for a coefficient means that the variable is more likely to increase the probability of introducing environmental innovations. The Wald test is calculated by dividing each coefficient by its standard error and squaring the result. The variables under the Sig. column that have a value less than 0.05 contribute significantly to the predictive ability of the model. “The odds ratio (The values under Exp(B) column) show the change in odds of being in one of the categories of outcome when the value of a predictor increases by one unit. The coefficients, B, for the predictors are the natural logs of the odds ratios: odds ratio = e^B. Therefore, a change of one unit on the part of a predictor multiples the odds by e^B ”(Tabachnick and Fidell, 2007, p.p.461).
According to the values under Sig. column, the only variable that is statistically significant is RDEXP meaning investment in R&D distinguishes firms who introduce environmental innovations from those that do not. Nevertheless, EXPORT, SIZE, GRANT, SUBSIDY and INDUSTRY are not significantly different from zero at 5% level. The values of the second column (B) indicate that expenditure on research and development increases the log odds of environmental innovation by 0.944. This is to say that, the probability of innovating for environmental purposes increases by a factor of 2.57 as firms invest in R&D.

Table 4.7 shows the estimation results once the main predictor variable, COOPERAT, is entered into the model. The p-value of COOPERAT is less than .05 confirming the hypothesis that “Firms that cooperate with their external partners on research and development are more likely to adopt or develop environmental innovations”.

The estimated coefficient of COOPERAT shows that the probability of adopting or developing environmental innovations by firms increases with the increase in cooperation with external partners. The odds ratio of COOPERAT indicates that the likelihood of innovating for environmental purposes increases by a factor of 2.50 as firms form business cooperation for innovation.
Similar to Model A, EXPORT is significant. This means that firms that invest in research and development have better chance of adopting or developing environmental innovations. The regression coefficient is positive and equal to 0.848. This suggests that firms reporting that they had expenditure on research and development are 2.33 times more likely to introduce environmental innovations. The results, however, show that EXPORT, SIZE, GRANT, SUBSIDY and INDUSTRY are not significantly different from zero at 5% level. The interpretation of these results is presented in the discussion section of this chapter.

4.3.2.3. Goodness of fit

The results shown in Table 4.8 and Table 4.9 provide an indication of how well both models performed—goodness of fit—in comparison to a model with none of predictors entered into the model. The aim was to find highly significant values, i.e., \( p \text{-value}<0.05 \).
The chi-square values of 27.578 and 33.046 with p-values of less than 0.05 suggest that both model as a whole fit significantly better than an empty model (i.e., a model with no predictors).

**4.3.2.4 Usefulness of the model**

The Cox & Snell R Square and the Nagelkerke R Square values provide an indication of the amount of variation in the dependent variable (environmental innovation) explained by each model. These are described as pseudo R square statistics and shown in Table 4.10 and Table 4.11.

<table>
<thead>
<tr>
<th>Step</th>
<th>-2 Log likelihood</th>
<th>Cox &amp; Snell R Square</th>
<th>Nagelkerke R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>258.867</td>
<td>0.074</td>
<td>0.134</td>
</tr>
</tbody>
</table>

A model with control variables only, have values that range from 0.074 to 0.134 (See Table 4.10), suggesting that between 7.4 per cent and 13.4 per cent of the variability is explained by this set of variables. Once the main predictor variable (COOPERAT) is entered into the model, the two values increase to 0.088 and 0.16 (See Table 4.11), suggesting that between 8.8 per cent and 16 per cent of the variability is explained by this new set of variables. Although, entering cooperation improves the model, overall it does not account for 84% of the variation of environmental innovation. This is discussed in the limitation section.
4. 4. Discussion and conclusion

There are numerous reasons why firms do not develop or adopt environmental innovations (See Biondi et al., 2002; Schaper, 2002; Collins et al., 2007; Young, 2010). Nevertheless, it is not easy to come up with a solution, as this is a multi-faceted issue. However, there is ongoing research on the positive role of cooperation with external partners in helping firms to develop environmental innovations. The analysis of the data set of Australian businesses also confirms this hypothesis. The sign and the magnitude of the regression coefficient of cooperation show this strong relationship. According to the resource-based view and institutional theory, the advantages and competitive benefits that result from cooperative arrangements include: access to new markets, acquisition of sources of technical support and expertise, increased market power, risk and investment sharing, economies of scale and scope, reductions in government or trade barriers, and the acquisition of institutional legitimacy (Dacin et al., 2007; Lin and Darnall, 2010). Nevertheless, as Carrillo-Hermosilla et al. (2010) state, this may be a chicken and egg situation, where the more competency that firms possess, the more they engage in cooperation.

Unfortunately, it was not possible to carry out a statistical test to compare between firms with environmental innovation reasons and those with other main reasons as De Marchi (2010b) did. This was due to the low response rates in the BLD data set for the following survey items:

- Cooperation with other businesses related to the business
- Cooperation with clients, customers or buyers
- Cooperation with suppliers of equipment, materials, components or software
- Cooperation with others

However, the descriptive results (See Table 4.4) demonstrate the contribution of each type of external partners. Cooperation with customers and suppliers is considerably higher for environmental innovators. This shows the importance of engaging supply chain partners. A close inter-relationship with suppliers of materials and equipment could facilitate the process of developing and implementing environmentally benign products, or practices that demand complex processes and heterogeneous skills and resources (Green, Kenneth et al., 1994; Revell and Blackburn, 2007; Vachon and Klassen, 2008). The same is true for clients and customers. More customers, today, call for details on ecological effects
of the product that they purchase. They exert pressure on sellers to keep them within the limits of environmental standards. Having environmental management systems such as ISO 14001 has become a primary requirement. This push has been transferred from the customer to its suppliers and, accordingly, to the suppliers of suppliers and so on. The rest of this research focuses on the interaction of buyers and suppliers over environmental issues.

Technological competencies are important either when a firm intends to develop environmental innovation or to adopt them from external sources (e.g., purchasing clean technologies). Some firms advance their technological capabilities by investing in research and development. The results in this chapter on the impact of the investment in R&D is that the generation of environmental innovation is significant and consistent with the previous literature (Horbach, 2008). This supports the argument that R&D investment increases the knowledge of the firm, which is a key to engaging in information flows. Nevertheless, it is not obvious how much of that investment has been devoted to environmental initiatives. Its investigation may be useful if appropriate data could be collected. Environmental R&D can be an appropriate measure for environmental innovation, if data were collected for those firms that are environmentally motivated to reduce environmental impact either within or externally, for example, at the point of use (OECD, 2009).

Contrary to the findings of several scholars, who found positive (Conceição et al., 2006; Martín-Tapia et al., 2010) or negative (De Marchi, 2010b) relationships between environmental innovation and export, this chapter’s findings show no statistically significant link between firms that do and do not sell overseas. This may be due to more than sixty percent of Australian commodities are exported to Asian countries (Factbook, 2011), which do not have stringent environmental regulations and environmentally conscious clients. Therefore, there is not a high demand or pressure on exporters for greener products or services.

Insignificant results were found for financial assistance from government. This contradicts the notion that environmental innovations are necessarily conceived and developed by firms awarded subsidies or grants. De Marchi (2010b) also established empirically that there is a weak relationship between public funds and environmental innovation. This is in line with some researchers stating that for firms to be persuaded to develop environmental innovations, they first need to foster internal skills and capabilities
(Biondi et al., 2002; De Marchi and Grandinetti, 2012; Leenders and Chandra, 2012). Given the controversial debate about government role in enforcing or encouraging environmental innovations, in the second phase of this research both buyers and suppliers’ participants were questioned about their motivations in addressing environmental issues. This provides more insight into understanding the extent to which government could drive a change and whether external factors such as government legislation and funds are more important than internal organisational factors. The results were insignificant for size of the firm indicating that the ability to develop environmental innovations is not directly related to how big or small is the firm.

4. 5. Limitations of this phase

This quantitative analysis has several limitations. First of all, the data source for the analysis is secondary. Despite collecting responses from a large sample of businesses on a regular basis, it is not designed specifically to collect data on different aspects of environmental innovation (Kemp and Arundel, 1998). The choice of using reduction of environmental impacts as a proxy for environmental innovation may not have been the main reason for innovation. It may have been secondary or a lower priority for some firms motivation for innovation. Therefore, some environmental innovations have been overlooked and have not been counted this way. Future studies in the form of surveys could use specific questions to measure environmental innovation.

The results may not be broadly generalized beyond Australian businesses. It would be valuable to conduct similar studies across other countries, where the data for such large scale surveys are available. According to Kemp and Arundel (1998), most countries in Europe, Canada, New Zealand, Korea and Japan have large-scale national innovation surveys that include questions relevant to environmental innovation. In the case of non-existence of such datasets, using standard or designed questionnaires could be valuable. A properly designed questionnaire could be obtained from the paper by Kemp and Arundel (1998).

While the results are significant for some variables, it is still not the best model fit: 84% of variance is unexplained (See Table 4.11). This is due to the lack of consideration of some internal (e.g., financial situation, position in the value chain, age of the firm or attitudes of managers) and external factors (e.g., general situation of economy, environmental information accessibility or technological characteristics) affecting the adoption and development of environmental innovations. There are two reasons why these variables
were not included in the analysis. Firstly, the data for most of these variables were not available and secondly the aim was to only investigate the relationship between cooperation and environmental innovation while controlling for some influential variables.

This phase only looked at the link between cooperation and environmental innovation at a general level using empirical evidence. This, however, is not sufficient to know what role each partner plays in the advancement of environmental innovation and how the process of cooperation occurs. Therefore, further research is required to investigate the practices, motivations, and barriers that firms encounter in developing environmental innovations with their external partners. Such investigation has been conducted for supply chain partners in the next phase, which is presented in the following chapters.
5. Chapter Five: Findings for Buyers

“You can only find nothing if you stare at a vacuum. You can only find nothing if you immerse yourself in nothing. You can only find nothing if you go nowhere. Go to real places. Talk to real people. Observe real things. You will find something. Indeed, you will find much, for much is there. You will find the world.”

Halcolm
5.1. Introduction

This chapter presents the key findings obtained from 16 in-depth interviews with senior managers at 13 buyer firms. The focus in this and next chapter is to organize and categories the large volume of interview texts into meaningful concepts. The intent is to tell the story of the research findings by way of capturing the opinions and feelings of interviewees. The findings are presented in an objective and narrative manner without speculation from the researcher. These include samples of participant quotations. The objective is to provide rich description and illustrate the points made by participants. As suggested by many qualitative researchers (Miles and Huberman, 1994; Bloomberg and Volpe, 2008; Yin, 2011), there is not an agreed and universal method of analyzing qualitative data. Nevertheless, the instructions provided by these scholars have been used to report and interpret the findings of this research.

To better communicate the findings, data summary tables are used. These tables display the number and types of participant responses. The purpose of having tables is for readers to scan the tables easily, deriving the key relationships between the rows and the columns and quickly interpreting the information in a table’s cells (Miles and Huberman, 1994). Data summary tables provide a record of who said what and how many times a particular response occurs. In the absence of such a summery, identification of pervasive themes and findings is either up to the discretion of the researcher or the interpretation of the reader (Bloomberg and Volpe, 2008). While the intent was not to quantify the qualitative data, these frequencies and percentages acted as supplements to the narrative. The narrative provides the opportunity to enter into this study and better understand the reality of the research participants. The emphasis throughout is on letting participants speak for themselves. Illustrative quotations taken from interview transcripts attempt to reveal multiple participant perspectives and capture some of the richness and complexity of green supply chain management.

For buyers, four major findings emerged from this study as follow:

1. Many participants (13 out of 16 [81%]) expressed that in selecting and assessing suppliers environmental credentials are preferential. The main criteria were price and quality, followed by compliance with environmental laws and provision of recycled packaging.

2. A majority of participants (11 out of 16 [69%]) stated that they have not been engaged with their suppliers on any type of environmental innovations at all.
Only five participates (5 out of 16 [25%]) stated that their firms had some limited interaction with their suppliers.

3. A majority of participants (14 out of 16 [88%]) stated that cost saving was main motivation for developing environmental innovations and investing in GSCM. Increasing stricter environmental regulations (such as carbon tax) and increased requests by business customers were also mentioned by some participants.

4. Many participants (11 out of 16 [69%]) stated that high investment cost and long payback period of environmental innovations as the main barrier for green supply chain management. Half of the participants (8 out of 16 [50%]) cited low importance of environmental innovations held by suppliers as another barrier.

Following is a presentation of the findings with details that support and explain each finding. Participants are listed down the vertical axis, with the categories (various participant responses) being listed along the horizontal axis. Pseudonyms are used to de-identify participants (Buyer Participant (BPi)). The cells within the tables show how each participant responded to each of the categories. Raw frequencies as well as percentage are noted at the bottom of each column.
5.2. Environmental factors in selection and assessment criteria of suppliers

The following section presents the findings about the criteria that are most important to buyers in selecting and assessing suppliers. The questions asked scrutinize the extent that environmental considerations are amongst buyers’ criteria for selecting and assessing suppliers. The following table (Table 5.1) shows the types of answers that were given by participants. They are: environmental factors are mandatory, environmental factors are preferential, and environmental factors never get mentioned.

Table 5.1: Environmental factors in selection and assessment criteria of suppliers- The opinion of buyer participants

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Environmental factors are mandatory</th>
<th>Environmental factors are preferential</th>
<th>Environmental factors never get mentioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP1</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP2</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP3</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP4</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP5</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP6</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP7</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP8</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP9</td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>BP10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP11</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP12</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP13</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP14</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP15</td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>BP16</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1 (6%)</td>
<td>13 (81%)</td>
<td>2 (13%)</td>
</tr>
</tbody>
</table>
Finding 1: Many participants (13 out of 16 [81%]) expressed that in selecting and assessing suppliers, environmental credentials are preferential. The main criteria were price and quality, followed by compliance with environmental laws and provision of recycled packaging.

A major finding of this study is that in their selection and assessment criteria of suppliers, many participants (13 out of 16 [81%]) stated that they prefer their suppliers to provide environmental credentials, but they had not imposed mandatory environmental requirements on them. Participants said they may sometimes ask suppliers about their practices for reducing their impact on the environment, but it is not a main decision making factor. Some participants contended that because they are locked into agreements (long term), environmental factors are not necessarily enforced. Participants used various terms when they referred to the non-mandatory aspect of environmental activities of suppliers: “we prefer”, “it is not mandatory”, “it is not an obligation”, “it is not absolutely essential”, “it is not the main offer”, “It is not a deal breaker”, or “It is not a precursor”.

Participants argued that they are positively influenced if suppliers could provide evidence of environmental management systems such as ISO 14001, or, any environmental policy and procedures. Nevertheless, they stated that although having environmental credential is favourable, it would be unlikely to change a decision significantly. Following are some ways participants expressed their views on the low significance of environmental factors in selection/assessment of suppliers:

They [suppliers] know it contributes to our decision making, but we don’t make it absolutely essential. They don’t need an ISO 14001; it’s not that sharp of a line. (BP4, Procurement Manager)

I don’t think it’s a deal breaker. If everything was equal then it would be a deal breaker. If we got two fit for purpose, technically equal, products and one came from a far more environmental responsible and had greater values in the DNA of their business, we would select them, no question at all. We don’t often see that. (BP16, Supply Chain Manager)

We ask them what they are doing for the environment, it works for them in their favour the long term, but because we are locked into agreements (long term), so they are not necessarily really forced. We monitor what they are
doing, and if we talk to other possible suppliers we ask what they are doing, but
nothing is mandated. (BP7, Supply Chain Manager)

Two participants (2 of 16 [13%]) mentioned their contracts with suppliers. They said
contracts are signed based on performance factors and there is no environmental factor.
One even went further by saying inclusion of environmental requirements in the selection
criteria of the firm makes the business less-competitive and, therefore, is not deemed a
major decision-making factor:

Two participants (2 of 16 [13%]) stated that their firms have included environmental
factors in their supplier scoring system. These firms had a supplier rating system—to some
extent similar—by which they select suppliers who score higher against specific criteria. If
suppliers could prove they are using environmentally-friendly practices, it would add to
their score. However, as a procurement manager described, it is still a minor percentage of
the total supplier score:

Out of that, there is a small percent for the environment compared to the total.
It’s probably 7 or 8 because if they don’t have an ISO14001, we’d get worried.
(BP4, Procurement Manager)

5. 2. 1. Price

From the interview responses, it was found that price is the most significant selection
criterion. When the participants were asked what really matters to them when it comes to
working with suppliers, nearly all (15 of 16 [94%]) talked about “the cheapest price”.
Participants said they want to go for the cheapest price and they do not have many
environmental requirements for their suppliers. This is best illustrated by the comments of
the following participants who said:

If we had to buy 10,000 of these, our company’s approach would be “let’s get
quotes on who can supply 10,000 of those” and we’d say “this company is $2 a
unit cheaper than the others, so let’s get it from them. We wouldn’t go and visit
their business and say “what’s your environmental policy and what’s your
process like? (BP12, Procurement Manager)

This price-driven approach was further confirmed by another participant when he
discussed the purchase of material from Australian suppliers compared to sourcing from
overseas:
We get aluminium from [A supplier] in Australia. It’s our biggest [spending] item. Nobody’s competing with them. All you’ve got then is imports. So then you’ll be comparing a manufacturer on site in country with downstream benefits to the environment versus buying aluminium from Korea. For us, they just present it to the mill. It’s completely separate, so really it comes down to price. (BP16, Supply Chain Manager)

Three participants (3 of 16 [19%])—from the automotive industry—were even more explicit when mentioning the escalating pressure exerted by their customers for them to reduce costs annually. They said they have been committed to substantial cost-downs to their customers every year; therefore, cost has always been an important issue for them.

Three participants (3 of 16 [19%]) gave a high priority to pricing, but environmental factors were also brought up with suppliers although nothing was mandated. The questions asked—for example, in purchasing agreements—were generally to ascertain suppliers’ practices rather than imposing practices upon them. These participants asserted that if they face situations in which there is a company who complies merely with their requirements, and another that moves beyond them, the latter company will obtain the contract. One participant mentioned that they have a panel who examines the suppliers, and if one gives better benefit, for not too much extra cost, they will select that supplier.

5.2.2. Quality

Amongst the criteria of supplier selection, quality was mentioned immediately after price and, in some cases, it was placed before price. Most participants (13 of 16 [81%]) said they want materials that they source to be delivered according to the specification. They asserted that material not of the right quality will be wasted, and consequently, production of waste would have the major environmental impact. One participant puts it this way:

As long as the quality meets our specifications, we don’t care...Sometimes you see tonnes of this stuff being dumped because it’s not going to specification.
We don’t have a lot of specifications around our suppliers to produce ISO 14001 management systems or copies of their sustainability policies or those kinds of things, but we want them to deliver our orders to our quality standards. (BP2, Environmental Manager)

Another participant described the importance of quality when he said: “Our aim is to get great product here at the right price, in the right quality, that’s our focus”.

5.2.3. Compliance with environmental regulation

Some firms (6 of 16 [38%]) revealed their concerns about the suppliers that they work with wanting to be compliant with environmental laws. They preferred to select suppliers that are aware of their environmental responsibilities and do not breach any environmental regulations. They said if suppliers breach an environmental law, the outcome may be passed on to them and they did not want to lose their reputation because of a malfunction of a supplier. Two participants described it in this way:

We would expect all of our suppliers to be an ethical company and not breach environmental safeguards. (BP12, Procurement Manager)

We outsource our maintenance and sometimes those contractors don’t take the care they should and they cause environmental pollution or they pour oil into the creek and we ends up wearing the costs and fines. (BP14, Procurement Manager)

Three participants (3 of 16 [19%]) referred to environmental regulations as the “minimum standard”. These participants (BP4, BP11 and BP13) expected their suppliers to meet the regulatory standards or the firms’ standards, which, in general, are meant to be above the regulatory standards. There was only one participant (BP14) who said their firm demand very strict environmental practices by suppliers. Product had to meet both the company and Australian regulations. Everything received and dispatched was monitored. When a purchasing order was made, purchasing department checked the product against the approved suppliers and items; if it was not on the list, it would not be purchased. A supplier that did not meet the standards was not included on the supplier list. The Procurement manager commented on this as follows:

If the supplier does not meet government or our environmental requirements initially, they are not chosen as a supplier, and they do not get to supply anything to us. (BP14, Procurement Manager)

5.2.4. Recycled packaging

Four firms (4 of 16 [25%]) pointed out the importance of recycled packaging as a criterion that is discussed with suppliers in purchasing agreements. They had explicitly stated in their agreement with suppliers that packaging needs to be recycled paper or cardboard. Firm BU5, for example, used to receive polystyrene packaging fill with a
product. They no longer were accepting polystyrene in packaging and had reengineered it to cardboard.

We’ve actually just done a new project where we import stators and rotors from Thailand. We’ve been over there 3 times and it’s been discussed because they wanted to package it with polystyrene but we want everything to be recyclable.
(BP8, Quality and Sustainability Manager)

Firm BU10 had certain packaging criteria that were incorporated in the firm’s OH&S policy:

There are OH&S policies, some of which are environmental. For instance, there are certain packaging that is mandated to be recyclable, e.g. timber and recyclable cardboards, so no foams, nothing that goes to landfill. (BP13, Procurement Manager)

5. 2. 5. Ongoing assessment of suppliers and finding a gap

It was explained in previous section that in selecting suppliers, buying firms would prefer to work with suppliers that provide environmental credentials. However, participants argued that it is not a major factor in decision making. In regards to environmental factors in ongoing assessment of suppliers, most participants (14 of 16 [88%]) stated that their firms have not changed their assessment procedure to include environmental requirements. It was, nonetheless, possible to distinguish between two groups of firms. The first group consisted of two participants (2 out of 16 [13%]) who said that their firms have not yet considered evaluating suppliers on the basis of their environmental merits. These firms neither had environmental criteria in their audits nor considered the environmental performance of their suppliers. Their audits purely focused on the quality aspects of their suppliers:

We don’t audit from an environmental point of view. We only audit from a quality point of view, and environment is not part of our quality standard.
(BP13, Procurement Manager)

The second group consisted of participants (14 out of 16 [88%]) who said they are concerned about the environmental performance of their suppliers. Either they had included or intended to include environmental questions in their periodic audits. For example, one participant said their firm is in the early stage of developing an environmental
questionnaire and have questions relating to the following: how suppliers track their footprint, whether suppliers have an environmental management system; environmental targets, “take back recycling” service; how suppliers deal with their packaging; whether they have policies around hazardous substances within their products and how they deal with that. These participants used internal auditors or third-party auditors to evaluate their suppliers. However, if a supplier had already been audited by another company, they would use that report. These participants were worried about the consequences of the activities of their suppliers that may impact either their firms’ reputation or result in their firms paying penalties.

Both groups—regardless whether or not the firm is assessing the suppliers based on their environmental merits—were asked what they would do if they found a problem in the environmental performance of suppliers. All participants (16 of 16 [100%]) seemed to be flexible towards environmental breaches. They said, they would consider how big the problem is, whether it is a serious issue or not, then they would issue a corrective action and give the supplier time to fix it. Participants stated that because environmental factors are preferential, it would not cause them to simply eliminate suppliers that may have some environmental discrepancies; rather, their approach is to work with the suppliers in correcting problems. This is best illustrated by the comments of one participant:

As part of our audit, twice a year, we have an auditor who goes around and checks the factories out and marks down whether they are compliant or not in that they have any effect on the environment. If there is, then we put measures in, to try and fix the problem. If it is pipes leading into the river; dyes stuffs, we try and avoid people who use dye stuffs which then go and pollute the river. So we do everything we can in our power. (BP6, Operations Manager)

If buying firms reassessed a non-compliant supplier and found out that the supplier showed no willingness to change, then they would consider eliminating that supplier from purchasing list. Nevertheless, most participants (11 of 16 [69%]) stated that it would be unlikely that suppliers do not cooperate to fix the non-compliance. They said if they ask for something, there is a reason why they want it and the suppliers may not want to provide it and then they discuss the implications. In the unlikely event of unwillingness of the supplier to commit to fix the problem, buyers may reconsider working with that particular supplier and find an alternative supplier. Based on the responses of participants, firm BU2 was the only one that had an experience terminating a non-compliant supplier:
There was a supplier that didn’t have an environmental and quality system. We audited them for continuing business. We found that they didn’t have any adequate OH&S and environmental practices. They were a small organisation who didn’t see the benefits or weren’t willing to pay the extra cost of improving the systems. We then took that business away and went to our original supplier and told them they need to incorporate what we are doing here, into the product. (BP4, Procurement Manager)

Some participants (9 of 16 [56%]) stated that if they ask a supplier to fix an environmental problem, they know it would take some time and resources to be assigned to the task. Thus, they would not expect suppliers to fix the problem immediately. But, they wanted evidence that the supplier was taking appropriate actions and was willing to find a resolution:

We would give them time. You don’t have any resources to do it over the next 48 hours, but over the next 3 months, you’ll find resources. A lot of the information is readily available. It is very onerous, we understand that. But if you want to do business with us, and if I say to you: “if I want you to spend 6 hours doing something, over the next 48 hours it’s a little unreasonable, but over the next 3 months, 6 months, 12 months you should be able to do it. (BP1, Procurement Manager)
5.3. Cooperation with suppliers

In advancing their environmental innovativeness, buyers may not interact with their suppliers at all; they may, however, have some limited interaction with suppliers over particular environmental issues, or they may engage with their suppliers closely and make joint plans. The following table (Table 5.2) shows the responses of participants about the way they cooperate with their suppliers on developing environmental innovations and addressing environmental issues.

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>No cooperation</th>
<th>Limited interaction over particular issues</th>
<th>Joint planning and decision making</th>
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<tbody>
<tr>
<td>BP1</td>
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<td>BP15</td>
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<td></td>
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<tr>
<td>BP16</td>
<td>●</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>11 (69%)</td>
<td>5 (31%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
Finding 2: Many participants (11 out of 16 [69%]) stated that they have not been engaged with their suppliers on any type of environmental innovations at all. Only five participants (5 out of 16 [31%]) provided examples of some limited interaction with their suppliers.

Given that, for buyers, environmental issues were not as important as other factors (e.g., price, quality, and delivery time) in selection of suppliers, it was not surprising that cooperation between firms and their suppliers was rare. Many participants (11 out of 16 [69%]) indicated “no cooperation” with their suppliers on environmental issues. Some participants, however, (5 out of 16 [31%]) indicated that they have had few cooperative experiences with their suppliers, yet none of them had a formal procedure for engaging suppliers on environmental innovations.

Some participants (4 out of 16 [25%]) asserted that they would like to receive environmentally innovative ideas from suppliers. However, they have had rarely experienced this happening and they stated that it would be unlikely to occur in future. This is best illustrated by the comment of the following participant:

We have to go and search for it [environmental proposal] to be honest. I think on one hand I could count the number of people [suppliers] who come to us with a true environmental proposal in the last two years. (BP9, Procurement Manager)

The suppliers are third party companies; the best way for them to reduce their footprint is for me to give them less business, which is counterproductive for them. Usually the ball is in their court, so the ball is in their court to come up with environmental improvements. (BP7, Supply Chain Manager)

Seven participants (7 out of 16 [44%]) mentioned that their relationship with their suppliers is mainly based on a buy and sell, based on cost. They said they have not worked with their suppliers closely to redesign processes to be more environmentally friendly or to create new products that are less harmful to the environment:

There are examples but in other parts of the business. They aren’t so much related to this [The environment]. They are more focused on the ways to reduce the price. (BP11, Procurement Manager)
The need to improve firstly their own internal environmental performance was expressed by three participants (3 out of 16 [19%]) as a reason for not acting cooperatively. On this point, the procurement manager of BU12 commented: “I can’t think of any joint environmental work with suppliers on top of my head. On our own manufacturing side, we are looking at ways of innovating our manufacturing environmentally”. Participants asserted that if they decide to demand their suppliers to adopt environmental practices, they would have to prove that in the first place. That is the reason they claimed their current focus is to look at the way they can improve their environmental performance internally. This would act as an example for suppliers:

The focus at the moment is looking at the way we do things internally. Fixing where we can and then going back to suppliers and saying “this is what we’ve done. What can you do with your own product?” because it’s very difficult for us to go out to a supplier and say “let’s look at the packaging for this product and we want you to fix it and we want you to change it and make it have a lower environmental impact.” When we have got all these products that we haven’t fixed the packaging of. So we want to get our own stuff in order. And then go out to suppliers and say “we’ve done this, now let’s work together and see what we can do for your products as well. (BP11, Procurement Manager)

Two participants (2 out of 16 [13%]) stated that they want to first examine the results of their environmental audits. Once they have sufficient experience, they would then instigate cooperative relations with suppliers on environmental issues:

Our auditing only started a year and a half ago. So we haven’t had much experience in that. (BP6, Operations Manager)

As it described above, five participants from four companies stated that they had been involved in some limited cooperation with their suppliers on environmental improvements. However, similar to the first finding that suggested the motivation for firms to invest in environmental innovations is cost-saving opportunities; the rationale for these cooperative activities with suppliers was mainly to reap the economic benefits. In the following paragraphs the cooperation experiences of these four buyers and their initiatives are elucidated.

Firm BU2 met its suppliers regularly. They acted on any opportunity that arose for improving the performance of either party. BU2 requested its suppliers to provide suggestions for improvement based on three criteria: environment, quality and safety.
Chapter 5: Findings for Buyers

There was some positive feedback from suppliers. Initiatives ranged from recycling activities to changing to more efficient air conditioning and better work practices. An example came from a plastic supplier who needed BU2’s support to obtain ISO14001 certification. BU2 worked closely with this supplier and helped it to obtain the certificate. In this example, BU2 acted as the best practice agent for the supplier so that the supplier could modify and develop its own version and for their conditions. The procurement manager of BU2 said that, on the start of project, they thought it would be impossible for the supplier to obtain ISO 14001 certification, but through cooperative efforts they were successful. The following comment illustrates the reason for the success of the project:

Our advantage is we had already done it. So rather than [the supplier] having to go and hire somebody, start from zero and learn about the company and think about what’s best and how to implement it, someone like (Operations leader) who knew the company and the practices can easily come up with efficient path to get there without having to explore ten different options, because of his experience in our own company. (BP4, Procurement Manager)

In another effective initiative, a supplier suggested BU2 that they send materials in returnable containers instead of cardboard boxes. The saving that was generated from this initiative was then shared between both BU2 and the supplier. In another instance, a supplier reduced the size of an incoming part, which in turn reduced the raw material consumption. This innovation benefited BU2 too, because they received lighter and cheaper components.

Firm BU1 had only one example in which the firm collaborated with a particular supplier. It concerns a biological treatment technology—in which bugs eat the waste—to treat its industrial waste. The project was implemented and has produced positive environmental benefits.

At a time of conducting this research BU5 was working closely with one of its suppliers to improve the energy efficiency of one of its main products. In another example that was mentioned, BU5 worked with a supplier to remove and replace polystyrene caps used in an incoming part with recyclable cardboard. The supplier did so and as a result now BU5 sends the cardboard to one of recycling companies and earns $20 a tonne back.

Firm BU7 had an environmental initiative in which the company was trying to increase the awareness of its suppliers by showing them the best practices in using electricity and other types of energy. BU7 recruited a third-party organisation that inspects the
manufacturing facility of the suppliers’ plants and measure how efficient the companies are at using their resources (e.g., electricity, water, etc.). Then the reports along with the improvement suggestions are sent to the suppliers. The Procurement Manager framed their dialogue with the suppliers as follows:

You [suppliers] can’t invest. But can you look at the ways of reducing the electricity that you are already getting from the grid. You are also reducing your impact on the environment if you are using less electricity. That’s where we are trying to focus right now. We are not making it mandatory for everyone to install solar panels or have their own rainwater harvesting system. Instead we are working collaboratively with our suppliers to say that “ok, we understand you can’t invest. But can you reduce what you are using from the current footprint.” (BP10, Procurement Manager)

BU7 had also started working with its suppliers to change the current packaging to returnable packaging. If for any reason suppliers could not use returnable packaging, then they would be advised to consider recyclable packaging. The procurement Manager of BU7 commented on this by saying: “There is no more packaging that you have to throw after using it one time”.

One major issue for BU7 was finding ways to reduce the weight of components that go to the final product. Therefore, as the Procurement Manager claimed they are constantly looking for opportunities to work with their suppliers to replace the current parts with lighter parts while still achieving the same strength:

We do the initial study and if it looks like we can make a part from aluminium and that will reduce the weight of the component for example by 30%, we say to our supplier let’s do the prototyping and see if your machines are capable of making the same thing from aluminium. And then that’s the type of study we would jointly do with a supplier. (BP10, Procurement Manager)

Participants were asked about their willingness to help suppliers, whether the buyers requested suppliers seek environmental improvements or suppliers themselves proposed environmentally innovative ideas. Almost all participants (15 out of 16 [94%]) expressed the willingness of their firms to help suppliers. However, they argued that it also depends on the type of environmental innovations. If buyers could see more benefits in it—mainly financial advantage—and it meets their product specifications, they would show more interest and may dedicate more resources. The following quotes illustrate this point:
If we said we wanted their supply to decrease energy intensity by 20% over the next 5 years and they said they have no idea how to do that, can you help? We would try to facilitate and help and we might put some resource towards it, if the reward was big enough. (BP14, Procurement Manager)

We’d sit down and listen. From that point of view, we’d have no issues. There would have to be a benefit, whether it is a significant environmental benefit. (BP15, Procurement Manager)

Buyers were not keen to provide financial aid to suppliers. They may help by providing human expertise or sharing their environmental knowledge. Participants argued that because suppliers are separate businesses, it is their responsibility to fund projects that benefit them directly. This notion is best illustrated by the comments of two participants:

We don’t provide finance. On the human side we don’t help them as such, but we point out the issues. (BP5, Procurement Manager)

With the funds side, we wouldn’t be offering resources; we would offer minor assistance. If a supplier said “we need help” we would be more than willing to show them what we do, how we started off and even do a site visit at their place and show them how we started off, maybe a dumpster dive. Start with the easy, low stuff and it just builds up momentum. (BP8, Quality and Sustainability Manager)

A few participants (3 of 16 [19%]), who had some limited environmental cooperative experience with their suppliers, pointed out the significance of technical knowledge and expertise that suppliers brought to their organisations. These participants stated that they may know what they want, but they do not necessarily know how it should be done. Thus, they rely on the suppliers’ knowledge and trust them on what they do:

If we buy plastic parts as we did in the case of (...), we understand we want the part to be a certain size and consistent and that sort of thing. But, the specific of how they make it is their specialty, not ours. (BP4, Procurement Manager)

When we find the supplier, if they are used to doing something more so than us, we will take everything, all suggestions on board. They are the experts; we just know what we want as a final result. (BP8, Quality and Sustainability Manager)
Two participants (2 out of 16 [13%]) were using seminars as a means of increasing the awareness of their suppliers about the expectations of their companies. These seminars, however, mainly focused on the operational performance of the suppliers. The two firms expressed that in their future seminars, they have planned to lay out their environmental requirements and possibly encourage suppliers to provide environmental ideas and findings ways to cooperate with them:

In a couple of weeks, a supplier conference with all of our key suppliers and one of the things that we want to speak about is: moving forward, what quality stuff they need to do but also about the environment as well. That's where we will mention things about the packaging try and do our bit for the environment the way that we do recycling here. We try to get our suppliers to do that as well. (BP8, Quality and Sustainability Manager)

We have two or three what we call “seminars” a year where we get all our suppliers together for a whole day and detail to them how we assess them and give them their scores and why. So they find out how they are getting assessed and how they are being encouraged. (BP5, Procurement Manager)
5. 4. Motivations to develop environmental innovations and invest in GSCM

Firms may have various motivations in investing in environmental initiatives. Such motivations seem to vary from pure compliance with environmental regulations to cost-saving opportunities and profit making. The following table (Table 5.3) demonstrates the responses of participants to the question of what motivates them to develop environmental innovations and invest in GSCM.

Table 5.3: Motivations to develop environmental innovations and invest in GSCM-Buyers

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Cost-saving opportunities</th>
<th>Compliance with environmental regulations</th>
<th>Increased requests from business customers</th>
<th>Being a market leader</th>
<th>Doing what is right</th>
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<tbody>
<tr>
<td>BP1</td>
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<td>BP16</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>14 (88%)</strong></td>
<td><strong>8 (50%)</strong></td>
<td><strong>4 (25%)</strong></td>
<td><strong>1 (6%)</strong></td>
<td><strong>1 (6%)</strong></td>
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</table>
Finding 3: Most of participants (14 out of 16 [88%]) stated that the main motivation they see to develop environmental innovations and invest in GSCM is the opportunity for cost-savings. Increasingly stricter environmental regulations (such as carbon tax) and increased requests by business customers were also mentioned by some participants.

5. 4. 1. Cost-saving opportunities

The cost-saving opportunities that come with the introduction of environmental initiatives was a recurring driver expressed by most of participants (14 out of 16 [88%]). This finding is highly significant in terms of illustrating the process by which firms make decisions about investment in environmental initiatives. Two participants put it in these ways:

Well, everything comes down to a cost benefit; the beauty about environmental initiatives is, quite often, if you reduce your environmental footprint, you save some money, so that gets a big tick. (BP7, Supply Chain Manager)

We've done some things in supply chain mainly from a cost point of view. We can change the way we freight things from roads to rail. For us, we might look at it costing $300,000. Is there a reduction? We have changed some processes where we stored things 30km out of Sydney and sent them to Newcastle. We said we are right by the port, let's leave them there. We did it from a cost point of view, but it has an environmental flow on effect. They're the kind of things we are constantly looking at. (BP15, Procurement Manager)

Participants emphasised the practicality and viability of environmental initiatives. They asserted that many firms would like to develop environmental innovations and adopt green supply chain practices, only if these practices are economically profitable and only if there are business cases for such initiatives. They argued that most businesses do not invest in something that will increase the price of a product merely because it benefits the environment. It has to be commercially viable, reduces the cost, increases the efficiency or generates profit:

Let's say we are going to change the lighting in our warehouses, so to be more energy efficient. But you do that because the electricity charges are getting to the point where this is a better case. So, there is a lot of opportunity to do the
right thing for the environment but also economically sustainable and economically beneficial that’s what we love. (BP10, Procurement Manager)

The way we get our most of environmental initiatives through is by pragmatically above the minimum regulatory standard. Just to make them commercially viable as well. They are the best ones. What you do is you put a business case for it. So, ok, I am going to make sure I go down the path of changing the lighting in our warehouses, so to be more energy efficient. (BP1, Procurement Manager)

I think our environmental credentials are winning us more business than losing us. So, we are pushing that because we believe as an organisation that things we are doing are going to make a benefit and we are doing it anyway. But, we need to make sure that we are selling it as well. (BP3, Sustainability Manager)

Among the comments cited were those by the Procurement Manager of BU9 who said: “Again it comes down to cost. I think some of the power generators are not making much money since the privatisation. So, yeah it always comes down to cost.” Another participant referred to the viability aspect of environmental innovations as “fit for purpose”. He said:

From a buying commodity, it’s about being fit for purpose. We wouldn’t buy a product that’s not fit for purpose or as appropriate as we need. Just because you are environmentally friendly...We respect it as a part of our value set, but it probably wouldn’t sway a decision. (BP16, Supply Chain Manager)
5. 4. 2. Compliance with environmental regulations

In the discussion of driving forces behind the environmental activities of firms, some participants (8 out of 16 [50%]) asserted that environmental regulations\(^5\) are becoming more stringent, and this, requires them to devise ways to avoid penalties and reputational risks of non-compliance. Participants mentioned that government regulations are constantly forcing them to be aware of their obligation and demanding them to monitor their environmental impacts such as watching their emissions. Nevertheless, no evidence was provided by the participants that environmental regulations have encouraged them to move beyond the standards. That is, most examples were about compliance with current regulations or prospective regulations. No participant mentioned anything about being interested in investing in developing environmental innovations along the supply chains because of government regulations. The regulatory requirement is illustrated by the following comment of one participant:

> As part of our business we have to comply with a license. If we are found to be breaching that licence, we can suffer a penalty. I don't mean that if we didn't have a licence, we'd be out there blatantly polluting the world, but yeah our licence just requires us to manage our own business within the licence requirements which says you are not allowed to emit things off your boundary.

(BP12, Procurement Manager)

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\(^{5}\) The main organisation that controls the environmental impact of business in Victoria, Australia is the Environment Protection Authority Victoria (EPA Victoria). EPA was established in 1970 and is responsible for the protection and improvement of the quality of the environment. It controls and monitors all activities relating to the discharge of waste, including emissions to air and water, noise, contaminated sites, municipal waste, and the generation, handling, treatment and disposal of industrial waste. EPA Victoria uses licences and works approvals to control discharge of emissions to air, land and water. Licences are required for the emission or disposal of waste, the treatment of waste or the handling of ozone-depleting substances at certain types of premises. Moreover, they are required for the transport of certain types of wastes. Works approvals, however, are required for new developments that could produce a potentially harmful discharge to the environment or an increase or change in an existing discharge. A works approval provides an overall framework for controlling discharges and the effects of an activity both off-site and on-site. Works approvals specify the type and volume of discharges for which licences may be issued for the premises (Leshinsky, 2010).
The liability and negative consequences of breaching environmental laws was stated to be so great that buyers did not want to ignore or underestimate it. Participants said environmental laws are becoming stricter and it is becoming more costly not to comply with government regulations:

We modify our trucks and our plants and our customer’s sites to bring in more funding. There is a cost when you don’t do it, for instance jail and fines. (BP15, Procurement Manager)

All participants raised a concern for the carbon tax (CT). Recently legislated, it was soon to be implemented. Some participants (4 out of 16 [25%]) said their firms had already started preparing for its impact and had formed groups to deal with it. However, over half the participants (9 out of 16 [56%]), said their firms were uncertain about what they were obliged to do.

There were mixed views on the effect of carbon tax on businesses. Some participants (7 out of 16 [44%]) were positive about the benefits of CT and argued that it would change the attitudes of firms and encourage them to find better solutions. This group argued that by increasing the final price of the products, carbon tax would change the individual decision point. They argued that it would change the consumer behaviour and they hoped this would flow back through the supply chain. Therefore, all firms including buyers and suppliers, and suppliers of suppliers, would have an incentive to invest in environmentally innovative technologies because they would receive a competitive advantage compared to those firms who had not done so. They would also be able to sell more to consumers. Proponents of carbon tax argued that this would be an initial step to move towards a

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6 - Carbon tax is a form of pollution tax. It is based on the economic principle of negative externalities. Externalities are costs or benefits generated by the production of goods and services. Negative externalities are costs that are not paid for. When utilities, businesses or homeowners consume fossil fuels, they create pollution that has a societal cost; everyone suffers from the effects of pollution. Proponents of a carbon tax believe that the price of fossil fuels should account for these societal costs. The Australian Government has introduced carbon tax from 1th July 2012. Under this new legislation the top 500 polluters have to pay per tonne of carbon they emit into the atmosphere. The price is set at $23, and increases gradually until 2015, when there will be a shift to trading scheme that will let the market set the price. Electricity generators will be also required to participate directly in the carbon scheme by reporting on their emissions and then acquiring permits to surrender. The cost of purchasing carbon permits will therefore increase the cost of producing electricity, meaning that the sale price of electricity will rise accordingly. Therefore the $23 per tonne carbon price will be passed on to the customer in the form of higher electricity prices that the Government indicates will “provide an incentive for households and businesses to use energy more wisely” (Dowdey, 2012; Energy Action, 2012).
sustainable society and a greener supply chain management. One participant conveyed this view when he said:

I am a big supporter of the carbon tax, because I think that is the first real change that we have ever made to force people to take things seriously. We don’t do enough. It stems from the top to down. When they try, the solutions they come up with are half baked, and not up to scratch. (BP7, Supply Chain Manager)

Two participants (2 out of 16 [13%]) strongly supported the carbon tax because they thought it would pave the way for an Emission Trading Scheme (ETS). ETS is based on a “cap and trade” principle, providing economic incentives to firms to reduce their emissions. There would be a “cap”, or limit, on the emission of specific greenhouse gases by companies. Under this limit, companies receive emission allowances that they can then sell to, or buy from, each other as needed. Limited availability of allowances ensures that they have value. At the end of each year each company must surrender enough allowances to cover all its emissions; otherwise they will be fined. If a company reduces its emissions, it can keep the extra allowances to cover its future needs or else sell them to another company that is short of allowances. The number of allowances is then reduced over time so that total emissions fall (Bonifant and Arnold, 1995).

Other participants (9 out of 16 [56%]), however, were sceptical about the positive impacts of carbon tax. These participants questioned the extent that carbon tax will drive genuine technical innovation. They claimed that the carbon tax may cause some manufacturing firms to move overseas. They were concerned that carbon tax makes competition more difficult for manufacturers in Australia than overseas, especially Asian countries. Their argument was that overseas manufacturers are not enforced to pay carbon tax; therefore, they are able to presents their products with lower prices compared to Australian manufacturers that have to bear the extra carbon tax.

I am a bit sceptical about carbon tax working because what I think it just offshores things to people who don't have a carbon tax. We've already seen it; people are already making that decision. We nearly made in quite few cases. The issue is that without some other consideration if it was just purely the price that comes out of it one with carbon and without we are better off going to Korea. It is actually quite scary for Australian economy. It is an exceptional
impost on the business. Let's say just our competitors don't pass it through and we do, we will lose business. (BP1, Procurement Manager)

Opponents of carbon tax argued that it is not about whether carbon tax is good or bad. They said they know that in principle carbon tax may benefit the entire nation in some ways, but they argued that they do not think it was a good time to introduce it. They claimed that after the financial crisis in 2008, the entire manufacturing industry was struggling to operate normally. They feared that the carbon tax makes imports more attractive and, consequently, makes the Australian manufacturers less competitive.

Nevertheless, some supporters of carbon tax argued that there will never be time that manufacturers will accept as appropriate for its introduction. They perceived the counter-arguments of carbon tax as a justification to avoid the difficulties of the change:

I don't think anytime is going to be a good time. People are going to say we are struggling. If you read the papers and from what government are saying, we have come out of the global financial crisis very well. We have had 7% growth. (BP9, Procurement Manager)

5. 4. 3. Increased requests from business customers

Four participants (4 out of 16 [25%]) mentioned the pressure from their business customers to adopt environmental practices. Although this pressure may not be in the form of fines or heavy penalties for buyers, they asserted that it may result in less market share and less business with customers, or, even the termination of business, with consequent losses:

We do it because the customer said “if you don’t do this, we won’t buy from you. (BP12, Procurement Manager)

If you put compliance to one side, because that’s not negotiable, the main pressure point comes from customers. The supply chain feeds backwards. What is the consumer going to be looking for? (BP2, Environmental Manager)

Three participants (3 out of 16 [19%]) described the ever-increasing demand from business customers to provide environmental credentials when they submit tenders. They said recently when they submit tenders—particularly with financial institutions such as banks—they receive general questions about the environment: Do they have an EMS? Are they certified? What are their companies’ approaches to protecting the environment or
sustainability in general? And how do they assess their supply chains? One participant explained how some customers require them to subscribe to Sedex, a third-party organisation, which monitors the firm’s sourcing practices. This participant said they questioned on sourcing of material. If sourced from Middle Eastern or African countries, they must answer a long list of supplementary questions.

5. 4. 4. Being a market leader

Only one participant (1 out of 16 [6%]) highlighted the importance of being a market leader as an impetus for investing in environmental innovations and GSCM. He said:

We have to be innovative. If you stick with the same product, you won’t get anywhere. If ours can be more energy efficient or quieter or something like that, then we can get that product out into the market before our competitor.
It’s quicker better faster than our competitors. (BP8, Quality and Sustainability Manager)

5. 4. 5. Doing what is right for the environment and the society

Doing what is right for the environment and the society was only mentioned by one participant (1 out of 16 [6%]). This participant stated that the aim for their firm in investing in environmental initiatives is to go beyond compliance, towards making their business environment and practices green. For them, investing in environmental initiatives not only made good business sense, but was righteous:

We’re a moral and ethical company and we want to do best by the environment. There’s no real incentive for us, except for trying to do the right thing. (BP6, Operations Manager)

7 - Sedex is a not for profit membership organisation launched in 2004 dedicated to driving improvements in ethical and responsible business practices in global supply chains. Sedex has an online database which allows members to store, share and report on information in four areas: Labour standards, Health & Safety, The environment, Business ethics
5. 5. Barriers in developing environmental innovations and investing in GSCM

The low rate of developing environmental innovations in cooperation with suppliers indicated that barriers discourage investment by firms. The following table (Table 5.4) shows the responses of participants about the various barriers standing in the way of them to develop environmental innovations and adopt green supply chain practices.

Table 5.4: Barriers in developing environmental innovations and investing in GSCM-Buyers

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>High cost and long payback period</th>
<th>The low importance of EIs for suppliers</th>
<th>Suppliers being overseas makes it hard to monitor</th>
<th>Few EI ideas</th>
<th>Many green proposals do not have true benefits</th>
<th>Low consumer demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP2</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP3</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP4</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP5</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP6</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP7</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP8</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP9</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP10</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP11</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<tr>
<td>BP12</td>
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<tr>
<td>BP13</td>
<td>●</td>
<td>●</td>
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<td>●</td>
<td>●</td>
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<tr>
<td>BP14</td>
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<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>BP16</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Total</td>
<td>11 (69%)</td>
<td>8 (50%)</td>
<td>5 (31%)</td>
<td>4 (25%)</td>
<td>3 (19%)</td>
<td>3 (19%)</td>
</tr>
</tbody>
</table>
Finding 4: Many participants (11 out of 16 [69%]) claimed that high investment cost and long payback period of environmental innovations as the main barrier for green supply chain management. Half the participants (8 out of 16 [50%]) cited low importance of environmental innovations for suppliers as an additional barrier.

5.5.1. High cost and long payback period of environmental innovations

Many participants (11 out of 16 [69%]) commented on the high cost of environmental investments and their long payback periods, and described these as a critical impediment to investments by both buyers and suppliers. As one participant said, “I don’t believe there is anyone that does not understand the importance of the environment and being responsible for producing waste and putting things in the landfill”. The main constraint was the large cost of investment not their antipathy towards environmental matters. It was, however, cited by a few participants (3 out of 16 [19%]) that the main cost is at the development phase. But this cost may be amortised over time. Following is an illustration of a participants’ comment about environmental initiatives being expensive:

Let me give you one example of a supplier whose business is aluminium foundry or as a matter of fact, any heavy metal driven industry. They use a lot of energy. They might be using a lot of electricity and a lot of water. They may also be using a lot of gas to produce the product. Let’s take electricity for example. Their electricity bill’s very high and they would like to reduce it. We would like to suggest they use environmentally efficient way of harvesting electricity. But when they do the cost-benefit analysis, the cost of installing the solar panels or the type of power they need or a dedicated windmill for the type of power they need, there is no justification for spending that much money because that means they will incur more costs than buying the cheaper. (BP10, Procurement Manager)

Investment, there are a lot of good ideas but there is always a constraint on how much money we have to invest on things. Investment is always the biggest concern. Resources, if you have the money, you can find the right people. (BP11, Procurement Manager)

It was not only the cost of environmental initiatives that was a concern for this group of participants, but the payback period as well. They argued that long paybacks lessen the motivation of them or their suppliers to further invest. Participants claimed that the time
span is too long. In some cases there is no rate of return. By the time they amortise their costs, the equipment needs refurbishment. Participants contended that to receive return on the investment, they need to increase the price, thereby making them less competitive.

A quarter of participants (4 out of 16 [25%]) linked the low motivation by many manufacturers to the economic conditions after the Global Financial Crisis (GFC) in 2008. They contended that the number of environmental projects dropped from pre-GFC, when businesses were profitable and capable of creating more opportunities. They asserted that businesses have insufficient funds to invest in environmental innovations, after the GFC. They declared that greening supply chains is a long-term process, and many suppliers are worried about whether in next month their customers will still exist:

If we said tomorrow that “you [a supplier] need to get 14001 or we are going to stop doing business with you” some of them might say “ok, we are going to stop doing business” because it’s just not worth it. That’s the real problem that you have. (BP4, Procurement Manager)

Some participants (4 out of 16 [25%]), who had already mentioned the cost of environmental investments as an impediment, pointed out the challenge of competing with overseas manufacturers as one issue that has been time consuming. They argued that, the priority was keeping their businesses from going bankrupt, and then, devising ways to improve the environmental performance of their supply chains. This group of participants mentioned the high Australian dollar, high labour costs, government regulations, and the small local market as the main challenges for manufacturers in Australia:

Australia is already a high cost, high labour, high burned for manufacturers. And then there is the carbon tax and then there are other factors that make the business very uncompetitive, especially when you can import things from another country, duty free. When your competition is coming from a country or environment where you don't have to adhere to safety regulations and labour laws and the same kind of infrastructure, it is very difficult for our suppliers, all of them, to invest the kind of money they need to. (BP10, Procurement Manager)

Two participants (2 out of 16 [13%]) explicitly mentioned their industry (Automotive industry) as a real issue. They argued that income is reducing because volumes of products were reducing significantly every year. Therefore, they may have to cut back on programs
that are not directly related to delivering product to customers, such as environmental and sustainability programs.

5.5.2. Low importance of environmental initiatives to suppliers

Half of the participants (8 out of 16 [50%]) argued that rolling out environmental innovation in their supply chain is difficult, because suppliers do not see the value in it and it is not in the suppliers’ agenda—some participants (5 of 16 [31%]) used the word “reluctant”. Buyers were asked to rank the importance of environmental issues for their suppliers, based on a scale ranging from 0 (meaning not important at all) to 10 (meaning very much important). Two participants scored the importance of environmental initiatives for their suppliers less than two. Eight participants indicated the low importance of environmental initiatives for their suppliers by scoring them under four. Five participants rated their suppliers between four and seven. One participant only rated a high importance of environmental initiatives to its major suppliers by scoring them eight. The average response was 4.28 out of ten (Figure 5.1).

![Figure 5.1: Participants’ views about the importance of environmental issues to their suppliers (1: Not important at all, 10: Very important)](image)

Among those participants who expressed low importance of environmental initiatives for their suppliers as a barrier, three (3 of 16 [19%]) contended that the main reason for their suppliers to be in the business is making money. They said that suppliers do not consider the environmental impact of their businesses important. Participants argued that it is not in the suppliers’ mindset to come up with environmentally innovative ideas—they
described it as a compliance-oriented attitude. Participants claimed that their suppliers do whatever they ask for, noting more. They go as far as the requirements are fulfilled. One participant said that a supplier may make a suggestion, but it would be unlikely to be an environmental proposal. Participants commented that their suppliers’ approach is how they can keep their businesses running and compete against others to obtain market share. They claimed that in most cases, suppliers are so focused on cost-benefit analysis that they do not perceive environment initiatives as a primary decision point for buyers. One participant described it in this way:

For them [suppliers], it’s not as important as it is for us. A majority of them are in it for the money side. They don’t put as much importance into it as we do. (BP11, Procurement Manager)

I don’t think they see environmental considerations are going to win them that case. In most cases they are trying to get in front of the others from a cost perspective. I don’t think they see that [environmental innovation] as our primary decision point. (BP9, Procurement Manager)

One participant said if they exert pressure on their suppliers to enforce them to improve their environmental performance, suppliers may take it seriously, but they were not sure that suppliers’ actions will be sufficient.

Some participants (7 of 16 [44%]) said the size of suppliers has a direct relationship with how suppliers value and care about the environment. Participants asserted that large organisations that have already established reputations are more environmentally thoughtful than small-sized suppliers. They gave as the reason that large corporations have more obligations to fulfil and may be monitored by the government. Whether or not suppliers belong to a dirty industry was another factor mentioned by participants in determining the importance of environmental initiatives for suppliers. The significance of suppliers’ size and industry is best illustrated by the comment of the following participant:

It depends on the suppliers. Our main suppliers are paper products, aluminium, glass raw materials for them very much so, heavy industries that are environmentally sensitive and large corporations that are very concern about their reputations. (BP1, Procurement Manager)

A few participants (3 of 16 [19%]) who were sourcing from various suppliers from different countries, raised the issue of the country from which they source. They asserted
that importance varies from one country to another. They contended that the importance of environment is not as high in Asia as it is in Europe and the U.S.A. For example, one participant said:

Environmental innovations in Asia tend to be more legal requirements than self-innovations. (BP15, Procurement Manager)

5.5.3. Working with overseas suppliers

Some participants (5 of 16 [31%]), expressed concerns about monitoring or working with overseas suppliers. In general, most participants had some suppliers from abroad. Some buyers with no local suppliers stated that it was due to the high cost of sourcing locally. The main issues that rose were the distance, the language barriers and the different environmental regulations across countries. Following quote demonstrates such concerns:

They aren’t Australia-based. It’s hard to work with these guys when we don’t know what their practices and legal compliances are; when they deal with people on a global scale, we are just a small part of their business. Ability to work with them is limited. They are not just down the road. The language barriers have different laws and influencing them in that side of things would be a challenge. If you go to them and want to invest money and time into a 12 month project, it would be difficult. (BP15, Procurement Manager)

5.5.4. Few environmental innovation ideas

A quarter of participants (4 of 16 [25%]) said that they are keen on co-investing with their suppliers on environmental innovations, but the problem is they do not find many useful ideas to implement. They claimed that there was inadequate research and insufficient examples of best practices available for businesses. These participants asserted that the manufacturing sector—especially they referred to their own industries—is immature and has not yet reached a point where environmental innovations become readily available or easily discussed:

Everyone talks about reducing our footprint, once you recycle a little cardboard, reuse a little water, reduce your electricity, but really what does it mean. So, my opinion is that the industry is very immature; nobody is providing any solutions, except very basic solutions, like using a little bit less cardboard and wasting less. These are small things. No one is doing the big ticket items. (BP7, Supply Chain Manager)
5.5.5. Not true environmental proposals

A few participants (3 of 16 [19%]) were sceptical about suppliers’ environmental proposals. This group said many of the proposals are “green washing”. They said that they have seen little or no effort from suppliers towards reducing energy or waste—and in general reducing their impact on the environment. They described the supplier environmental suggestions as a way of legitimising their activities, but whether it is a real suggestion with a positive environmental and economic impact was questionable for these participants. One participant puts it this way:

A lot of people [Suppliers] come to me and say this is good for the environment. I say prove that to me, show me the research and show me validated research. I would like to see there is true benefit not just an environmental stamp on it so that you can tick a box, and put it in sustainability report. (BP1, Procurement Manager)

5.5.6. Low consumer demand

The low consumer demand for environmentally sound products was mentioned by a few participants (3 of 16 [19%]) as another barrier for both buyers and suppliers in investing in environmental innovations. Participants compared the willingness of consumers in other countries, especially European countries, versus Australia in using environmentally friendly products and discussed that environmentally sustainable products are more popular in European countries. They argued that when it comes to purchasing products, consumers still prefer to go with the cheapest price and do not make a decision based on environmental considerations. Thus, they claimed the challenge is to present the sustainable products into the market on an equal price as unsustainable products:

If consumers are faced with two products then it always comes down to cost. I think the same will happen in the environmental space as well. The biggest challenge is getting the environmental stuff to the same price. (BP11, Procurement Manager)
5.6. Comparison across four findings (Table 5.1 to Table 5.4)

Those who had limited environmental interaction with their suppliers (BU1, BU2, BU5, and BU7, see Table 5.2) had indicated that environmental factors are preferential for them (See Table 5.1). This could mean that firms that are in the early stages of cooperation with their suppliers may not be willing/ready to impose stricter environmental criteria on their suppliers. Perhaps such an imposition could discourage suppliers engaging in cooperative activities. As stated in literature, a fundamental principle of cooperation is trust between partners and their willingness to engage in mutual activities.

A common practice amongst these four buyers was that to some extent, they all had internal programs around sustainability and improving energy efficiency. Firms such as BU1, BU2, and BU7 had roles within their organisation with environmental or sustainability titles. This could mean that cooperation with suppliers on environmental innovations requires firms to be internally proactive. The examples given by these participants show that greening supply chains is an extension to their internally-focused activities, though not mature enough.

Two of the buyers (BU2 and BU7) with cooperation experience (See Table 5.2) were from “Transport Equipment Manufacturing” industry (See Table 3.2). This may be related to the nature of this industry with high competition domestically and internationally. When competition is fiercer, firms seems to be more encouraged to look for environmental solutions. This could be for a number of reasons such as, improving their image and reducing their costs (Table 5.3 provides evidence for such motivations).

For all these firms (BU1, BU2, BU5, and BU7) cost-savings was a major motivation followed by increased request from customers (See Table 5.3) by three of them (BU1, BU2, and BU5). This may mean that those buyers that are more proactive in cooperating with their supply chains have less legislative-driven motivations and more economic and customer-driven motivations. On the other hand, those buyers that indicated no cooperation with their suppliers were more concerned about complying with environmental regulations (See Table 5.3). This may suggest that environmental regulations are not sufficient to encourage firms to invest in cooperative activities that result in more systemic environmental innovations. These firms were also more driven by cost-savings reasons than for example, a request by a customer, leading the market, or doing something that is right for the environment.
Even though cost savings was a main motivating factor (See Table 5.3.), participants from BU1, BU2, BU5, and BU7, unanimously considered the high cost and long payback period of environmental innovations as a major barrier to further engagement with their supply chains (See Table 5.4). For all businesses, return on investment (ROI) is a substantial investment decision factor. Therefore, if ROI of environmental initiatives cannot be justified, the likelihood of their adoption will decrease.

Overall, these findings reveal that those firms that are more proactive internally and their managers view environmental challenges as opportunities may be more inclined to engage their supply chains in environmental initiatives. Their motivations seem to be more capability-driven than compliance driven. The implications of these findings are discussed in details in “Chapter Seven”.
5. 7. Summary

This chapter presented the four findings for buyer organisations. The aim was to build the confidence of readers by accurately representing the reality of the firms and participants’ opinions.

The first finding was that many participants stated that in selecting and assessing suppliers, they consider environmental credentials preferential. Participants argued that it would be unlikely that they decide to either start or continue working with a particular supplier merely based on the environmental qualifications of that supplier. It could affect them in a positive way, but they said it was not a significant decision-making factor. They stated that their main criteria are price and quality, followed by compliance with environmental laws. Some participants also mentioned provision of recycled packaging as a criterion for their suppliers.

The second finding was that a majority of participants indicated no environmental cooperation with their suppliers. This, however, was not surprising, as previous findings showed environmental considerations were not amongst buyers’ priorities. Participants argued that their relationship with their suppliers is based on a buy and sell relationship, based on cost. Only a few buyers showed some limited interaction with their suppliers over particular issues, but there was not any formal procedure to engage suppliers in joint decision makings.

The third finding was that many participants see the main motivation in developing environmental innovations and investing in GSCM to be cost-reduction opportunities. Increasingly stricter environmental regulations (such as carbon tax) and increased requests by business customers were also mentioned by some participants. Increased request by business customers to incorporate environmental measures in business practices, willingness to be a market leader, and doing what is right for the environment were some other motivations mentioned by a few participants.

The fourth finding was that many participants stated that the cost of environmental initiatives is often high and their pay-back periods are longer than other types of investment. This had made environmental initiatives less desirable for them and their suppliers. Some participants cited low importance of environmental innovations to their suppliers as another barrier standing in the way of engaging with suppliers. For those buyers who had suppliers overseas, this was another barrier. They stated that there are distance, cultural, language and issues when they interact with overseas suppliers. A few
participants also mentioned inadequate environmental ideas and innovations, insufficient true proposals, and low consumer demand as some other barriers. A summary of all the findings for buyers is presented in Table 5.5.

<table>
<thead>
<tr>
<th>Finding one</th>
<th>Environmental factors are mandatory</th>
<th>Environmental factors are preferential</th>
<th>Environmental factors never get mentioned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 (6%)</td>
<td>13 (81%)</td>
<td>2 (13%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finding two</th>
<th>No interaction</th>
<th>Limited interaction over particular issues</th>
<th>Joint planning and decision making</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11 (69%)</td>
<td>5 (31%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finding three</th>
<th>Cost-saving opportunities</th>
<th>Compliance with environmental regulations</th>
<th>Increased requests from business customers</th>
<th>Being a market leader</th>
<th>Doing what is right</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14 (88%)</td>
<td>8 (50%)</td>
<td>4 (25%)</td>
<td>1 (6%)</td>
<td>1 (6%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finding four</th>
<th>High cost and long payback period</th>
<th>The low importance of EI proposals</th>
<th>Suppliers being overseas</th>
<th>Few EI ideas</th>
<th>Many green proposals</th>
<th>Low consumer demand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11 (69%)</td>
<td>8 (50%)</td>
<td>5 (31%)</td>
<td>4 (25%)</td>
<td>3 (19%)</td>
<td>3 (19%)</td>
</tr>
</tbody>
</table>
6. Chapter Six: Findings for Suppliers

“There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact.”

Mark Twain
6. 1. Introduction

This chapter presents the key findings obtained from 12 in-depth interviews with the General Managers of 11 supplier firms. A similar approach in reporting the findings of buyers in the previous chapter is used in this chapter. The emphasis throughout is on letting participants speak for themselves. Illustrative quotations taken from interview transcripts attempt to reveal multiple participant perspectives and capture some of the richness and complexity of green supply chain management. The previous chapter revealed some of the complexities of green supply chains from the perspective of buyers. This, however, does not portray the complete picture. Supplier participants may have their own perceptions and interpretations about environmental cooperation with buyers. Knowing suppliers’ views could help in better understanding of the GSCM concept and complexities associated with its implementation.

For suppliers, four major findings emerged from this study as follows:

5. Many participants (9 out of 12 [75%]) stated that in interacting with buyer firms, they rarely receive requests to provide environmental credentials. Suppliers asserted that they are selected and assessed mainly on price and quality of the supply.

6. Many participants (9 out of 12 [75%]) stated that they have had no cooperation on any type of environmental innovations at all and only three participants (3 out of 12 [25%]) said that their firms have had limited interaction over particular issues.

7. All participants (12 out of 12 [100%]) expressed that cost-saving opportunities are one of the main motivations in developing environmental innovations and investing in GSCM. Building a positive image was also mentioned by half of the participants (6 out of 12 [50%]).

8. Many participants (9 out of 12 [75%]) cited low importance of environmental innovations for buyers the main barrier standing on the way of GSCM. The high investment cost and long payback period of environmental innovations as well as the lack of resources required to implement environmental initiatives were also mentioned by some participants (8 out of 12 [67%]) and (7 out of 12 [58%]) respectively.
Following is a presentation of the findings with details that support and explain each finding. To present the findings of each section, a table is used. The rows of these tables represent the participants. Pseudonyms are used to de-identify them (Supplier Participant (SPi)). The columns show the categories for each concept. The cells within each table show whether or not the participants have mentioned the categories in their responses. The total number and percentage are reported under each column.
6. 2. Environmental factors in selection and assessment criteria of suppliers (tenders/contract/agreements)

Buyers use specific criteria to evaluate their suppliers. The first concern of this research was to determine the suppliers’ perception about the importance of presenting environmental credentials to buyers. Suppliers were asked about the extent they think buyers consider and want their suppliers to be environmentally innovative companies, and what criteria appeal most to their buyers. From the previous chapter, however, it was found that environmental qualifications were not mandatory for buyers, but merely preferred. The following table shows the extent to which suppliers perceived environmental factors were important to buyers in the selection and assessment process. The responses of participants are shown in Table 6.1. They range from environmental considerations being preferential to rarely being mentioned.

Table 6.1: Environmental factors in selection and assessment criteria of suppliers - The opinion of supplier participants

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Environmental factors are preferential</th>
<th>Environmental factors are rarely mentioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP1</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>SP2</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>SP3</td>
<td>●</td>
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<td>SP5</td>
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<td>SP10</td>
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<tr>
<td>SP11</td>
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<td></td>
</tr>
<tr>
<td>SP12</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3 (25%)</td>
<td>9 (75%)</td>
</tr>
</tbody>
</table>
Finding 1: Many participants (9 out of 12 [75%]) stated that in interacting with buyer firms, they rarely receive requests to provide environmental credentials. Suppliers asserted that they are selected and assessed mainly on price and quality of the supply.

The responses by participants indicated that most participants (9 out of 12 [75%]) rarely face situations where customers impose environmental requirements on them. They do not perceive environmental factors to be amongst the main decision-making factors of buyers. They had not received probing questions from buyers on the environmental aspects of their activities and they did not think it would influence the buyers significantly. The environment was said to be a minor factor relative to the major determinants:

They [Buyers] don’t go down to the environmental aspects like recycling water, recycling plastic, using less energy, contributing any toxins to the environment. We get none of that. (SP9, Operations Manager)

There would not be one customer in the entire demographic group that will buy our product because of its sustainability features, not one customer. (SP7, General Manager)

Although many participants asserted that providing environmental credentials is not crucial for most business customers, a quarter (3 out of 12 [25%]) highlighted that it may positively impress buyers. One of these participants said if they could show to buyers that they have environmental management systems in place alongside optimise resources, buyers may be more willing to source from them. Environmental credentials of suppliers were considered to be a sign of competency. Thus, if suppliers could demonstrate that they have environmental systems, they would be perceived as more competent. Consequently, buyers would tend to think they were less likely to have problems with these suppliers:

If you have an environment standard you monitor more than just the minimum. You are doing something a little bit more than that. It gives a favourable impression that you are more sophisticated than a company that doesn't have it. (SP1, General Manager)

However, the degree to which this positive impression may result to more business was something that participants were not sure and positive about.
A third (4 out of 12 [33%]) stated that they had observed an increase in customers’ requests for environmental credentials recently; particularly, larger customers with requirements not imposed by small companies. They stated that customers nowadays request more information about the environmental aspects of their activities. One of these participant said that, although their firm did not have a certified environmental system, they felt that they needed to consider it. All of these participants asserted that obtaining an environmental certification is a trend occurring overseas (e.g., Europe) and is spreading to Australia. In offering a reason for increased requests, they nominated benefits perceived by buyers. When they buy from a supplier that has environmental systems in place or some moral obligations to produce in most efficient way, they would have greater confidence that the supplier’s products are environmentally harmless.

When suppliers were asked whether they have to fill out the environmental questions when they take part in tenders or make contracts, surprisingly three quarters (8 out of 12 [67%]) stated that they had never come across environmental questions. The rest (4 out of 12 [33%]) stated that questions tend to be limited, such as if they have an environmental policy, environmental statement or system (e.g., ISO14001), or whether the material they supply contains noxious components. Even with the environmental questions being asked, or included in the contracts, participants said they have not been required to show an audit team their environmental credentials.

Two participants (2 out of 12 [17%]) who dealt with intermediating offering, mixed products sourced from various suppliers, said environmental consideration have never risen by them. Environmental improvements seemed to be important to middlemen only if it adds to their profits. For example, one participant mentioned a new sustainable packaging that they had developed and was of the interest to a middleman only because they thought it increased the shelf life. Whereas, recycled packaging without increased shelf life would not be of interest.

Participants were asked about the criteria they perceived to be more important to buyer firms. They unanimously referred to price and quality, and some (5 out of 12 [42%]) included lead time in the factors that give them the chance of being selected for continuous business with customers.
6. 2. 1. Price

Price was perceived to be the key factor for winning tenders, contracts and ongoing business with customers. All participants (100%) claimed that in the current climate, buyers only look at the price to see whether it fits within their range and whether it is going to sell. They argued that customers would not purchase a product if it is environmentally friendly, but more expensive. They said that occasionally they meet customers interested in environmental ideas, but they are not willing to pay the extra cost. One participant commented on the price-driven approach of buyers in this way:

They [buyers] are pushing us to be more competitive on price. They have a cost down mentality. You sell it for a $1, and then next year you sell it for 95 cents, and then 94 cents, then 91 cents. (SP10, General Manager)

6. 2. 2. Quality

Participants mentioned that quality is usually the second most important criterion, and occasionally it precedes price. Suppliers claimed that buyers want products that are “fit for purpose” and “to the specifications”. Products have to be made to the buyers’ specification and consistently:

They don’t worry about environmental standards as such. It’s just more to do with the stability and reliability of the product and how long it will last. It’s just product conformity. (SP4, General Manager)

With the two suppliers in the food industry, participants asserted that it is all about quality and safety of the food supply. Things such as product arriving with correct temperature, approved specification, and no contamination. One participant asserted that there are some possible ways to adopt some form of process innovations (e.g., some dairy products could be stored at 12-15 degree Celsius instead of 5 degree Celsius) that reduces the electricity usage, but it would be impossible to implement because it is possible for opponents to argue that there is increased food safety risks even though it may be small.

6. 2. 3. The outcome of compliance-oriented practices

Regardless of whether or not suppliers had been requested by buyers to comply with specific environmental expectations and requirements, they were asked how they would see the effects of these compliance-oriented practices in prompting them to be more environmentally innovative. Most of the suppliers (11 out of 12 [92%]) stated that they
introduce environmental innovations if they felt that it makes business sense. Customer pressure may be a motivation, but it only triggers them to adopt low-level innovations; something that only assures them that they will not lose business with customers.

Eight participants (8 out of 12 [67%]) argued that even with the customers that may proactively pursue environmental agenda with their supply chains, it is unlikely that they would request something that would need a significant change in suppliers’ current production processes or product functions. Two participants (2 out of 12 [17%]) even claimed that the intention for implementing GSCM for some buyers are mainly for marketing purposes. Buyers want to show to their stakeholder (e.g., consumers or the government) that they are not reluctant to their supply chains. This is best illustrated by a comment of one participant:

I know they have marketing people that are reasonably active wanting to promote themselves as environmentally friendly company. (SP8, General Manager)
6. 3. Cooperation with buyers

Enforced environmental requirements by buyers may encourage investment in environmental innovations. Cooperation with buyers, however, tends to produce more sustainable outcomes. The results from chapter four showed that whenever there is cooperation between firms and their supply chains, there is a higher likelihood of introducing environmental innovations. Suppliers were asked about their cooperation level with buyers; whether or not they have been approached by buyers for joint environmental works; whether or not they have proposed environmental solutions to buyers. The following table (Table 6.2) shows the responses of participants about the way they cooperate with buyers under these categories: no cooperation, limited interaction over particular environmental issues, and joint planning and decision making.

Table 6.2: Cooperation with buyers

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>No cooperation</th>
<th>Limited interaction over particular issues</th>
<th>Joint planning and decision making</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP1</td>
<td>●</td>
<td></td>
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<td>SP11</td>
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<tr>
<td>SP12</td>
<td>●</td>
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</tr>
<tr>
<td>Total</td>
<td>9 (75%)</td>
<td>3 (25%)</td>
<td>0 (0%)</td>
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</table>
Finding 2: Many participants (9 out of 12 [75%]) stated that they have had no cooperation on any type of environmental innovations at all. A quarter (3 out of 12 [75%]) said that their firms have had limited interaction over particular issues.

Many participants (9 out of 12 [75%]) stated that they have not had any environmental cooperation with their customers. A quarter (3 out of 12 [25%]) had limited interaction with their customers on special environmental issues. Suppliers said they have been rarely approached by customers about joint environmental projects. Participants said it is either not within the priority or at the lowest importance to buyers to co-invest in environmental innovations.

The arguments presented by some of these participants for the little environmental cooperation, reinforced the previous finding: buyers focus on quality and price of supply more than any other factor. Participants asserted that when they win a tender, they have to conform to buyers’ demands. Thus, suppliers have little input into the work. Participants argued that contracts are to a large extent specification-driven and buyers are not willing to change them. One participant puts it this way:

“They tell us what they want; we manufacture the fabric and ensure it conforms to their requirement; that’s it. So, it is not like we sit around with them [Customers] and say how we can improve the environment. It’s not a sort of relationship that way.” (SP1, General Manager)

Four participants (4 out of 12 [33%]) argued that if their product was a commodity, then the expectation of buyers would be more price-driven. Participants contended that this was mainly due to customers being able to import the same product from overseas (e.g., China, India, Pakistan, Thailand, and Malaysia). Therefore, they said it is not a relationship based on looking at the best way for the environment; it is about which supplier offers the best price. Most participants were of the opinion that doing something for the environment costs money and if they decide to invest in environmental initiatives, customers would not be willing to contribute to the increased costs.

When suppliers were asked about their willingness to propose environmental suggestions or contribute to enhancing environmental performance of buyers, a majority commented on their lack of resources making it difficult for them to proactively engage with their buyers. Three participants (3 out of 12 [25%]) said that if they propose an idea,
they must pursue it alone without support from buyers. One participant described the activities of their firm in promoting their products in this way: While the firm’s customers had not shown much interest in environmentally friendly products, the firms’ strategy has been to promote their product because it was recyclable and carbon neutral:

> Our customers don’t help us at all other than saying “if you do this, we will put you on our panel” they don’t help us innovate. It’s up to us to come up with innovations. (SP9, Operations Manager)

Similar to the previous chapter, here the limited cooperation experiences of the three suppliers are presented. This helps to better understand their cooperative-oriented practices. Firm SU5 had worked with a buyer to change the packaging to a more environmentally-friendly form. The initiative not only had positive environmental impacts, but also had reduced the handling and transportation costs. Nevertheless, as the General Manager explained, changing something simple as packaging needed a lot of coordination with different stakeholders. When SU5 proposed to change the packaging, the customer had to negotiate with its own customers to find out if they agreed. The General Manager of SU5, however, asserted that while buyer was willing to help, it was in their interest to do so. If there was no pay back, buyers would not support the initiative:

> If it just helps me they may not necessarily do it. Because they say what's in it for me. So, it is a pragmatic response really. (SP6, General Manager)

This participant pointed out the significance of speaking to customers on a regular basis. He asserted that the more they spoke to customer representatives, the more they knew about them and their businesses, and the more likely they see opportunities for cooperation.

Firm SU9 was working with a customer to replace timber palette with steel stillage (Used for the safe transport and storage, and maximum utilisation of space of the finished product). This was to address several concerns including environmental concerns. The General Manager of SU9 claimed that the steel stillage protects the product better than the product wrapped in a palette. Therefore, it reduces the number of damaged products. Furthermore, the use of stillage was considered safer and lower cost. The main issue raised by this participant was the lengthy process of obtaining approval to shift to this new method of handling and shipping parts:
Because they are an OEM [Original Equipment Manufacturer], you have to go through a certain process with them to change anything that you do with them or supply to them. They have specifications and that sort of things…Without annoying them too much, we raise it periodically with them because we are trying to get it as soon as we can. (SP10, General Manager)

This participant said that because the firm is a small supplier amongst many other suppliers to the buyer, their voice would not always be heard. If they have an idea, the customer may not take it on board because it would be a small improvement to them:

It’s important to sort that palette issue out because 10-15 palettes a month is a lot to us. I’m sure when they do 50-100 thousand palettes a month; it’s totally irrelevant to them. It won’t give them a big lift. (SP10, General Manager)

Firm SU10 was a 100% carbon neutral offset firm. If SU10 wanted to pay for a finished product to be carbon neutral, they would have to pay for some more offsets. The General Manager of SU10 stated that some of their customers are willing to pay for that extra offset, but that was the only cooperation with customers. He said, in general, most of the customers want only to reap the benefits. He claimed that customers sometime want to use their products because they want to show to their own customers that they are doing what is right for the environment and the society.

6.3.1. The outcome of cooperative-oriented practices

As the previous paragraphs showed, there was not much environmental cooperation happening between buyers and suppliers. Nevertheless, the three suppliers that had indicated limited cooperation with their buyers on environmental issues were asked to comment on how they see the effects of these cooperative-oriented practices in helping them and their buyers to adopt or develop environmental innovations. All three suppliers asserted that working with buyers have been beneficial to both buyers and suppliers. They explained the cost reductions opportunities available in environmental co-investments as the primary achievement.

Suppliers argued that whenever they see a business case in environmental projects and buyers are willing to commit resources, they would have a better chance to introduce more systemic environmental innovations. That goes beyond merely compliance. They argued that the rationale is that having the support of the buyer, they have another organisation willing to assist them if there are problems. Suppliers could complement resources with
those of the buyers. Moreover, suppliers asserted that they know there is a real demand for what they are doing. This will assure them a return on investment. One participant mentioned their co-work with a buyer to obtain ISO14001 as follows:

We had an environmental policy, but not more than that. [The buyer] said they could help us to get ISO14001 certification. We didn't have to be certified, but we said we want to. At the beginning it seemed impossible to us, but we worked hard and [The buyer] helped us a lot. Whenever we had a question they were there willing to assist us. (SP6, General Manager)
6. 4. Motivations to develop environmental innovations and invest in GSCM

In the previous chapter, the motivations of buyers in developing environmental innovations and engaging with suppliers on environmental innovations were presented. The same question was asked from suppliers’ participants to identify their motivations and to determine whether they were different from the buyers. The following table (Table 6.3) shows the responses of participants. Suppliers’ motivations varied from cost saving and building a positive image to complying with environmental regulation, doing what is right for the environment and complying with increased requests from customers.

Table 6.3: Motivation to develop environmental innovations and invest in GSCM- Suppliers

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Cost-saving opportunities</th>
<th>Building a positive image</th>
<th>Compliance with environmental regulations</th>
<th>Doing what is right</th>
<th>Increased requests from business customers</th>
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<td>SP12</td>
<td>●</td>
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<tr>
<td>Total</td>
<td>12(100%)</td>
<td>6 (50%)</td>
<td>3 (25%)</td>
<td>3 (25%)</td>
<td>2 (17%)</td>
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</table>
Finding 1: All participants (12 out of 12 [100%]) expressed cost-saving opportunities as one of the main motivations in developing environmental innovations and investing in GSCM. Building a positive image was also mentioned by half of the participants (6 out of 12 [50%])

6. 4. 1. Cost-saving opportunities

All participants (12 out of 12 [100%]) invest in environmental innovations mainly if they see economic advantage. Suppliers highlighted scarcity of financial resources as an issue. Their investments in new equipment or environmentally innovative practices were dependent on financial return. For them, decisions were primarily economical. A quarter also declared that it is the “right thing” to do.

Some participants (5 out of 12 [42%]) had already started looking at improving their environmental performance through some incremental innovations, but they were all at an early stage. Most of the environmental activities of these firms were within the last 3-4 years. Other participants (7 out of 12 [58%]) said that their firms do not have any plan to adopt or develop any type of environmental initiatives, because they had not been able to justify the economic benefits.

One area of improvement that was cited by participants was energy efficiency and waste management initiatives. These innovations focused on reducing the electricity consumption of the factory, reusing the water, or recycling the waste. These initiatives include optimising machines during off-peak demand, correcting the power factor, using eco-lighting, catching water on the roof for reuse, recycling hot water for dying or warming up buildings, recycling plastics and cardboards, and optimising packaging to eliminate unnecessary use of cardboards. The main purpose of conducting these initiatives was to reduce the cost, particularly the cost of energy, which is expensive in Australia. Some participants stated that they have been able to reduce their electricity consumption between 20-30%, the water usage between 20-50%, and the waste between 30-40%. These, in turn, had contributed to substantial cost reductions:

In terms of waste, we reduced our bin collections and we started with recycling, which reduced our waste by 20%, less bins, less dumpsters getting emptied.
And then we reduced our recycling amount because putting it in the recycling
isn’t as good as being efficient so we reduced that by 40%. (SP7, General Manager)

Participants argued that if they could reduce some of their costs by having environmentally improved practices, pricing of their products would become more competitive. The practicality of environmental innovations was a common response by most participants:

I don’t believe in tokenism. I will not do things because it is a token effort. I am not into that. What I do is practical response to increase in cost savings and all of that. That’s why we do it. It all helps. It is part of the competency. It makes business sense. (SP6, General Manager)

Some participants (5 out of 12 [42%]) argued that sometimes they invest in initiatives that are purely intended to reduce the cost or improve efficiency, but later they realized that there were also positive environmental outcomes. Participants said they are pleased when they see their projects result in environmental achievements, but it is not the main motivation. Reducing cost comes first, followed by environmental considerations. On this point one participant explained their initiative to eliminate the cardboard boxes in cooperation with their suppliers:

When you are out there in the factory and you have cardboard all around you, you just go “Where’s all this cardboard coming from and how can I get rid of it?” It’s not through any sort of environmental goal, it’s just when you are out there in the factory, and it’s just when there’s so much cardboard around you and it could take some cost out of the product. (SP4, General Manager)

On the importance of economic viability of environmental innovations, one participant that was proactive in implementing environmental innovations mentioned a programme that they had joined called “Grow me the money”. According to the General Manager of SU10, this programme is designed to help small and medium size businesses operating in regional or metropolitan areas that would like to improve their environmental sustainability and their financial bottom line. The programme is developed in partnership with the Victorian Employers’ Chamber of Commerce and Industry (VECCI) and Environment Protection Authority Victoria (EPA Victoria) as part of a Sustainability Covenant. Grow me the money is for businesses that are conscious of their environmental footprint and are keen to begin implementing environmentally friendly practices but unsure where to start. This
initiative guides small to medium-sized businesses through the steps necessary to implement sustainable business practices.

6. 4. 2. Building a positive image

Each business has an image, irrespective of whether it has tried to create one or not. It is made up of the way that it is perceived by its stakeholders including business customers. Half the participants (6 out of 12 [50%]) asserted that if they improve their environmental performance, they will improve their image; consequently, they may receive more business from their customers.

Suppliers said that they are sometimes approached by customers that are interested in the environment. A good environmental image makes it easier for them to conduct business with such customers. Two participants talked about the importance of advertising their environmental achievements. One participant, for example, said their firm did not promote their environmental improvements publicly, not even with business customers. Realising that a competitor that openly touted its environmental achievements procured customer more, encouraged the firm to distribute information packages about their environmental activities. They felt that they are in better position with this new image:

If you don’t advertise what you achieved, they [customers] will go to someone down the road who they think has. We’ve had to make a song and dance about our environmental credentials to expose our customers to what we are doing environmentally. That was never our intention. (SP11, General Manager)

Three participants (3 out of 12 [25%]) explained how they have been using their environmental credentials as a marketing tool for their overseas customers (mainly Europe and USA). Interestingly enough, one participant said while foreign customers appreciate their environmental efforts, the Australian customers seem indifferent. This participant asserted that doing well for the environment provides a positive outlook for the business, so the business is seen to be more than just merely a means for making capital, but one that is aware of its environmental responsibilities.

6. 4. 3. Compliance with environmental regulation

Only a few participants (3 out of 12 [25%]) expressed some concerns about existing environmental legislation and how it may drive them to be more innovative in their activities. What seemed challenging for suppliers was the need to comply with the new
environmental legislation, especially the carbon tax (chapter 5 describes the details of the carbon tax legislation). One participant puts it as follows:

At the moment we are working on few projects, as far as efficiency goes, with our electricity, gas, and water consumption, implementing projects before we start getting hit with increased costs as opposed to waiting until those increased costs come in and they start to hit our pocket. And then working out what we can do, what we need to do. (SP3, Sustainable System Coordinator)

All participants unanimously asserted that the carbon tax will affect their businesses. They asserted that there would be higher overhead costs, associated with electricity, gas, water consumption, and inward goods, due to passing on costs that they cannot absorb. One participant predicted 2.3 cents increase per kilowatt/hr. for electricity alone. This is a substantial increase for electricity intensive processes.

A few participants (3 out of 12 [25%]) were in favour of the carbon tax; a few were neutral and hesitant (2 out of 12 [17%]); and the rest (7 out of 12 [58%]) strongly opposed it. The argument presented by advocates of the carbon tax was similar to the one presented by the buyers’ advocates. Although there may be some negative consequences in the short-term, they envisaged that eventually it would lead them to develop capabilities that would make them more competitive. According to this group, the carbon tax would increase the final price of the products, and that would change consumer behaviour: what consumers do and how they do it and that will flow back through the supply chain.

Some participants (4 out of 12 [33%]) did not know much about the details of the carbon tax. They knew there will be a new tax, but they did not know how it will affect their businesses. Their source of information was from the mass media, and not through stakeholders such as government agencies, or perhaps customers. The common reason given by most participants for not knowing the details of the carbon tax was the lack of time to spend on investigating it. In addition, they were still unsure if it would directly affect them:

I have no idea! That’s an easy answer. I don't know if it affects our business. I haven't heard anything from our customers about it. The electricity may goes up. I don't know what the impact is. (SP8, General Manager)

No idea! I don’t even have the time to look into it. (SP5, General Manager)
There were, however, a majority of participants (7 out of 12 [58%]) who strongly opposed the carbon tax. They claimed that the government has not considered carefully how the carbon tax will affect small and medium size-enterprises (SMEs). They argued that carbon tax discourages investments and causes business to close down. They claimed that there will be less capital available for environmental innovations. These participants said that they have already been doing whatever they could and the new legislation is just a burden:

Instead of trading an old machine in for a new one, we won't do that because we can't do that. (SP6, General Manager)

Opponents of the carbon tax argued that if the government wants something to happen, it should put laws in place that encourage businesses, not laws that punish them. One participant said that six percent of the firm’s turnover was spent on electricity, and increased prices will affect their profitability. Two participants (2 out of 12 [17%]) said that their objection was not based on the carbon tax being a good or bad policy, but concerned its management by government. They reasoned that the Australian government policy does not fit international policies. They claimed that while many developing and developed countries were still reluctant to take initiatives, Australian government is enforcing them to bear a cost that will make them less competitive. They said if they were in the same position as the rest of the world, then they would be less concerned. These participants used terms and phrases such as “terrible legislation”, “unfair tax”, and “big mistake” when talked about the carbon tax:

I am not going to be able to do anything about it. I have this list that I don’t have the money to spend for. If I go and spend money at the time, just to find out what it all is, what’s the point? I’m going to pay it all anyway. Nothing’s come up; nothing’s come through. (SP7, General Manager)

6. 4. 4. Doing what is right for the environment and the society

A few participants (3 out of 12 [25%]) said that while there exist economical or regulatory motivations, it is also the right path their firms should go. They wanted their businesses responsible for looking after the environment and preserving its resources. These participants commented that it is inevitable that following generation will see environmentally innovative products as a priority. Therefore, they claimed that part of the
motivation in investing in environmental innovations is to keep the planet in a better shape for their children:

We would like to make sure we are a good citizen and we can sell the products to the consumer with our hand on our hearts to say “we are doing everything we can to give you a good environmental product. (SP9, Operations Manager)

These participants asserted that employing green practices are businesses’ commitment to where they thought the nation is heading and where they thought every firm should be heading. They saw it as an opportunity to express their voices with the climate change.

6.4.5. Increased requests from business customers

Not many suppliers said they were pressured by customers to become green. Only two participants (2 out of 12 [17%]) cited a recent increase in customers’ expectations as a motivation for their environmental activities. These two firms said, in dealing with some of their major customers, they demand for green features and products. For instance, one participant mentioned that their firm became interested in obtaining ISO 14001, after increasing requests by customers for FSC licence:

A couple of our customers asked us if we were intending to get chain of custody certification, which we were looking to do anyway. So as a management group, we got together and said “Look, if we are looking to do that, then we should look at 14001, which is all-encompassing for everything environmental anyway. (SP11, General Manager)

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8- FSC is a global, not-for-profit organization dedicated to the promotion of responsible forest management worldwide.
6. 5. Barriers in developing environmental innovations and investing in GSCM

The low rate of developing environmental innovations in cooperation with buyers indicated that there are some barriers discouraging cooperative investments. The following table (Table 6.4) shows the responses of participants about the various barriers in development of environmental innovations and adoption of green supply chain practices. They were low importance of environmental innovations to buyers, high cost and long payback period of environmental innovations, and lack of resource to invest in environmental initiatives.

Table 6.4: Barriers in developing environmental innovations and investing in GSCM—Suppliers

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Low importance of EIs to buyers</th>
<th>High cost and long payback period of EIs</th>
<th>Lack of resources (finance, human and capital)</th>
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</thead>
<tbody>
<tr>
<td>SP1</td>
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| Total     | 9 (75%)                        | 8 (67%)                                | 7 (58%)                                     |
Finding 4: Many participants (9 out of 12 [75%]) cited low importance of environmental innovations to buyers the main barrier standing on the way of GSCM. The high investment cost and long payback period for environmental innovations (8 out of 12 [67%]), as well as the lack of resources required to implement environmental initiatives (7 out of 12 [58%]) were also mentioned by some participants.

6.5.1. Low importance of environmental initiatives to buyers

Many participants (9 out of 12 [75%]) asserted that environmental considerations are not a priority for their buyers. Even a few participants, who said it is important for buyers, stated that buyers are not committed to push an environmental agenda into their supply chain. Participants were asked to rank the importance of environmental issues for their buyers, based on a scale ranging from 0 (meaning not important at all) to 10 (meaning very important). Only two participants ranked the importance high (above six) for the customers they interact with, and the rest ranking it below six, with two suppliers scoring it even less than three. The average response was 4.95 out of ten (Figure 6.1).

Figure 6.1: Participants’ views about the importance of environmental issues to their business customers (1: Not important at all, 10: Very important)

The first finding that environmental credentials were merely preferred by buyers, can be related to the motivation of suppliers. Participants claimed that this position does not provide enough incentive for them to invest in environmental initiatives. Suppliers
contended that they may sometimes have proposals that could create environmental benefits and they try to promote it to buyers, but usually it does not change what they are buying. As one participant said “it is just nice to have”. Two participants commented on the low-level of importance of environmental innovations to buyers as follows:

I don’t think it’s been made a priority. They don't see the need for the interaction, and most of the interaction is between small ones not between big and small companies. And the other barrier is production level, quality, etc. is in their priority area. (SP2, General Manager)

Our customers aren’t shy to put requirements on us like documentation and everything, but they have never mentioned environmental things once. Because I think it is not a priority for them. (SP12, General Manager)

Participants said they may receive some feedback from customers about improving the quality of the product to match their specification, or they may be given suggestions on how to change some of their practices to reduce the cost of supplied products, but feedback on the environmental aspect of their activities is exceptional:

We don’t get any customer feedback saying “it’d be better if your tyre cover was biodegradable” most of them just want it to last forever. (SP10, General Manager)

Some participants (7 out of 12 [58%]) contended that from the buyers’ perspective, suppliers are independent businesses that have to abide by relevant government legislation on their own. Therefore, participants argued that they do not receive support from their customers in the innovation process. They stated that they must solely come up with ideas and implement them. On this point, one participant said customers do not help us; they only say if you develop and implement environmental innovations, we will shortlist you in our supplier list, but no guarantee to be selected.

The fact that many of buyer organisations that suppliers interact with are busy managing their own internal environmental systems was mentioned by three participants (3 out of 12 [25%]). One participant asserted that buyers may be environmentally responsible organisations; they may have recycling, reusing and other form of environmental practices in place, but they still have not reached a point to bring it up with their suppliers. These participants said that partial reason they are not pushed by buyers is that buyers still have
not fully implemented their own environmental standards. Some are still in the process of obtaining accredited environmental management systems:

> People [buyers] are so caught up with what’s happening in their own factory, they don’t have time to see what others are doing in theirs. It’s one of those things that’s always at the bottom of the list and keeps getting pushed down.

(SP10, General Manager)

The difference between what buyers say and request, and, what they really care about in practice was mentioned by a few participants (3 out of 12 [25%]). These participants claimed that on the surface it seems that it is important for some buyers; it is in their tenders, contracts and sometimes they raise the environment as a concern. They stated that increasingly more tenders request suppliers to demonstrate that they have an environmental policy. However, they claimed that when it comes to choosing a supplier based on its environmental credentials or paying for the associated costs of implementation, buyers are less willing to commit:

> If you’ve got a tender panel and you get onto the panel, they congratulate you on all the [environmental] awards you’ve won but then you get on the panel, you go out the next week to try and sell your product and they go “nah, we don’t want to use you because we’ve been using the same guy for...” and when you ask them what kind of environmental credentials he has, they don’t care.

(SP11, General Manager)

One participant discussed another reason for reluctance of buyers in co-investing in environmental innovations. This participant claimed that many buyers source materials and components from overseas, particularly China. These countries may not have high environmental standards and ethics, but they offer cheaper supply. Therefore, if buyers include environmental criteria among their priorities then they may not be able to buy from these countries.

Two (2 out of 12 [17%]) participants highlighted the low importance of environmental issues to wholesale buyers. They argued that these trading companies buy in high volumes and their margins are small. It is not a priority for them to request environmental credentials. These participants asserted that when they deal with customers directly—not through middle men—environmental factors become more important.
6.5.2. High cost and long payback period of environmental innovations

The high cost of environmental initiatives and their long payback period was another barrier pointed out by a significant number of participants (8 out of 12 [67%]). These participants argued that environmental innovations—for example, environmentally friendly products—cost 50% to 300% more to produce, especially if they are from renewable sources. They also argued that consumers are not willing to pay for the higher prices of environmentally friendly products yet. Two participants commented on the associated cost of environmental innovations in these ways:

To get heavy metals out of a master batch can be a more expensive master batch formulation and you have to pay laboratories to test your master batch and confirm there are no heavy metals present. This is obviously an extra cost. (SP9, Operations Manager)

The suppliers of palette, there aren’t that many suppliers worldwide. What they’re charging for that raw material is quite high. Say it is $2 a kilogram for poly; they might be charging 6 or 8. So, that means our product is orders of magnitude higher. And our customers aren’t willing to turn around and say “I value that and I’d pay 3-4 times the price” the market’s not there. I think the market, these two things being equal; I’d take that over that. Or if it’s a few cents or a small percentage but if I’m talking four times the price, it’s not there yet. (SP5, General Manager)

The payback time for environmental innovations was another factor that added to reluctance of suppliers to engage with their buyers. Participants claimed that for most financial investments, they look at a payback period of less than 3 years, but with environmental investments, it is often above three years; it might be 5 to 7 years. Therefore, if the business have not set long-term environmental goals, it is unlikely to spend money on such initiatives.
6.5.3. Lack of resources (finance, human and capital)

Many participants (8 out of 12 [67%]) argued that because they are small businesses, they do not have access to all resources (financial, human, and capital) that they need to invest in environmental initiatives, especially innovations that could be developed in cooperation with buyers. They argued that investing in systemic environmental innovations—such as renewable and clean technologies—require considerable financial investments that would be difficult for small business to fund. Participants argued that their capacities are limited and their margins are tight. These limitations, therefore, make it difficult for them to make the environment a priority. They argued that their priorities would be first on the critical aspects of their businesses (e.g., sales and marketing), because it was more important to them to increase sales: otherwise, as some participants said they may go out of the business. One participant puts it as follows:

I think when you are a very, very small business, we’ve got very, very tight margins and very, very focused on delivery and output and to have extra capacity to focus on that is just not up there as a priority. (SP4, General Manager)

In line with the financial difficulty that suppliers encounter, some participants (5 out of 12 [42%]) pointed out the high Australian dollar as another factor that had made the competition more difficult and, accordingly investing in environmental innovations and GSCM practices became less appealing for them. These participants claimed that the value of the Australian dollar has increased so quickly that they were not able to adjust their cost structure to accommodate it. In addition, they argued that the high value of the Australian dollar has made it more difficult to compete with overseas suppliers, especially Asian suppliers that offer lower prices. Participants claimed that these pressures have caused some businesses to immigrate to countries such as China, Thailand, Vietnam, or Malaysia.

Participants argued that to combat the negative effects of above-mentioned financial difficulties, they have focused their strategies on cost-saving programmes so that they can keep their businesses running. One participant asserted that they know that the environment is important and they should look after it, but they still have no desire to define environmental goals, unless a mandatory legislation is introduced:

The biggest challenge would be if there was any mandatory legislation that came along and it would mean we have to set environmental goals. It would
also mean adding extra time and labour to our business and it would add time to what we have to do. (SP4, General Manager)

Some participants (5 out of 12 [42%]) asserted that part of the reluctance of businesses, especially smaller, in investing in environmental innovations relates to the current economic situation, which is still recovering from the financial crisis in 2008. Participants explained that when the global economy was doing well and companies could make money, they were more environmentally conscious and buyers were willing to use environmentally sources, but now businesses are less motivated:

There have been a lot of businesses that have gone out of the business and it becomes very tight. Few years ago, we would get some questions about environmental content of our products, but then in the last two years they seemed to be disappeared. (SP8, General Manager)

Five participants (5 out of 12 [42%]) contended that they do not have the time to determine what they need to do to improve their environmental performance. Participants said they would not be able to hire someone else to look after their environmental side of their activities—because of financial constraints—and the managers themselves claimed to be busy with other aspects of their businesses.

Many suppliers (10 out of 12 [83%]) were not aware of the government environmental grants that they might be eligible. This was mainly due to their lack of time and human resources to obtain this knowledge. According to some participants applying for these types of grants is a long-term process and requires much paper-work. It also needs a dedicated person to follow the grants or they may have to hire consultants to apply for grants. Participants considered these as extra burden that they would prefer to avoid. In addition, two participants (2 out of 12 [17%]) argued that even if they could succeed and receive a grant, they have to prepare reports and they will be under monitor, not only on the environmental aspects, but also other areas of their business:

I don't like government incentives. I'm cynical about all that. You really need to be very focused on the application to receive the grants and deliver a project that can meet the requirements to access the funds. That's hard to do frankly for our business. (SP12, General Manager)
6. 6. Comparison across four findings (Table 6.1 to Table 6.4)

The suppliers (SU5, SU9, and SU10) that had indicated some interaction with their buyers on environmental innovations (See Table 6.2) had one thing in common. Their clients favoured environmental efforts more than the others (See Table 6.1). This could be attributed to the industry sectors of these clients with more awareness and proactivity with regards to environmental solutions. For SU5, a major client type was banking. Banks are increasingly investing in their environmental programs, not only internally, but also along their supply chains, thanks to the financial resources they have. In the case of SU5, which was a printing company, the banking clients had preference towards suppliers with carbon neutral papers. For both SU5 and SU9, the clients were from “Transport Equipment Manufacturing” industry. This is in line with the findings of previous chapter (See section 5. 6. ), which indicated that firms working in “Transport Equipment Manufacturing” industry face a higher competition domestically and internationally, which can result in more environmental awareness and more green practices along their supply chains.

An interesting finding in comparing the findings of Table 6.3 and Table 6.4 is the relevance of the size of a supplier to its motivations and perceived barriers with regards to environmental initiatives. It seems that the larger the company is the more concerned they are about compliance with regulations and less about resource availability. SU1, SU2, and SU7 were comparatively larger than the other suppliers. As Table 6.3 shows these are the only suppliers that indicated compliance with environmental regulation as a major motivating factor in investing in environmental initiatives. Table 6.4 also shows that 3 out 4 participants from these suppliers did not raise lack of resources as a barrier at all.

Overall, these findings revealed that similar to buyers, suppliers are highly reactive in green supply chain practices. From the limited evidence of cooperation provided, it could be seen that buyers have the ability to influence the green activities of their suppliers, whether by increasing the pressure or involving them in cooperative activities.
6. 7. Summary

This chapter presented the four findings of supplier organisations. Findings were organised according to the research questions. The aim was to build the confidence of readers by accurately representing the reality of the firms and participants’ opinions.

The first finding was that many participants stated that in interacting with buyer organisations, they rarely receive requests to provide environmental credentials. Participants asserted that they are selected and assessed mainly on price and quality of the supply. Nevertheless, a few suppliers mentioned that recently when they take part in tenders they see an environmental section among the questions, although they stated that the questions are not still probing questions.

The second finding was that many participants indicated that there was no environmental cooperation with their buyers. Participants argued that it is not in the agenda of their firms and their buyers to invest in environmental projects. Only three participants said that they had limited interaction with their buyers over particular issues. These participants contented that whenever they see a business case in environmental projects and buyers are willing to commit resources, they will have a better chance to introduce more systemic environmental innovations.

The third finding of this chapter was that all 12 participants expressed cost-saving opportunities as the main motivation in developing environmental innovations and investing in GSCM. Building a positive image was another motivation cited by half of the participants. They argued that if they could enhance their environmental image they may be able to receive more business from their customers in future. Furthermore, some participants mentioned environmental regulations, doing what is right for the environment and the increased requests of customers as other motivations.

The fourth finding was that many participants cited low importance of environmental innovations to buyers was the main barrier standing in the way of GSCM. The high investment cost and long payback period of environmental innovations, as well as the lack of resources required to implement environmental initiatives, were also mentioned by some participants. A summary of all the findings for suppliers is presented in Table 6.5.
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<th>Finding one</th>
<th>Environmental factors are preferential</th>
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<th>Limited interaction over particular issues</th>
<th>Joint planning and decision making</th>
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<th>Cost-saving opportunities</th>
<th>Building a positive image</th>
<th>Compliance with environmental regulations</th>
<th>Doing what is right</th>
<th>Increased requests from business customers</th>
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<th>Finding four</th>
<th>Low importance of EIs to buyers</th>
<th>High cost and long payback period of EIs</th>
<th>Lack of resources (finance, human and capital)</th>
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<td>9 (75%)</td>
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7. Chapter Seven: Discussion

“A new word is like a fresh seed sown on the ground of the discussion.”

*Ludwig Wittgenstein*
Chapter 7: Discussion

7.1. Introduction

In this chapter, the findings of qualitative interviews are discussed. The discussion is based on the cross-case analysis, interpretation, and synthesis of the findings of buyers and suppliers. The previous two chapters (chapter 5 and 6) presented the findings of this study by organising data from various sources into categories to produce readable narrative. The purpose of this chapter is to interpret the findings and to move beyond the codes and themes to develop a more holistic understanding.

This chapter is structured as follows. “The existence of a gap between theory and reality” section provides explanation for the findings of the previous two chapters as to why environmental issues are not still considered in buyer-supplier interactions. The “Why is there a gap?” section seeks to find the underlying reasons for a discrepancy between the importance of GSCM that could lead to better environmental innovations results and the reality that is a low adoption of GSCM. The “Primary factors” section underlines the significance of two internal factors, namely the managers’ notions that GSCM and developing environmental innovations are costly as well as the inadequacy of resources of suppliers. The “Secondary factors” section highlights the importance of government and consumer pressures and explains how the lack of such external motivations could result in a passive environmental supply chain strategy.
7. 2. The existence of a gap between theory and reality

The findings of quantitative analysis (See chapter 4) suggested that cooperation with external partners, including suppliers and customers, increases the likelihood of adopting environmental innovations. Nevertheless, the results of the multiple-case studies indicated the presence of a gap between the importance of green supply chain practices in theory and the reality that is a low adoption of green supply chain practices. A main reason for such discrepancy seems to be related to the passive environmental strategy of firms vis-à-vis their external partners, especially supply chain partners. A majority of interviewed firms (both buyers and suppliers) have not considered environmental improvement an important factor in their interaction with their supply chain partners.

As far as supplier’s selection and monitoring was concerned, the traditional criteria of price, quality, and delivery were the top priorities. Similar results were found in the literature (Hill, 1997; Preuss, 2001), in which other factors (e.g., quality, price, and lead time) were found to be of prime importance to buyer organisations. Environmental requirements were rarely embedded in the tenders or contracts and if they were discussed with suppliers, it was only as a preference that did not necessarily lead to granting the contract to a more environmentally friendly supplier. As long as suppliers could prove that they comply with the environmental laws, that would give buyers confidence that they would not be in trouble. The environmental competency of suppliers was mainly confirmed through informal channels such as the dialogue between purchasing staff of buyer organisations and the general manager of supplier organisations, or through the site visits that were mainly conducted for other reasons than environmental inspection.

There were only a few buyers who had developed questionnaires with environmental questions and were conducting site visits aiming to assess environmental compliance of suppliers. Nevertheless, with the latter group, the environmental criteria included in the questionnaire focused on easy measures such as the existence of an environmental management system (e.g., ISO14001), a record of any environmental breach, or the usage of any hazardous material in their products. There were few attempts to investigate the internal capabilities of suppliers as recommended by some scholars (Keating et al., 2008; Pagell, 2009; Gold et al., 2010; Gnioni et al., 2011). Furthermore, it did not seem that buyers with environmental questionnaires have realised the complex nature of decision making for different suppliers when considering all the environmental criteria because they were using a generic questionnaires for all different suppliers (e.g., strategic suppliers and
suppliers of commodities). This situation may suggest that firms need to adopt more efficient supplier selection tools that consider multiple criteria including the supplier size and relationship type in conjunction with other environmental and non-environmental factors. The design of questionnaires is another important consideration that sometimes is neglected by buyers, as was observed in one of the firms in this study’s sample. The issue is that the questionnaire consists of a long list of questions that is unlikely to be used later. Although the temptation to collect more information regarding the environmental activities of suppliers is high, this may make the questionnaire too complex and that discourages suppliers from engaging and responding. A better approach is to use the questionnaire as a basis for regular conversation to establish a common understanding of the organisation’s definition and vision of sustainability, the purpose of assessment, and the setting and reviewing of targets to work towards. An ongoing approach based on realistic expectations that develops and strengthens the relationship with suppliers is the key.

The extent to which buyers enforce environmental requirements (compliance-oriented practices) into their supply chains affects the level of proactivness of suppliers to fulfil these requirements. In light of this notion, it appears that the signals that buyers have sent to suppliers have been weak. While buyer demand is one of the key drivers to the adoption of environmental innovations, few buyers are actually making such demands. A majority of buyers said they consider the environment as a preference in their selection of suppliers. The question is: does such an approach provide enough incentive for suppliers to green their activities and improve their environmental performance? The answer, not surprisingly, seems to be negative. Suppliers were sceptical about the value that buyers assign to their environmental efforts. From the suppliers’ perspective, they will not invest in something that may or may not be accepted by customers. This is considered a high risk investment. Such concerns arise when an innovation is more radical, rather than a minor incremental change.

With regards to cooperative practices many participants claimed to have no interaction with their supply chain partners on environmental issues at all:

When we deal with suppliers, we typically have buy and sell relationships with them. We see what they do, etc. I can’t think of any off the top of my head where we will work that closely to redesign their process. (BP15, Procurement Manager)
This, however, is not surprising because when buyers have a passive environmental strategy vis-à-vis their supply chains, it would be unlikely to see them devote their resources to joint environmental efforts. They may have had other joint activities that have been pursued with their supply chain partners, but mainly focused on cost, quality or other performance areas. The passive environmental supply chain strategy could be seen in the comments that each party (for example buyers) made about the other party (for example suppliers) in that they blamed the other party for being ignorant or less active in cooperative works. For instance, participants in buyer organisations blamed suppliers for not being willing to become involved in joint works and complained about suppliers’ inaction in proposing environmental solutions. On the other hand participants in supplier organisations accused buyers of not requesting and valuing environmental merits:

The standard is more to do with the product. They don’t worry about environmental standards as such. It’s just more to do with the stability and reliability of the product and how long it will last. It’s just a product conformity, that’s it. (SP4, General Manager)

As far as buyer participants’ claims are concerned, although it is positive developments to see suppliers proactively propose environmental solutions, it would not be practical to solely rely on suppliers’ proposals in order to initiate a cooperative work. This situation suggests that buyers have not been able to communicate the positive economic and social merits of green practices with their suppliers. Cooperative-oriented practices are different from compliance-oriented practices, in that they require both parties to commit resources, especially buyer organisations that have better control over the relationship and have better access to resources. Nevertheless, it appears that a majority of buyers prefer more convenient solutions, in which they choose to delegate the responsibility for generating and proposing ideas to suppliers. This way, instead of buyers spending time and financial and human resources, suppliers will do the main job and buyers use the benefits. However, in practice this approach does not lead to positive outcomes because the complexity of environmental solutions discourages suppliers from beginning the initiatives on their own.

The limited examples of cooperation between a few firms and their supply chain partners may provide some insights. These ad-hoc cooperative activities were mainly undertaken to reduce packaging or waste. One explanation for popularity of these types of environmental innovation is perhaps the immediate benefits they produce. Both buyers and
suppliers showed more interest in cooperative arrangements that result in direct cost-reductions:

We worked with one of our suppliers and they removed the polystyrene and changed it to recycled cardboard. The cardboard would probably take a lot less space than the polystyrene blocks we’d been using. Plus, we crush it back to [name of a recycling company] and we get at the moment, because there are staples and things in it, we get $20 a tonne back. (BP8, Quality and Sustainability Manager)

One of the things we are starting with the suppliers is returnable packaging instead of the packaging that comes and you just throw it and it ends up in landfill. So we are asking more and more suppliers on a returnable packaging and for any reason they cannot use returnable packaging, and then we use recyclable packaging. There is no more packaging that you just have to throw after using it one time. (BP10, Procurement Manager)

This finding is congruent with the study of Bowen et al. (2001). The authors call these types of environmental initiatives, “win-win” green supply initiatives. They found that more than two-thirds of participants in their study had implemented either recycling initiatives, which require cooperation with a supplier, collaboration with a supplier to reduce packaging or had made efforts with a supplier to reduce waste. These initiatives often increase efficiency, reduce cost, or increase sales (Vergheese and Lewis, 2007). Therefore, it could be argued that waste and packaging minimisation initiatives (what Bowen et al. call product-based innovations) are “low-hanging fruits” that do not necessarily require high investments, yet benefit the environment, and produce immediate economic returns. Given these considerations, these cooperative initiatives may provide better motivation for firms that have less proactive environmental supply chain strategy. However, as Preuss (2005) argues one has to be careful because packaging and waste initiatives are peripheral to the environmental performance of the supply chain as a whole.

The reality of the environmental profile of a majority of sample manufactures interviewed vis-à-vis their supply chain is not promising. Thus, questions arise as to whether there is any evidence of the companies who have been able to effectively cooperate with their supply chain partners and reap the benefits and whether the hypothetical positive relationship between implementing GSCPs and greater adoption of environmental innovations is practically evident. Contrary to some other studies (De
Marchi, 2010a) that found well established environmental cooperative arrangements between the sample they studied, this study did not find systemic cooperative arrangements between firms and their supply chain partners. However, there were two firms (BU2 and SU10) in the sample that stood out and exhibited more proactive environmental supply chain strategies. BU2 had the experience of guiding a supplier to obtain ISO14001 and SU10 was actively seeking opportunities to liaise with its supply chain members to find better environmental solutions. Hines (2001, p.4) refers to this behaviour as a mentoring act and defines it as “the development of a close relationship between the customer and supplier company, usually focusing on one or more discrete projects. The customer company may agree to mentor or guide the supplier company in developing or working through a particular project”. Mentoring is different from partnering (or cooperation) as it is not regular and does not require substantial resource commitment of the parties involved. These two firms show that there are exceptions that attempt to engage with their supply chains to generate environmental innovations and their achievements corroborate the findings of quantitative analysis (see chapter four) and some other studies in the literature, which emphasise the positive relationship between cooperation and greater adoption of environmental innovations. However, the activities of these companies are still exceptions and not a standard approach followed by a majority of manufacturers.

Examining the characteristics of the two direct buyers-suppliers dyads in the sample (BU10-SU9 and BU2-SU5) may provide some insight. Both buyers and suppliers were in the “Automobile Manufacturing” sector. In both cases, the findings showed that there were some limited interaction between buyers and suppliers on environmental innovations. This may be related to the nature of this industry. The challenge of developing environmental innovations, whether in the form of more efficient practices or new products (e.g., electric cars, solar cars, etc.), has been a subject of concern for car manufacturers and their supply chains for a while. The awareness and maturity in this industry seems to be comparatively higher. The fact that the two buyers interviewed, were willing to provide the contact details of their suppliers may also suggest that there are some green supply chain practices in this sector that the participants would like to share.
7.3. Why is there a gap?

The question is: why despite the growing importance of green supply chain management and some though limited successful evidence within this study’s sample, a majority of firms are still passive in their approach to green their supply chains? The examination of findings as well as exploration of the literature suggests some primary and some secondary factors as the possible explanations. Similar to the findings of other researchers (Bowen et al., 2001; Preuss, 2005; Hoejimose et al., 2012; Walker and Jones, 2012), the primary factors that are more dominant in determining whether or not firms invest in GSCM practices relate to internal organisational factors. These factors include the notion of senior managers that implementing GSCM practices and developing environmental innovations are costly as well as the inadequacy of resources of suppliers. Secondary factors relate to external environment of firms. These include lack of motivating policies and low customer and consumer demands.

This finding that internal factors have priority over external factors in implementing GSCM has important implications. It indicates that more attention has to be given to eliminating internal constraints to encourage further investment in joint environmental innovations. Although government and consumer/customer pressure could provide an incentive, their absence may not have the same effect as the internal constraints might have. The next section presents a detailed discussion of these primary and secondary factors, which are shown in Figure 7.1.
Figure 7.1: Factors contributing to the existence of a gap in greening supply chains and developing environmental innovations
7. 4. Primary factors

These are the participants’ notions that environmental initiatives are costly and their concerns about the resources they require for environmental initiatives.

7. 4. 1. The notion that greening of supply chains is costly

The notion that implementing green supply chain practices and adopting environmental innovations are costly appears to be one of the most serious constraints on greening supply chains. Congruent with the literature (Walley and Whitehead, 1994; Bowen et al., 2001; Preuss, 2005; Giunipero et al., 2012; Muduli et al., 2012; Seidel et al., 2012), the economic advantages of green initiatives are still unclear for many of the participants. The seriousness of this issue has affected the willingness of firms to engage proactively in environmental initiatives. This concern is reflected in the conversation with the following participants and echoed by many others:

Investment; there are a lot of good ideas but there is always a constraint on how much money we have to invest on things. Investment is always the biggest concern. If you have the money, you can work with your suppliers. (BP10, Procurement Manager)

Any of the products that I’m talking about if they are from renewable sources they will typically be higher price. Maybe about 50% higher, which in some cases maybe a lot and in some cases it is not a lot, but I don’t remember I’ve seen anything cheaper. (SP8, General Manager)

Participants’ concerns about the high cost of addressing the environment could be attributed to the fact that some of these initiatives (especially cooperative practices to develop more complex environmental innovations) are not still prevalent and are expensive. Therefore, with a majority of the participants worried about their cost management, it is likely that they avoid a pioneering approach. Instead, they seem to like to take advantage of the innovation results of others rather than incurring all the costs by themselves. This could be seen in the comments made by participants of buyer organisations, for example, about their unwillingness to assist their suppliers financially if an opportunity for improving environmental performance of either party becomes available.

The interest in the environment and the fact that businesses are responsible for their impact on the environment was not much of a debate for the participants. A majority of
participants, especially buyers, agreed that they should take some steps to green their supply chains, but their approach was oriented towards calculating the costs and benefits they gain in pursuing environmental initiatives. The same findings are observed by Bowen et al. (2001). In their study of UK firms, the authors found that 60% of purchasing managers agreed strongly that their company should share the responsibility for the environmental performance of their suppliers. However, when it came to engaging in environmental initiatives with suppliers, their interest dropped as they thought such investments may be costly and that they did not have the resources to find the best solutions. A lot of the financial concerns seem to relate to start-up costs of environmental initiatives. This was also observed in a study by Zhu et al. (2013). When firms have other priorities than the environment, they are less willing to invest in joint environmental projects that often payback in long-terms.

The mentality of focusing on costs and increasing profitability seems to be the result of the dominance of “free-market decision-making frames” as suggested by Williamson et al. (2006). The importance of frames rests on their provision of a certain perception that forms people’s behaviour. These frames may cause people to be inclined to or avoid a certain type of behaviour. The authors found that many respondents in their study express free-market values and attitudes in their comments, as was also observed in this research. For example two participants in their study said: “everything we try to do is based on the commercial angle and if there is another benefit to it, then I guess that is nice” and “primarily the thinking here is to make money and that is...you know, it’s financially led, everything is financially led” (Williamson et al., 2006, p.322). Or, the comment made by a participant, General Manager and CEO of Tekniska Verkenin, in another research study: “We must remember that one of the aims of the new organisation was to generate savings of SEK 100 million” (Ahmed and Kamruzzaman, 2010, p.37). These frames do not necessarily induce firms to carry out voluntary actions (in the form of cooperation with supply chain partners for instance) that may benefit the environment, unless it is assured to lead to more profit, whether in the form of increased market share or reduced costs. A comparison of these comments with the comments made by participants of this study shows the similarity between these decision frames that exist in markets that work under relatively free-market conditions (Australia is considered a country with free-market conditions).

In addition to the cost constraint, participants expressed concerns about the time span to return their investments. When businesses talk about an investment, they often look for
short-term returns, something less than three to five years (Carrillo-Hermosilla et al., 2009). The benefits of environmental initiatives, however, may accrue long after they are introduced and with firms interested in short-term achievement, this could be a challenge for their adoption. In particular, when the economic climate of the country is fragile (e.g., in the 2008 financial crisis and the unsteady conditions afterward), the priorities of firms shift towards more urgent investments that help their presence in the market. This supports the findings of Giunipero et al. (2012) who found that the economic conditions affect the green supply management. Their study shows that under unsteady economic conditions firms tend to rearrange their priorities in favour of immediate financial gains as opposed to environmental or social values. An issue with many green initiatives is their intangible benefits that are often ignored by managers. These intangible benefits include things such as improved image, increased motivation of employees, and improved quality of products.

The significance of cost constraint seems to be higher amongst suppliers than buyers. This supports the literature (Min and Galle, 2001; Walker and Jones, 2012) that suggests a positive relationship between size of firms and the ability to adopt environmental initiatives. Smaller companies have much more limited access to the financial resources required for many environmental initiatives. Consequently, the decision frame of managers of smaller companies seems to be more focused on undertaking activities that relate to their bottom-line. The relevance of the size is discussed in more detail in the next section.

The conclusion to be drawn, as observed by Bowen et al. (2001) and Preuss (2005) is that a majority of managers are still hesitant about the potential benefits of greening supply chains and developing environmental innovations. To expect organisations to address environmental challenges within their own companies and across their supply chains would be a difficult task if not impossible in the presence of such sceptical attitude.

7.4.2. Inadequate resources of suppliers

The willingness and involvement of suppliers in green initiatives is a significant factor that determines the success of GSCM. The findings, however, indicates that many of suppliers, especially smaller firms, are unable/struggle to acquire resources they need for implementing GSCM. The main resources required as mentioned by some participants include financial and human resources. As is the case with many other organisational initiatives, the shortage of these resources is a discouraging factor, especially considering that the benefits of environmental initiatives are more intangible in the short-term and
therefore it is more difficult to capture the attention of managers who have a reluctant attitude to environmental issues. According to Hart (1995) a minimum level of environmental resources and capabilities is required to effectively engage in environmental activities. Following is a comment made by a supplier participant that illustrates this view:

It depends on the resources that you’ve got. We have 8 big buckets to attend, to work through them and prioritise them. It’s not that environment is less important than safety and quality, per say. It’s just that our resources are limited in some ways. (SP10, General Manager)

This finding supports the argument of some researchers who contend that size of the company may be a factor limiting more proactive organisational environmental strategies. Holt and Ghobadian (2009) and Lee (2008), for example, found that SMEs engage in the least amount of green supply chain practices than larger manufacturers. Hillary (2004) suggests that adoption of green practices can be adversely affected as the size of the firm becomes smaller.

Small suppliers suffer from having access to the resources and since a majority of them have other strategic priorities (e.g., financial targets), they put less effort into obtaining these resources. A manager of a small supplier, for instance, who had bought the business recently, commented that he does not have time himself and cannot afford to recruit a new person to look after the environment side of his business. He said his first priority is to increase sales otherwise he will not be able to maintain his business. This may explain the argument that to drive green activities within the supply chains, large buyers who have a greater access to resources should assist their smaller suppliers with their expertise and perhaps financial assistance where possible.

With regards to human resources, large buying firms were in a better position. In some cases, the company had an environmental (or sustainability) manager that had regular contacts with procurement and supply chain managers regarding environmental decisions. The large number of employees enables buyers to train some people specifically in environmental skills, although it has to be said that not all buyers had taken advantage of this opportunity. In contrast, suppliers—especially small ones—had no defined position as environmental or sustainability manager nor had they trained their current staff on environmental skills. Even with the few more proactive suppliers, they had to add the environmental tasks to the current staff’s responsibilities. However, such a staffing approach is not capable of meeting all environmental demands. Engaging with supply chain
partners requires expertise and time. If the cooperation between buyers and suppliers is focused on more technical environmental solutions, then highly-skilled employees may be required. This may act as a barrier to those with limited expertise.

Financially, small suppliers perceived environmental initiatives as add-ons to their businesses and given that a majority of them were saying that they will not be able to pass the costs of environmental investments on to their customers, they were more cautious about integrating the environment into their business practices. This demonstrates that environmental credentials are still not widely considered a competitive advantage. Suppliers know that it is not just them that have a passive approach it is their competitors too.

Small suppliers encounter another difficulty and that is their low awareness of possible environmental solutions, government grants and subsidies, and industry initiatives. Research shows that there is a positive link between a firm’s willingness to adopt environmental initiatives and its knowledge of environmental issues (Biondi et al., 2002; Brío and Junquera, 2003). While in some cases managers were reluctant to adopt environmental practices, in many other cases it was the lack of knowledge about the potential benefits of environmental initiatives (poor eco-literacy) that has inhibited them from adopting a more proactive strategy.

We really don’t know if we should do something about it [the environment]. We’ve heard things in the news and papers, but don’t know the real benefits to us to be honest. (SP7, General Manager)

A comment made by one supplier participant, which was repeated by few others, about their deliberate reluctance to search for environmental knowledge may provide some insight. Given that the government ran some initiatives to engage SMEs in the environmental considerations, these participants were asked if they have used government grants or subsidies or had been seeking the governmental agencies’ support to fill the knowledge gap. It was however discovered that these participants were sceptical about dealing with government agencies as they thought it would put them in a situation such that their activities would be monitored afterwards—for them an undesirable outcome. A close examination of this type of responses by some supplier participants indicates once again a reactive environmental strategy that is dominant amongst many SMEs. They prefer to “walk in shadow”. They would rather avoid talking about and engaging in environmental issues with their stakeholders because their mindset is that if they go out to find more information then they will be more visible and this may force them to take more proactive
measures. Furthermore, these comments point to a lack of effective communication between government agencies and small manufacturers. While the government is interested in improving the environmental performance of SMEs, it does not seem that it has been able to create a minimum level of trust that is essential for the engagement of smaller firms.

The distribution of limited resources between various business practices was another issue resulting in a passive environmental supply chain approach. A majority of both buyers and suppliers were at the early stages of environmental development (or had not started yet) and tended to improve their internal resources and capabilities before bringing that up with their supply chains. One main reason could be that firms would like to act as good examples themselves if they decided to demand environmental requirements. Another reason could be that adopting environmental innovations internally and greening supply chains means they would have to dedicate more resources, which does not seem to have happened yet.
7. 5. Secondary factors

A less proactive environmental supply chain strategy is exacerbated by some external constraints. This is partly due to an institutional environment that does not consider environmental issues a key priority (Carrillo-Hermosilla et al., 2009). From a review of the literature, it was found that government and consumer/customer pressure are two key drivers of firms’ environmental responsiveness (See chapter two). Nevertheless, the question remains, to what extent have these institutional factors been influential in encouraging interviewed firms to address environmental challenges across their supply chains?

7. 5. 1. Lack of government pressure

Governments could play important roles in driving firms to become involved in environmental activities and to follow specific behaviour. The government initiatives may range from setting strict environmental regulations to providing guidelines to businesses and offering incentive programmes. Government pressure could drive firms to look beyond their borders into their supply chains, which then could result in increased pressure by buyer organisations on their suppliers (Hill, 1997; Walker et al., 2008). Nevertheless, as far as Australian environmental regulations and policies are concerned, it does not appear that till now they have been effective in challenging businesses to adopt greener practices across their supply chains. Despite the recognition of a need to move to a greener economy by the government, accomplishing it has remained elusive due to the complexity of the issue.

A close examination of the responses of participants shows that complying with current environmental legislation has not been a challenging task for them, perhaps because the focus of this legislation has been on the minimum requirements. A policy framework that stresses minimum requirements does not seem to be effective in encouraging firms to adopt a holistic approach towards their environmental activities and to adopt green supply chain practices. One possible explanation for lack of government pressure could be countries’ obsession with economic growth and Australia is not an exception. On one hand there is a need for protecting the environment, which demands government intervention to set stricter laws for businesses; on the other hand, Australia relies on exploiting natural resources for revenue and exports. This controversy means that initiatives have met with limited success to date. Ross and Dovers (2008) point out the shortfalls related to environmental policies integration in Australia. The fear of losing competitiveness and
confronting economic interests, have held back the Australian government—similar to many other countries—from developing sustainability strategies for economic sectors, undergoing strategic economic restructuring, and investing in transition mechanisms. The lack of proper resource allocation has caused many environmental and sustainability projects to fail. With political cycles, the extent of political commitment and leadership varies, especially when governments change. Most policies still have a relatively short-term focus related to the electoral cycle. Thus, the need for a consistent and long-term approach towards environmental policies seems to be a real challenge.

While the existing regulations provide no or little motivation to the sample firms to engage with their supply chain partners on environmental issues, the fear of forthcoming regulations has driven some firms to implement some forms of environmental initiatives (mainly compliance-oriented practices). The findings are consistent with some of the earlier studies (Hill, 1997; Bowen et al., 2001; Khanna and Anton, 2002; Kivimaa, 2007) indicating that environmental initiatives are often adopted to avoid the threat of future legislation. In “the state of environmentally preferable or green purchasing in Australia” report published in 2009 (Netbalance Foundation), it was found that the “threat of regulation” is a major driver of decisions to adopt green purchasing practices. Consistent with this research’s findings, the Netbalace Foundation report shows the concern of Australian business about the impact of the Carbon Pollution Reduction Scheme (CPRS) and also broader carbon reduction commitments made by the Australian Government. Similarly, an OECD survey conducted with more than 4,200 companies located in seven industrialized countries (Canada, France, Germany, Hungary, Japan, Norway, and the United States) showed a positive and significant relationship between the perceived severity of environmental regulations and firms’ environmental responsiveness (Lanoie, 2011).

A notable finding of this research is the relationship between perceived impact of environmental regulations and the firm’s size. While suppliers expressed fewer concerns about the legislation, buyers frequently raised the issue of complying with upcoming environmental regulations, particularly the carbon tax (CT) law, to justify some of their environmental activities. With the suppliers, in some cases, participants did not even know how, for example, the carbon tax will affect their businesses, whereas, a majority of buyers

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9 - The Carbon Pollution Reduction Scheme Bill 2009 legislation was first introduced to the Australian Parliament in early May 2009. The Senate voted against the CPRS legislation in August 2009 and again in December 2009, after it had been reintroduced in Oct. 2009.
had already started investigating the consequences of CT and determining the appropriate responses. The more proactive responses from buyers could be attributed to the size of these companies that make them more visible to government agencies and therefore make their monitoring easier. Large companies are usually concerned about their reputation and a quick investigation of the consequences of a new legislation such as CT is to ensure they do not breach any law.

Another aspect of environmental policies is their variation in extent and intensity from one country to another, which directly affects the procurement strategies of buying firms. Governments of different countries around the world have still not reached an agreement on the degree and scope of environmental policies to set for businesses. While developed countries—particularly European countries—favour stricter environmental legislation, developing countries perceive these regulations as hurdles to their economic growth. These differences in environmental policies could create competitive advantage for suppliers functioning in countries with less rigid environmental legislation, though it may be a short-term advantage. The consequence is that buyers may shift from sourcing their needs locally (or from suppliers in countries with high environmental standards) to suppliers in countries that offer lower costs, but do not necessarily comply with environmental standards. This could be a reason that some participants in this study opposed a carbon tax law:

If you’re a manufacturer and you’ve got the carbon tax, and you are going to try and sell me something and I’d say “no, I’m not going to accept it” then they are going to be less competitive. All it does it makes imports more attractive.
(BP16, Supply Chain Manager)

Therefore, while some researchers (Porter and van der Linde, 1995; Ambec et al., 2011) argue on the benefits of stricter environmental policies, there is the likelihood to turn the attention of less proactive buyers towards suppliers with a lesser amount of environmental merits. In line with some other researchers (Bansal and Roth, 2000; Walker et al., 2008), it could be argued that while environmental legislation is essential to the process of greening supply chains, they can act as barriers too. Given that organisational strategies by their nature are to avoid risk and minimise costs, it is unlikely that more stringent regulations would spur a behaviour that exceeds compliance. In another words, environmental regulations are incapable of encouraging firms to invest in more systemic environmental innovations. This may be especially true for SMEs that according to Williamson et al. (2006) have a market-based decision frame that is incompatible with exceeding the
minimum requirements. This reinforces the previous argument that more fundamental changes could happen if internal constraints of GSCM could be removed.

7.5.2. Low customer/consumer pressure

Another institutional factor is consumer and customer demand for greener products. Because customers directly determine a firm’s economic performance, firms are sensitive to the way customers (or markets) perceive them. A greater demand from the public for environmentally friendly products could create stronger motivation for firms to adopt green practices and avoid risks of working with non-compliant suppliers. Some participants claimed that environmental considerations are not important to a majority of people. The absence of consumer pressure means firms still do not see an urgent need to direct their resources towards improving their supply chain environmental performance:

From our perspective, it’s important to collaborate wherever possible with suppliers. It’s something we know we can do better at. A lot of it is going to be driven by whatever the customers want. It comes back to “buy Australian”. People say they want to buy Australian but when it’s a dollar more expensive, and then nobody wants to buy Australian. If they are faced with two products then it always comes down to cost. (BP11, Procurement Manager)

The belief is at the moment that the end consumer will not pay for it. So, in most cases they won’t make a buying decision based on environmental considerations. (BP1, Procurement Manager)

Despite the marketing opportunities for green products, consumers, in general, do not pay attention to environmental problems and, even when they are aware of environmental issues, they are not willing to pay premium prices for such products. A possible explanation for such unwillingness—which seems to be a worldwide issue—is because consumers may think it is the responsibility of either the government and/or manufacturers to look after the environment and make sure products are environmentally friendly (Chang and Kristiansen, 2006). Therefore, while the concern over environmental impacts of businesses is increasing, the market response to reward good environmental performance is still weak.

The data from a survey by the Australian Bureau of Statistics (ABS) (2010) and another survey by National Geographic (2012) provide some insights into environmental views and behaviour of Australian consumers. The ABS report shows that 82% of Australian adults (12.8 million people) were concerned about at least one environmental problem. However,
only around a quarter (26%) reported that the condition of the natural environment was bad while almost two-fifths (39%) felt that it was neither good nor bad. Nevertheless, over half of adults (53%) said they thought the natural environment was declining. While 12.8 million Australian adults reported that they were concerned about any environmental problems, only 5.4 million (34%) had been involved in some form of environmental activity in the 12 months prior to interview. Environmental involvement includes signing a petition, making a donation and taking part in a demonstration or rally (ABS, 2010).

The National Geographic survey is based on the results of online interviews with approximately 1,000 consumers in each of the 17 countries, representing both developed and developing economies. The findings show that consumers in industrialized countries (including Australia) tend to be less concerned about the environment and more concerned about the economy and the cost of energy and fuel (See Figure 7.2). Eighty percent of consumers in Australia said they were worried about the cost of energy and fuel. Only 45% of Australian consumers were concerned about global issues such as climate change and global warming, which puts Australians amongst the least three concerned countries along with Americans and British. The trend shows a decline from 2009 to 2012. In 2009, 64%, and in 2010, 61%, of consumers expressed concern on global issues. Only 19% of Australian participants felt guilty about the impact they have on the environment (Greenindex, 2012).
National Geographic and GlobeScan developed a composite measure of environmentally sustainable consumption called the Greendex. The Greendex scores each respondent based on the consumption patterns they report in the survey, and compares average scores by country. Low scores signify greater environmental impacts, and vice versa. In the overall rankings of Greendex scores, Australian consumers are in the bottom of the ranking amongst the 5 lowest scored countries, with an overall score of 49.2. On the top of the list are Indians, Chinese, and Brazilians.

Consumers play a key role, but when firms realise that consumers have little knowledge about environmental issues or seem to be less willing to contribute financially to a greener economy, they may not necessarily “play the environment card”. Large buyer organisations tend to deal with the subject of public image through compliance with regulations and public relations strategies and standardization of their environmental communication rather than by self-regulating their environmental conduct. Smaller suppliers, on the other hand, are less concerned because considering their position in supply chain they are one step farther from consumers and they are smaller too. Thus, suppliers tend to be less affected by the activities of consumers. The literature also suggests that firms selling final goods are more likely to feel consumer pressure and consequently they may develop better
environmental practices than firms selling primary or intermediate goods (Khanna and Anton, 2002; Solér et al., 2010).

The discussion on the constraints provided the insight that it is the collective influence of internal and external factors that inhibits firms from adopting a proactive environmental supply chain strategy although there was a tendency in participants to over-stress the factors that they had less control over. Such a tendency has been found in other studies too. Shi et al. (2008), for example, interviewed three groups of stakeholders, namely business managers, government representatives, and experts and found that while all three groups agree on the main barriers, each group has a different perspective about which factors are more important. Similar to this study’s findings, business managers largely emphasised the financial and economic barriers and technical and information barriers and gave a lower profile to internal managerial and organizational barriers. On the other hand, government representatives stressed the impact of internal managerial and organizational barriers. The expert group seemed more neutral and balanced, despite their relative emphasis on policy and market barriers.
7. 6. Summary

This chapter provided a discussion of findings of qualitative interviews. While chapters five and six presented an objective account of buyers and suppliers participants’ responses, this chapter endeavoured to move beyond the objective to the subjective, to produce a holistic and integrated synthesis of the findings. This chapter provided some sense of understanding what lies under the responses of participants. It offered insights about the connection between the practices, experiences, and opinions of this study’s samples and the current literature. The close examination of the findings reveals a gap between the importance of green supply chain implementation in theory and the reality that shows a minimal involvement of both buyers and suppliers in the greening process. This gap stems from a passive environmental supply chain strategy and in further examination for the underlying reasons it is uncovered that two primary and two secondary factors contribute to such passive strategy.

The primary factors, which are internal organisational factors include, the managers’ notions that implementing green supply chain practices and developing environmental innovations are costly as well as the inadequacy of resources of suppliers. A focus on cost by managers is the result of the dominance of “free-market decision-making frames”. These frames do not necessarily induce firms to carry out voluntary actions (in the form of cooperation with supply chain partners for instance) that may benefit the environment, unless it is assured that they will lead to more profit, whether in the form of increased market share or reduced costs. Small and medium-size suppliers find it more difficult to obtain the financial and human resource required for GSCM. Co-investment on environmental innovations requires minimum capabilities that still not commonly available to suppliers.

The secondary factors, which are external organisational factors include, the lack of pressure from the government as well as consumers/customers. Government regulations and policies to date have not been effective in challenging firms to adopt green practices along their supply chains. Furthermore, the market demand for environmentally friendly products has not been sufficient to encourage firms in further environmental investments. While some consumers may have concerns about the impact of businesses on the environment, a majority are not still willing to change their preferences.

The main argument of this chapter was that internal factors have priority over external factors in implementing GSCM and bridging the gap between theory and reality. If a
change needs to happen, these internal constraints have to be dealt with first. Next chapter presents a detail discussion on how a change within the organisations could be encouraged.
8. Chapter Eight: Conclusion and Recommendations

“We shall require a substantially new manner of thinking if mankind is to survive.”

Albert Einstein
8. 1. The conclusion

The aim of this research was to investigate the development of environmental innovations in the context of cooperation with supply chain partners. The first objective was to test an assumption that until now had little empirical evidence to support. It was hypothesised that cooperation with external partners increases the likelihood that environmental innovations are developed or adopted. Using a large dataset based on 2732 Australian firms, the validity of this assumption was tested. The findings supported the proposition that there is a positive relationship between environmental innovation and cooperation. This finding is in line with the resource-based view that firms can obtain sufficient resources to facilitate the process of developing environmental innovations by linking to other organisations. These resources include guidance, technical know-how, and human and financial assets. The findings also provide support for institutional theory’s suggestion that cooperation helps to enhance legitimacy of firms and reduces the pressure from various stakeholders.

Although the knowledge of a positive link between cooperation and environmental innovation is useful, it still does not provide a rich and in-depth explanation for environmental cooperation with external partners. The second objective therefore was to investigate the way firms interact with their suppliers on environmental issues. A sample of manufacturing firms was selected and representatives were interviewed. The aim was to understand the factors that buyer organisations consider as important in selecting and monitoring their suppliers and whether or not environmental criteria were amongst them. Moreover, the environmental cooperative practices of interviewed firms with their supply chain partners were examined to determine the type and method of cooperation and the areas that buyers and suppliers were more interested in for co-investments. The participants were also asked about their motivations as well as their perceptions about the barriers against pursuing environmental objectives within their companies and along their supply chains.
Chapter 8: Conclusion and Recommendations

The findings revealed a gap between the importance of green supply chain implementation in theory and the reality that shows a minimal level of involvement of both buyers and suppliers in the greening process. Some buyers were using compliance-oriented practices to push their suppliers to become involved in the greening process. The evidence, however, showed environmental criteria are still not compulsory and are considered as preferences that may not necessarily change buyers’ decisions in selection of suppliers. With regards to cooperative practices, the evidence was scarce. There were limited joint environmental works, mainly focused on packaging and waste minimisation. A main motivation for such (albeit limited) joint-works, was the immediate cost reductions that both buyers and suppliers had experienced.

These findings prompted further questions as to why firms do not engage with their suppliers on environmental innovations. What could explain the gap between the importance of GSCM in theory and the reality? A closer examination of the findings in conjunction with the results of other researchers in the field uncovered two primary and two secondary factors as the possible explanations. The primary factors, which are internal organisational factors, include the notion of managers that implementing green supply chain practices and developing environmental innovations are costly, as well as the inadequacy of resources of suppliers. A focus on cost by managers is the result of the dominance of “free-market decision-making frames”. These frames do not necessarily induce firms to carry out voluntary actions (in the form of cooperation with supply chain partners for instance) that may benefit the environment, unless it is assured that they will lead to more profit, whether in the form of increased market share or reduced costs. Small and medium-size suppliers find it more difficult to obtain the financial and human resources required for GSCM. Co-investment on environmental innovations requires minimum capabilities that are still not commonly available to suppliers.

The secondary factors, which are external organisational factors, include the lack of pressure from both the government and consumers/customers. Government regulations and policies to date have not been effective in challenging firms to adopt green practices along their supply chains. Furthermore, the market demand for environmentally friendly products has not been sufficient to encourage firms in further environmental investments. While some consumers may be concerned about how businesses affect the environment, most are not willing to align their preferences with environmental concerns.
Although both types of internal and external constraints were evident in the data, this thesis has demonstrated that **internal factors have more impact than external factors on driving firms to develop environmental innovations and to engage with their supply chain partners**. If a change needs to occur, the internal constraints must be dealt with first. The following section presents a detailed discussion on the way business decision makers could drive that change. This discussion is followed by recommendations to policy makers that could also help to resolve some of the secondary constraints. Recommendations to prospective researchers are also provided as they could play important roles by providing more knowledge and insight into the areas that have had little investigation.
8. 2. Recommendations

This investigation concludes with a series of recommendations based on an examination of the constraints cross-referenced with the literature, as well as some further reflections. These recommendations could help the following groups to make informed decisions in the area of GSCM:

(A): Business decision makers

(B): Policy makers

(C): Prospective researchers

8. 2. 1. Recommendations for business decision makers

The finding that internal factors such as managerial notion about the cost of environmental initiatives are more important than external factors has significant consequences for business decision makers. Business decision-makers include people whose decisions may change the way a business is operating. With regards to environmental issues, business decision-makers are from top management, procurement and supply chain managers, and environmental managers. This finding indicates that it is the perspective of these people in preserving the natural environment that shapes their business strategies and practices. If their view is that environmental initiatives are “add-on” to their businesses, it is difficult, if not impossible to begin any environmental initiative including greening supply chains. Therefore, more focus should be on changing business managers’ perspectives so that they feel responsible for their supply chain activities, and the impacts their businesses have on the natural environment.

The view that environmental initiatives negatively impact the financial performance of firms is a major challenge. It would be unrealistic to expect firms to invest in environmental initiatives without incurring any costs. There would be cost associated with implementing green supply chain practices and adopting green innovations. However, as suggested by Seidel et al., (2012) with a more holistic approach that considers the benefits and costs together, many environmental investments can become more feasible. To achieve this, managers should be made aware that environmental and economic performances do not operate in competition with each other. Managers should recognize that economic growth and environmental protection can work together if they adopt a long-term view (Bowen et al., 2001; Zhu et al., 2013). The ever-increasing pressure from stakeholders, especially government, makes it more costly to take a passive approach (e.g., Australian
carbon tax for polluters). Energy prices are rising and proactive competitors are opening new markets and enhancing consumers’ awareness of environmentally friendly products. These potential threats could be turned into opportunities if firms became more proactive in their environmental strategies. As Bowen et al. (2001) and Preuss (2005) argue, many environmental supply chain initiatives could improve supply chain efficiency (e.g., reducing waste, reducing material and energy usage, better utilizations of facilities, improved transportation) not just for an environmental benefit per se, and may be undertaken without assigning specific environmental resources.

As suggested by Carter and Dresner (2001), to move away from a passive attitude, it is essential that business decision makers incorporate long-term environmental targets in their strategies. If firms consider a short-term approach in deciding whether or not to engage in activities and practices that improve their environmental performance, they will tend to respond negatively. However, with a long-term view, they would see how their investments could pay off, which could give them a competitive advantage. For many environmental initiatives, firms have to allow up to five years, to reap the benefits. Such long-term thinking can be seen in the conversation with the General Manager of one interviewed supplier, a proactive supplier in the area of environmental activities with a high profile in its own industry:

When we started it in 2005-06, there was discussion about the CPRS (Carbon Pollution Reduction Scheme). This was when the first round of discussion started about it. It didn’t get anywhere but there was discussion. That was also when FSC chain of custody became more prominent in the printing arena. There has been PEFC, which has been the competitor for FSC but FSC had been getting a lot more momentum, particularly here in Victoria. A couple of our customers asked us if we were intending to get chain of custody certification, which we were looking to do anyway. So as a management group, we got together and said “Look, if we are looking to do that, then we should look at 14001, which is all-encompassing for everything environmental anyway. Also if the government had the view to introduce some sort of carbon tax, which was called the CPRS in another version we should aim, as a longer term goal, to do something about that. (SP11, General Manager)

Closely related to the long-term approach is consistency in pursuing the environmental objectives. It is unfortunate that when firms face difficulties such as financial hardship, the first thing they do is cease environmental initiatives. As some participants in this study
mentioned, the willingness of firms dropped after the 2008 financial crisis. Whilst it is recognised that many industries suffered financial strain during this time, managers should be determined in their goals and not waste their prior efforts. They should be patient and allow time for their efforts to produce results. An unstable approach can waste resources and create scepticism amongst partners about the determination of a firm’s future programmes. This is particularly true for greening of supply chains that involves more than one party. For instance, a buyer starts joint environmental work with a supplier and halfway through, the project is shut down because of an underestimation of costs or change in economic circumstances. This will waste the resources of both parties and run the risk of losing their credibility.

Resource scarcity was a major issue pointed out by some participants, especially supplier participants. Although the size of a company is relevant, it may not be a deterministic factor. The argument that lack of resources inhibits the ability of smaller firms to be environmentally innovative, does not precisely justify their passive environmental strategies. A review of the findings shows that there are examples, although limited, among the supplier participants that have been able to take advantage of their early involvement in environmental activities, regardless of their smaller size. One reason for holding such a view may be that some firms are so focused on their routine activities and fulfilling their contractual requirements that they leave no space for devising ways to efficiently use their resources for other purposes. As Etzion (2007) argues, there are some environmental initiatives, especially organisational innovations such as life cycle thinking, or business alignment with environmental issues that are less relevant to size and can be implemented by any company.

“Bigger” may not necessarily mean “better” with regards to environmental improvements (Bowen, 2002). While large organisations may benefit from their ample resources, they are limited in some other ways. Large organisations do not have the flexibility and agility of small firms. It is often more difficult for them to change their existing processes, products, and technologies. Not only may smaller size of suppliers not be a threat, it may even offer the opportunity to attain competitive advantage. Smaller firms have less bureaucracy and benefit from flexible structures, as well as the fact that access to top management is much easier for them. As argued by Aragon-Correa et al. (2006), for a proactive stance on the environment, smaller firms need to develop a set of organisational capabilities, similar to large firms. The difference, however, may be that smaller firms may
follow different paths and therefore develop different capabilities than large firms (Seidel et al., 2008).

One way of changing the perspective of managers could be educating the younger generations who will step into managerial roles in the future. There is still limited emphasis on the importance of the environment (and, in a broader perspective, sustainability) in the current curriculum of many education institutes. Students studying engineering or business are taught to be good problem solvers. However, so far, environmental issues have not been recognised as a major teaching focus. As suggested by Schaper (2002, p.530), through inclusion of environmental information in the current courses, universities will be able “to measure student concerns about the environment, and to assess what (if any) impact such courses ultimately have on the environmental performance of students once they graduate.”

Within Australia and across many other countries there are some reputable organisations that provide references and materials, some free of charge, to help current supply chain and procurement managers to be aware of their legal environmental responsibilities. These organisations also provide firms with the essential tools and guidelines they need for greening their supply chains. To the best of the author’s knowledge ‘Eco-buy’ and ‘Net Balance’ located in Melbourne, Australia provide special services in the area of green supply chain management. ‘Sedex’, the online platform for supplier assessment, has released a free, publicly available document offering practical guidance to help suppliers all around the world to understand what ‘good practice’ looks like in the areas of labour, health and safety, environment and business ethics.

Training procurement and supply chain managers could be of great importance because they are the contact points with suppliers and the success of green supply chain projects highly depends on their willingness and knowledge. As observed in this study and found elsewhere (Bowen et al., 2001; Preuss, 2001; Hamner, 2006), the dominant mindset amongst a majority of purchasing personnel is to source from suppliers that offer cheap products, reasonable quality, and fast delivery. For large buyer organisations that have people who are specialised in environmental skills (e.g., environmental or sustainability managers), a way forward is to hold internal workshops so that purchasing personnel can be taught about environmental principles. Managers can also form working teams consisting of environmental and purchasing staff for better implementation of green supply chain initiatives.
A positive managerial attitude that considers environmental costs as an investment, adopts a long-term and consistent approach, and does not perceive resource scarcity as a threat, could pave the way for changing the traditional buyer-supplier interaction to include environmental considerations. For buyers aiming to green their supply chains a certain level of compliance-oriented practice may be required. It might be unrealistic to expect suppliers to adopt environmental practices unless stakeholder pressures (especially from their influential customers) can provide a credible threat to their survival and legitimacy (Eiadat et al., 2008). By better monitoring of suppliers’ activities, buyer organisations could build on confidence in their suppliers. This is especially true if buyers expect suppliers to develop environmental innovations that are not easily controllable through market mechanisms (De Marchi, 2010a).

Research on the effects of compliance-oriented practices gives credence to the perspective that these practices are influential in adoption and diffusion of green practices by suppliers (Bala et al., 2008; Baden et al., 2009; Delmas and Montiel, 2009; De Marchi, 2010a). Buyer organisations that incorporate environmental criteria in their selection procedures, implement supplier audits, establish formal evaluation processes, and offer feedback to suppliers are likely to see positive changes in how suppliers regard environmental issues. As it was observed in a few cases in this study and reported elsewhere (Bala et al., 2008; Baden et al., 2009; De Marchi, 2010a), the set of compliance-oriented practices implemented by buyers could drive environmental innovations among suppliers. A survey of 103 UK small and medium-sized owner/managers in response to buyer pressure showed that a majority of suppliers believed the inclusion of environmental requirements in tenders or contracts encouraged them to be more proactive in their environmental activities (Baden et al., 2009).

Despite increasing evidence about the potential benefits of green compliance-oriented practices, it is not surprising to find suppliers that complain that such measures make their businesses less productive. Tate et al., (2011) argue that, if green selection and monitoring practices increase the information seeking and enforcement costs of suppliers, they may decide not to continue the business with the buyer. Thus, while dictating certain levels of green practice for suppliers seems necessary to green the supply chain, buyers may have to be careful not to put too much burden on suppliers. Buyers could discuss their requirements with their suppliers and give them time so that the suppliers have enough time to prepare and change their practices.
There are limits on the extent to which compliance-oriented practices can drive genuine change. The main drawback of these practices is that forcing suppliers to comply with certain standards may reduce their motivation to exceed those limits. In other words, when suppliers reach the point where they can meet the requirements, they may not necessarily take on further endeavours to improve their environmental performance. They may consider these the upper bound on what they need to achieve. In terms of the extent of influence of these practices, they are similar to environmental regulations. They often prompt firms to adopt low-level environmental innovations in the form of control technologies (Vachon, 2007; Baden et al., 2009). These practices rarely induce suppliers to adopt systemic environmental innovations.

Another issue with compliance-oriented practices is that sometimes buyers use them mainly for advertising and marketing purposes. Buyers may implement these practices to avoid reputational risks related to unethical supplier behaviour instead of incorporating environmental principles in the long-term purchasing policy (Min and Galle, 1997). Such scepticism about the genuineness of buyers can be seen in a comment made by one of the interviewed suppliers’ participants:

They [buyers] occasionally ask us about what we do for the environment? I know they have marketing people that are reasonably active wanting to promote themselves as an environmentally friendly company. (SP8, General Manager)

If imposing environmental standards on suppliers is not performed with a genuine concern for the environment, time and resources will be wasted for both of buyers and suppliers. Suppliers may suffer more because they are smaller entities with more limited resources (Delmas and Toffel, 2004; Baden et al., 2009). That may partially explain the reason some suppliers become more cautious and sometimes cynical about the environmental requests of buyers. Therefore, it is reasonable to suggest that purchasing managers of buyers to be clear and genuine in their intention to green their supply chains.

The process of greening supply chains does not simply end with exerting pressure through compliance-oriented practices. Despite the advantages of compliance and monitoring-oriented practices, these practices should be viewed rather as a risk management tool than a competitive weapon. Better outcomes in terms of financial, operational, and environmental benefits could be gained if both buyers and suppliers moved beyond the adversarial mode of relationship and cooperated with their supply chain.
partners. Cooperation with supply chain partners not only helps firms to avoid the risks of non-compliance, but may also creates economic opportunities and contributes to their bottom-line. The results of the BLD survey presented in chapter 4 showed that linking to external partners increases the likelihood of adopting environmental innovations. The findings of interviews with managers of manufacturing firms—though limited and mainly focused on packaging and waste minimisation or mentoring activities—provide some insight as to how cooperative practices could benefit the involved parties.

Procurement and supply chain managers could use mixed methods to involve suppliers. While traditional interaction methods such as telephone calls or emails make some contributions, more proactive practices such as on-site visits, face-to-face discussions, and joint planning and decision-making, from the start of design and development of products, could produce more effective results. Buyers with more experience in cooperation with suppliers could provide some tangible show-case examples to other suppliers. This will improve the likelihood of other suppliers being interested in engaging.

Special organisational capabilities emerge when firms engage in mutual interrelation and exchange of resources with their supply chain partners. These capabilities would be valuable and likely to become sources of sustained competitive advantage. These resources and capabilities would differ from those developed via normal cooperation between firms. This can be attributed to the characteristics of environmental issues, which are socially and technologically more complex. Trust is a valuable inter-organisational resource that emerges from close cooperation of supply chain partners as suggested by Gold et al. (2010). It is a belief that the other party is honest and sincere. Trust is an important element in inter-organisational relationships because it reduces the risks of opportunistic behaviour by partners and facilitates knowledge sharing (Cheng et al., 2008). The importance arises for environmental cooperation because the knowledge of environmental issues tends to be less prevalent and more difficult to obtain. In the absence of sufficient trust, firms will not share vital and sensitive information, because it may jeopardise the investment. With trust, however, partners engage in more open and effective knowledge sharing. Suppliers are more willing to share their technical know-how and buyer organisations could take advantage of their wealth of experience as well as better access to resources in order to create more fundamental solutions. In conclusion, this study argues that cooperative-oriented practices, although limited in the sample interviewed, are more likely to prompt fundamental environmental changes (i.e. more novel and/or more complex and systemic environmental innovations).
8.2.2. Recommendations for policy makers

Despite the importance of having internal stimulus to engage in environmental initiatives, not all firms are willing to volunteer action—as it was observed in this study. Therefore, in line with scholars such as Porter and van der Linde (1995), and Cleff and Rennings (1999) policy makers could actively promote investment in environmental initiatives. It is not within the scope of this research, however, to provide a detailed discussion of what and how governments could contribute to the greening process. This topic itself would be a separate topic for research. Nonetheless, based on the findings and further reflections, some recommendations are presented here to elucidate some of the actions that governments could undertake to help and impact the greening process of supply chains.

As the green movement continues to gain momentum, governments could set policies that facilitate supply chain cooperation. These could be in the form of subsidies or incentive packages that encourage buyer organisations to engage their suppliers in green programmes. The dominant mindset within the business is that environmental initiatives are costly, therefore, actions are unsolicited. Perhaps such reticence may be ameliorated through preliminary funding by governments. The increased number of companies adopting green supply chain management may spur other companies to keep up to their competitors and adopt environmentally innovative practices.

To encourage environmental cooperation amongst supply chain partners, governments may form coalitions with industrial associations. The benefits are that government agencies can provide funding and information regarding environmental expectations and requirements. Given that industrial associations have well-established relations with their members, they can plan, lead and monitor the projects. An example of such initiatives was found in the relationship between Sustainability Victoria (a government agency) and Australian Industry Group (an industrial association). In a project called “ResourceSmart Business Industry Pilot”. They came together to help two large food manufacturers engage with their suppliers in evaluating their impacts on the environment and then to devise solutions.

Governments themselves may demonstrate best practices to businesses by integrating environmental principles in their procurement policies. In a recent initiative, the Australian Department of Sustainability, Environment, Water, Population and Communities engaged ECO-Buy to develop a sustainable procurement guide to help Australian Government
purchasers to include sustainability principles in all stages of the procurement process, from identifying the business need to use and disposal of goods (Eco-Buy, 2013). Similarly, governments could assist the development of guidelines for manufacturing firms. This would help to fill the information gap mentioned by some participants, especially SMEs.

Governments may encourage the usage of environmentally friendly products by raising consumer and customer awareness. If there is more demand in the market for environmentally friendly products, manufacturers may be more willing to invest in environmental initiatives. Activities such as TV advertisements, documentaries, free workshops, newsletters, and environmental awareness campaigns are just some ways that governments may change consumers’ attitudes.

Sometimes governments may not need to be involved directly. They could support environmental activists and NGOs to drive the change. Given that in developed countries such as Australia, these groups have influence on businesses; their engagement could be an effective strategy. These groups could exert pressure on firms and also liaise with them to pursue environmental goals. It is argued that cooperation with NGOs could help firms to achieve their environmental objectives (Fiedler and Deegan, 2007).

One fundamental way to change the direction of firms could be educating managers on the benefits of environmental initiatives, as mentioned in an earlier section. Governments can contribute by providing free of charge or low fee training courses. Government agencies could also sponsor informative events about the business impact on the environment. These could be conferences, seminars and forums where the experts in the field meet up with the business owners and senior managers to discuss their findings. This would be a valuable opportunity for those firms who would like to see best practices in the field and would like to know how to start the greening process.

Despite the increasing scientific research in the area of sustainability and the environment, there is still a lack of research, especially in the field of green supply chain management and environmental innovation. Governments could fund research and encourage knowledgeable scholars to become involved. Dedicated grants with some kind of reward could effectively attract more researchers.

In addition to various incentive and support programmes, governments could gradually raise environmental standards. This would alert laggards that lack of improvement in environmental performance will breach laws with consequence loss of their businesses. It will also assure the frontiers that their efforts are acknowledged. Environmental
management literature offers various tools that governments could use for this purpose. These include, for example, putting a price on carbon so that polluting firms will be encouraged to reduce their carbon emissions and take up renewable energy. This scheme started in July 2012 in Australia and according to the report published by “Department of Climate Change and Energy Efficiency”, 33 countries and 18 sub-national jurisdictions will have a carbon price in place by 2013 (Flannery et al., 2012). Emission trading schemes have also been introduced in some countries around the world including the 27 countries of the European Union, and three non-European Union members and New Zealand. The Australian government is aiming to shift the carbon tax to an emission trading scheme in July 2015.

The points discussed above are shown in a resolution framework (See Figure 8.1). This framework contributes to a better understanding of the activities that can be undertaken to move towards a greener supply chain and consequently a greener economy.
Figure 8.1: A resolution framework: recommendations to business and policy decision makers

Increasing level of influence

Encouraging and supporting supply chain cooperation
Acting as best practices by incorporating environmental practices in the procurement policies of government agencies
Raising consumer awareness
Supporting the training and education of current managers and younger generations
Supporting the research
Increasing the environmental standard levels gradually

Policy makers → Business decision makers

Having positive attitude towards environmental initiatives
Considering cost of environmental initiatives as an investment
Adopting a long-term and consistent approach
Not considering the small size as a threat
Implementing green supply chain practices

Green compliance-oriented practices
Green cooperative-oriented practices

System level innovation
Opportunity-driven innovation
Improvement innovation
Passive/cosmetic

Weak impact → Medium impact → Strong impact

Chapter 8: Conclusion and Recommendations
8.2.3. Recommendations for future researchers

The outcomes of this research suggest that internal organisational factors such as managers’ view on environmental improvement and availability of resources are the primary factors that drive GSCM. One opportunity for further research would be to test the validity of this finding using a survey questionnaire or conducting a similar study in other regions of the world. The questionnaire can list the drivers and barriers of GSCM and ask respondents to give them a score based on their importance.

A secondary factor in the findings was the lack of government pressure. It would be interesting to conduct further research to know the extent to which changes of governments’ policies (for example in Australia the introduction of carbon tax in July 2012) would drive firms to become more proactive in their environmental supply chain strategies. The expectation is that such policies could drive some changes, although limited. Government regulation may encourage firms to integrate green compliance-oriented practices in their suppliers’ selection and evaluation process, but it is unlikely that it would encourage cooperation.

Another opportunity for further research is to compare and contrast environmental, operational, and financial performance of firms with different approaches towards greening supply chains. Sample cases could, for example, be selected from firms having a passive approach, those who use compliance-oriented practices only, and firms with both compliance and cooperative-oriented practices. It is expected that firms who partner with their suppliers to devise environmental solutions (or at least guide and support their suppliers) should achieve more systemic environmental innovations and consequently should be able to reap more economic benefits than others. The findings would be of higher value if the data from these cases were obtained on intervals over a long-term period (5-7 years). As discussed above the reason for this is that many green supply chain initiatives pay back on longer terms.

In line with the previous recommendation, another approach would be to investigate how companies with business models based on compliance-oriented practices transit to a business model based on cooperative-oriented practices. What changes (e.g., structural, decision making, etc.) occur when firms transit from compliance to cooperation. A case study approach with some firms that are proactively seeking to engage in green supply chain management would be a suitable method.
Large buyers have a large role to play in the green supply chain debate. They could use their power to influence their suppliers. It would be useful for future studies to investigate the circumstances under which large buyers would include environmental criteria in their suppliers’ selection and monitoring requirements and would be willing to invest in joint environmental projects with their suppliers.

Further insights could be gained if future research could focus on identifying the best available approaches that smaller suppliers can undertake to face up to the challenges of green supply chain management. Suppliers were more concerned about the unavailability of financial and human resources. Future research could look more in-depth into the ways that small firms could overcome such barriers so that they become more willing to engage in environmental initiatives.

Another opportunity to build on this research would be to replicate this study with a sample of firms in the service industry (e.g., banks, insurance and transportation companies, etc.). It would be interesting to know the type of green supply chain practices that they use and the motivations and challenges that they face. The findings obtained from such a study may be compared to this research’s findings to ascertain the similarities and differences.
8.3. Contribution of this research

There were several notable contributions by this research. From a theoretical perspective, this research used the resource-based view, institutional theory, and existing literature on environmental innovation and green supply chain management to analyse and discuss the complex and multi-facet concept of ‘cooperation for environmental innovation’. A framework was constructed from the key elements that emerged from these theories and the relevant literature enabling conduction of further empirical study. This framework, which linked different branches of the vast literature, is a useful guide for current and new researchers in the field.

From a practical perspective, this research presented novel empirical evidence on cooperation for environmental innovation and green supply chain management in the Australian context. There is scant quantitative study in Australia to test the hypothetical relationship between cooperation and environmental innovation—to the best of the researcher’s knowledge. This relationship was tested using a sample obtained from a large Australian dataset and results showed a positive relationship between cooperation and environmental innovation. The implication of such a finding for businesses is that the more they engage in cooperative activities with their external partners, the more likely they are to develop environmental innovations.

New insights were presented on how Australian firms deal with the environmental challenges along their supply chains. This was done through the analysis of a series of interviews conducted with Senior Supply Chain, Procurement, Environment and General Managers. The findings, though not promising, showed that there is a gap between desired state of green supply chain management and the reality, which is a low adoption of green practices. This indicates that Australian firms a passive environmental supply chain strategy and perhaps behind firms in other developed countries (e.g., some European countries, Canada, and USA) with regards to GSCM.

Most studies that have looked at environmental innovation in the context of supply chains have analysed the issue from the buyers’ perspective. Despite the power of large buyers to initiate the greening process, successful implementation of green initiatives depends on suppliers (Forman and Jørgensen, 2004). This research, therefore, made a significant contribution by integrating the views of participants from both buyers and suppliers.
One main contribution of this research was that by examining the findings, it highlighted the factors that lead to a passive environmental supply chain strategy by firms. It demonstrated the importance of internal organisational factors (e.g., the perspective of managers and culture as well as the sufficiency of resource) over the external factors (regulations and consumer expectations). The resolution framework proposed in the final chapter showed that fundamental environmental changes (i.e., more novel and/or more complex and systemic environmental innovations) could be achieved, if firms engaged their suppliers in the greening process.
8. 4. Limitations

This research is one of the few works in studying green supply chain practices in Australia. Thus, the investigation and its findings are still relatively exploratory. Any conclusion to be drawn from these findings has to be interpreted with caution. Furthermore, similar to other studies that use qualitative methods, this research may have been restricted by the thinking and choices of the researcher, which could have been a source of potential bias in the findings. However, by recognising this limitation up-front, a systemic approach that limits the influence of researcher’s self-opinion was adopted. All interview transcripts were coded and the coding scheme was scrutinised by the research team and the analysis of findings was also cross-examined with the previous studies.

The responses of participants might have been biased due to the participants’ managerial positions. This might have affected the way participants answered certain questions. They might have given answers that show a good image for their firms. Nevertheless, to reduce the effect of this bias, the researcher assured the names of companies and their participants are kept anonymous and the information they provide are only used for the research purpose.

This research studied a sample of manufacturing firms across different industries. While such approach increases the generalisability of findings, it does not consider specific industry factors (e.g., size, age, pollution level, technological advancement, etc.) which could limit its appropriateness.

The cases selected in this study are confined to Australian manufacturing firms and the extent to which the results are generalizable beyond the Australian setting is a question for further research. It is believed that this research will encourage other researchers to conduct similar studies in other regions and countries to determine whether the results that were obtained have features that are idiosyncratic to manufacturers in Australia.


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Young, G., 2010. Opportunities and challenges related to SME implementation of EMSs.


### Appendix A: Qualitative methods

Qualitative methods (Yin, 2011 p.17)

<table>
<thead>
<tr>
<th>Illustrative variation</th>
<th>Relevant works</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action research</td>
<td>Lawin (1946); Small (1995); Greenwood &amp; Levin (1998); Reason &amp; Riley (2009)</td>
<td>Emphasizes the researcher's adoption of an action role or an active collaboration with study participants.</td>
</tr>
<tr>
<td>Case study</td>
<td>Platt (1992); Yin (2009); Yin (in press)</td>
<td>Studies a phenomenon (the &quot;case&quot;) in its real-world context.</td>
</tr>
<tr>
<td>Ethnography</td>
<td>Powdermaker (1965); Geertz (1973); Wolcott (1999); Anderson-Levitt (2006)</td>
<td>Involves a field-based study lengthy enough to surface people's everyday norms, rituals, and routines in detail.</td>
</tr>
<tr>
<td>Ethnomethodology</td>
<td>Garfinkel (1967); Cicourel (1971); Holstein &amp; Gubrium (2005)</td>
<td>Seeks to understand how people learn and know the social rituals, mannerisms, and symbols in their everyday life and culture.</td>
</tr>
<tr>
<td>Feminist research</td>
<td>Fine (1992); Olsen (2005); Hesse-Biber &amp; Leavy (2007)</td>
<td>Embraces the perspective that methodological and other relationships embed oft-ignored power relations that can affect research findings.</td>
</tr>
<tr>
<td>Grounded theory</td>
<td>Glaser &amp; Strauss (1967); Charmaz (2005); Corbin &amp; Strauss (2007)</td>
<td>Assumes that the natural occurrence of social behavior within real-world contexts is best analyzed by deriving &quot;bottom-up&quot; grounded categories and concepts.</td>
</tr>
<tr>
<td>Life history</td>
<td>Lewis (1961, 1965); Langness (1965); Bertaux (1981)</td>
<td>Collects and narrates a person's life story, capturing its turning points and important themes.</td>
</tr>
<tr>
<td>Narrative inquiry</td>
<td>Riessman (1993, 2008); Chase (2005); Connelly &amp; Claxton (2006); Murray (2009)</td>
<td>Constructs a narrative rendition of the findings from a real-world setting and participants, to accentuate a sense of &quot;being there.&quot;</td>
</tr>
<tr>
<td>Participant-observer study</td>
<td>Becker (1958); Spradley (1980); Tedlock (1991)</td>
<td>Conducts field-based research based on the researcher locating in the real-world setting being studied.</td>
</tr>
<tr>
<td>Phenomenological study</td>
<td>Husserl (1970); Schutz (1970); Van Manen (1990); Moustakas (1994); Giorgi &amp; Giorgi (2009)</td>
<td>Studies human events as they are immediately experienced in real-world settings, resisting prior categories and concepts that might distort the experiential basis for understanding the events.</td>
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</tbody>
</table>
Appendix B: Interview protocol

I want to thank you for taking the time to meet with me today. My name is Mohammad Yarahmadi, a PhD researcher at Swinburne University of Technology and this research is for the fulfilment of a Doctoral thesis.

The main purpose of this interview is to know your opinion and experiences on the way your firm interacts with your major suppliers (buyers) on developing environmental innovations and addressing environmental issues.

The interview should take about an hour. I will be recording the session because I don’t want to miss any of your comments. So, please be sure to speak up.

This research has been approved by Swinburne Human Research Ethics Committee. All responses will be kept confidential. This means that your interview responses will only be shared with research team members and we will ensure that any information we include in our report does not identify you as the respondent. You do not have to talk about anything you do not want to and you may end the interview at any time.

I use the term “green or environmental innovation” during the interview in my questions, which means any new or modified products and services, processes or organizational practices aiming to reduce or avoid harming the environment.

Are there any questions about what I have just explained?

If you are willing to participate in this interview, please read and sign the consent form.
Closing Key Components:

- Additional comments
- Other potential participants
- Next steps
- Thank you

Is there anything more you would like to add?

Are there other people within your firm that may have information to assist me for this research?

Could you provide me with some contacts of your suppliers that may be interested to contribute to this research?

I'll be glad to send you a copy of the final results of this study if you like. Please let me know your email address.

Thank you for your time.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Questions asked from buyer participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>• Sector</td>
</tr>
<tr>
<td></td>
<td>• Number of employees</td>
</tr>
<tr>
<td></td>
<td>• Primary product(s)</td>
</tr>
<tr>
<td></td>
<td>• Presence of an environmental department/R&amp;D department/Environmental management system (such as ISO 14001)</td>
</tr>
<tr>
<td></td>
<td>• Your job title and responsibilities</td>
</tr>
<tr>
<td></td>
<td>• How long have you been in this job?</td>
</tr>
<tr>
<td></td>
<td>• How long have you been in this industry sector?</td>
</tr>
<tr>
<td>Interaction with suppliers</td>
<td>1) What is your perception of the importance of environmental innovations for your suppliers (1-10)?</td>
</tr>
<tr>
<td></td>
<td>2) Does your firm require suppliers to improve their environmental performance?</td>
</tr>
<tr>
<td></td>
<td><strong>If yes then:</strong></td>
</tr>
<tr>
<td></td>
<td>3) What practices do you have in place to enforce your current suppliers to improve their environmental performance? What is your approach for selecting new suppliers?</td>
</tr>
<tr>
<td></td>
<td>4) How do you think these practices will impact the green activities of the suppliers? What benefits do you see from applying these practices to your own enterprise? Please give some examples</td>
</tr>
<tr>
<td></td>
<td><strong>If no then:</strong></td>
</tr>
<tr>
<td></td>
<td>5) Why isn’t that important?</td>
</tr>
<tr>
<td></td>
<td>6) What do you do if you find any gaps in supplier’s environmental performance?</td>
</tr>
</tbody>
</table>
7) Do you cooperate with your major suppliers on developing environmental innovations?

If yes then:

8) How do your major suppliers contribute to the improvement of your environmental performance? Can you give examples of your cooperation experiences? Have you found this effective?

9) What types of knowledge, experience, or skill do your suppliers bring into your firm?

10) Do you help (financially, human resource, etc) your suppliers if they come up with an environmental innovation proposal? How?

11) Are suppliers involved in any stage of product lifecycle? How do they contribute?

12) What drives you to ask for environmental innovations from your suppliers? And what do you think motivates suppliers to comply with your expectations? What are your own motivations in pursing environmental objectives with your suppliers?

13) Which functions/departments of your enterprise are more involved?

14) What are the challenges and trade-offs of cooperating with your suppliers on environmental issues?

If no then:

15) Why not and what are the barriers?

<table>
<thead>
<tr>
<th>Theme</th>
<th>Questions asked from supplier participants</th>
</tr>
</thead>
</table>
| Demographic | • Sector  
• Number of employees  
• Primary product(s)  
• Presence of an environmental department/R&D department/Environmental management system (such as ISO 14001)  
• Your job title and responsibilities  
• How long have you been in this job?  
• How long have you been in this industry sector? |
| Interaction with buyers | 1) What is your perception of the importance of environmental innovations for your buyers (1-10)?  
| | 2) Is your firm required to comply with certain environmental criteria, standards or monitored by the buyer to improve its environmental performance?  
| If yes then: | 3) What are the main environmental expectations and practices of buyers?  
| | 4) Have these obligatory practices stimulated your firm to develop or adopt environmental innovations? How? Can you give some examples?  
| If no then: | 5) Why do you think it is not important for the buyer?  
| 6) Do you cooperate with buyers on environmental innovations?  
| If yes then: | 7) What is your contribution to the improvement of the buyer’s environmental performance and in what type of activities are you more engaged?  
| | 8) What motivates you to cooperate with buyers and how does such cooperation benefit your firm? Can you give some examples?  
| | 9) What types of knowledge, experience, or skill does the buyer deliver to your firm?  
| 10) Which functions/departments of your enterprise are more involved?  
| 11) What are the challenges and trade-offs of cooperating with buyers on environmental issues?  
| If no then: | 12) What are the barriers? |
Appendix C: Invitation letter

Dear...

We would like to invite you to participate in a PhD study that investigates the way firms interact with their supply chain partners in developing environmental innovations. With the increased importance of environmental challenges along the supply chains, we would like to know the practices your firm has in place, your motivations, and the challenges you encounter.

We would like to interview senior experts in your organisation with responsibilities related to procurement and the environment. Each interview will last approximately an hour. Only with your consent, the interviews will be recorded and transcribed in a way that ensures the anonymity of participants is preserved. A copy of sample interview questions is attached and it will be sent to the participants before the interviews. After analysing the data, you will receive a summarised confidential report of the research findings. Participation in this study may further your organisation’s knowledge and understanding of environmental supply chain cooperation. The risks associated with participation in this study are minimal and either your company or participants may withdraw at any time with no consequences.

Please let us know if your organisation is interested or if you would like to arrange a meeting that our research team, Dr Peter Higgins, Professor Michael Clements and I, can discuss this in further detail.

With regards,

Mohammad Yarahmadi: 03 9214 4857 or 0401 371 866 myarahmadi@swin.edu.au
Dr Peter Higgins: 03 9214 8029 phiggins@swin.edu.au
Professor Michael Clements: 03 9214 5265 mclements@swin.edu.au

This project has been approved by or on behalf of Swinburne’s Human Research Ethics Committee (SUHREC) in line with the National Statement on Ethical Conduct in Human Research. If you have any concerns or complaints about the conduct of this project, you can contact:

Research Ethics Officer, Swinburne Research (H68),
Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122.
Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au
Appendix D: Consent forms

Swinburne University of Technology
Consent Form (Manager)

Developing environmental innovations: A study of cooperation and greening supply chains

Principal Investigator(s):

Supervisory team: Dr Peter Higgins and Professor Michael Clements
Student investigator: Mohammad Yarahmadi

1. On behalf of: …………………………………………… (Name of Organisation)
I hereby authorise the following official(s)/employee(s)/agent(s) to participate in the project in a representative capacity, the project’s particulars having been satisfactorily explained to me:

2. Name of representative(s): ………………………………………………..…………

2. In relation to this project, please circle your response to the following:

- I agree that s/he can be interviewed by the researcher Yes No
- I agree that the interview can be recorded by electronic device Yes No
- I would like to check any transcription / citation in respect of my organisation’s involvement for accuracy Yes No

3. Please circle your response to the following:

- I give my permission for the organisation to be named in any publication arising from the research. Yes No
- I further give my permission for the named researcher(s) to access/analyse organisational records as requested. Yes No
- In permitting access to or use of organisational records, the following / attached condition(s) apply:
  ………………………………………………………………………

4. I acknowledge that the data collected for the Swinburne project will be used for research purposes and not for direct profit; research purposes may include publishable / peer reviewed outcomes.

Name of Person of Authority and Position: …………………………………………………

Signature & Date: ………………………………………………………………………
Appendices

Swinburne University of Technology

Consent Form (Individuals)

Developing environmental innovations: A study of cooperation and greening supply chains

Principal Investigator(s):

Supervisory team: Dr Peter Higgins and Professor Michael Clements

Student investigator: Mohammad Yarahmadi

1. I consent to participate in the project named above. I have been provided a copy of the project consent information statement to which this consent form relates and any questions I have asked have been answered to my satisfaction.

2. Please circle your response to the following:
   - I agree to be interviewed by the researcher [Yes] [No]
   - I agree to allow the interview to be recorded by electronic device [Yes] [No]
   - I agree to make myself available for further information if required [Yes] [No]

3. I acknowledge that:
   (a) My participation is voluntary and that I am free to withdraw from the project at any time without explanation. I have been informed that in event of my decision to withdraw from the research, all data related to me will be completely destroyed and will not be incorporated in any stage of the research.
   (b) The project is for the purpose of research and not for profit.
   (c) Any identifiable information about me which is gathered in the course of and as the result of my participating in this project will be (i) collected and retained for the purpose of this project and (ii) accessed and analysed by the researcher(s) for the purpose of conducting this project;
   (d) My anonymity is preserved and I will not be identified in publications or otherwise without my express written consent.

By signing this document, I agree to participate in this project.

Name of Participant: ..............................................................

Signature & Date: ..............................................................
Appendix E: NVivo screenshots
Appendix F: Ethics Approval letter

Dear Peter and Mohammad,

SUHREC Project 2011/146 Supply chain cooperation: a superior approach to environmental innovation

Dr Peter Higgins FEIS Mr Mohammad Yarahmadi

Proposed duration: 1/07/2011 To 1/12/2013

Ethical review of the above project protocol was undertaken on behalf of Swinburne's Human Research Ethics Committee (SUHREC) by a SUHREC Subcommittee (SHESC3) at a meeting held 15 July 2011, the outcome of which was as follows.

The project protocol has been approved subject to the following addressed to the Chair's (or delegate's) satisfaction:

1. *A member of the committee questioned the use of the word 'innovativeness'.
2. *Future applications including appendices need to be carefully proof read prior to submission.
3. Title of the project is presumptive. Consider removing reference to a 'superior' approach.
4. Page 2: Given the nature of the project it was not necessary to check any boxes.
5. A2: refers to 'literature'. Clarify what literature you are referring to.
6. A3: refers to 'almost' four middle or large-size manufacturing companies. Clarify what is intended.
7. A7: Clarify how 'normal composure' will be determined.

8. Appendix A: Make reference to preservation of anonymity of the participant given that recordings are to be made. There are some errors in the first paragraph: e.g., "an organisational practice that benefits the environment", "your company about experiences of cooperating…" Suggested corrections are shown in italics; please address prior to circulation.

To enable further ethical review/finalise clearance, please would you respond to the above items point by point (by direct email reply if preferred). Re your responses:

- please DO NOT submit a full revised ethics clearance application unless specifically required
- queried, missing, additional or revised text from the ethics application can be incorporated into your responses (within the body of the email if appropriate and to save disk space)
- attach proposed or revised consent/publicity/other instruments in light of the above (if available, converting these documents to pdf before submission will disk space)

If accepted by the SUHREC or Subcommittee delegate(s), your responses/attachments will be added to previous documentation submitted for review, superseding or supplementing the existing material/protocol on record. Please also note that human research activity (including active participant recruitment) cannot commence before proper ethics clearance is given in writing.

Please contact me if you have any queries about the ethical review process undertaken. The SUHREC project number should be quoted in communication.

Yours sincerely

Ann Gaeth
Secretary, SHESC3